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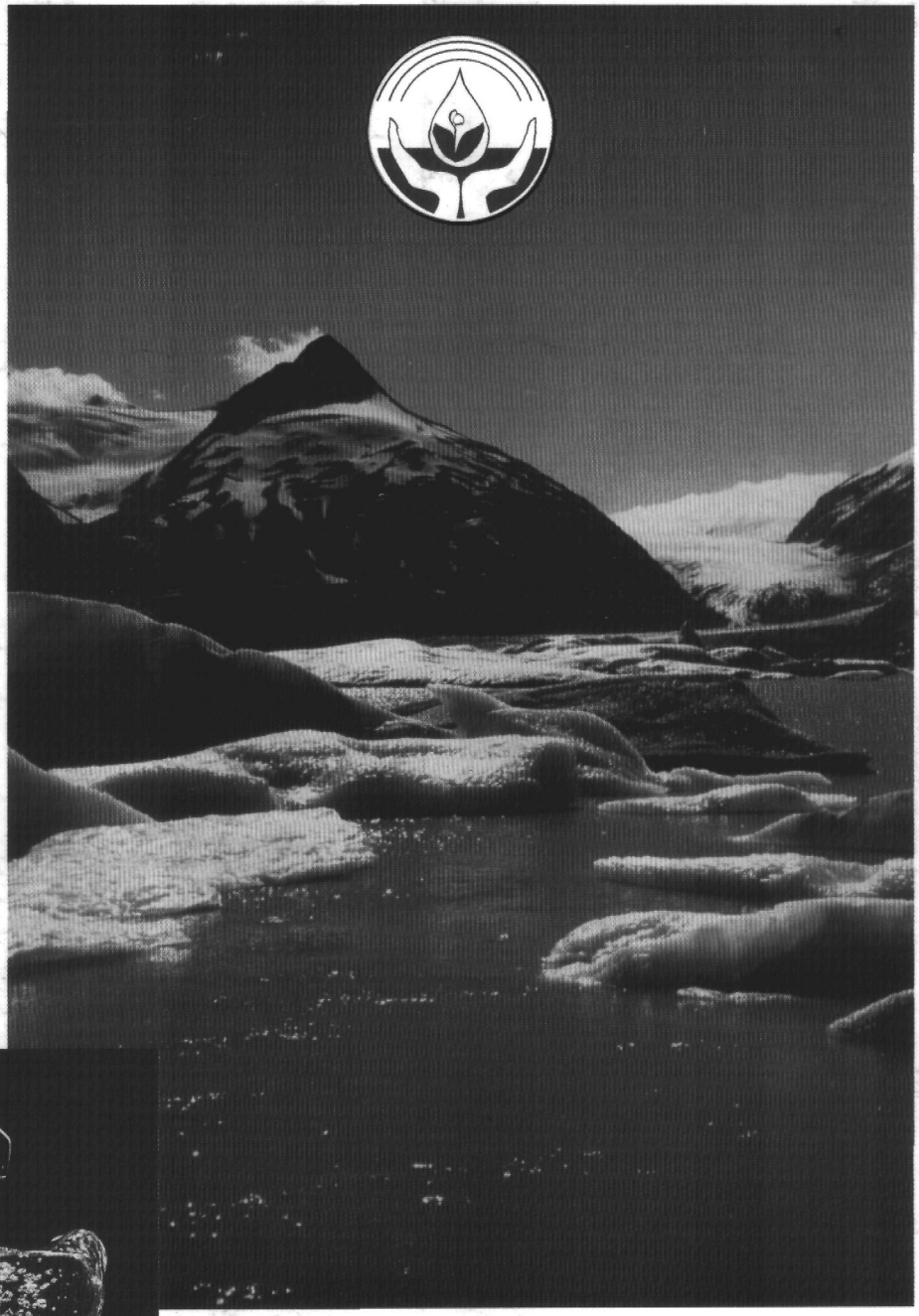
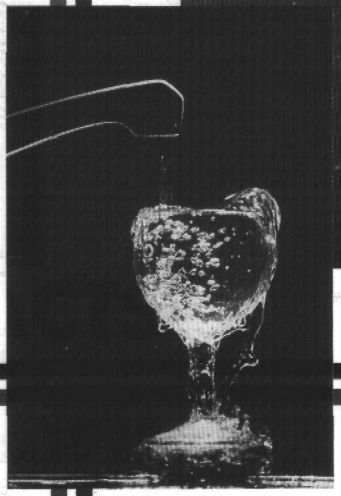
THIRD INTERNATIONAL CONGRESS
"WATER: ECOLOGY AND TECHNOLOGY"

ECWATECH-98





ABSTRACTS

MOSCOW, MAY, 26 - 30, 1998

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International Congress

and Technical Exhibition

"Water: Ecology and Technology"

much success,

wishes all participants and visitors

an interesting exchange of the information

and a pleasant stay in Moscow.

Berliner Wasser Betriebe

PREFACE

The present edition is composed of the abstracts of the papers submitted to the Third International Congress "Water: Ecology and Technology" ECWATECH-98 (Moscow, Russia, May 25-30, 1998).

ECWATECH-98 maintains the principal feature of the previous Congresses, that is complex analysis of water resources condition, water supply and water disposal problems, monitoring, legal and economic problems of water sector. Besides, the principle of continuity of the previous Congresses' approaches towards solving practical and scientific tasks of improvement of water use is strictly observed.

The abstracts in the edition are grouped according to their subject in different sections of the Congress.

Sections

- Water Resources Rational Use and Protection, subsections:
  - Surface Water
  - Groundwater
- Water Disposal
- Ecological Monitoring of Water Resources
- Economics and Law
- Emergency Situations and Ecological Safety of Water Resources

International Water Supply Conference

International Ozone Association Conference: Ozone Employment in Water Technology

Round-Table Meeting: Water Quality and Public Health

Workshop: Geoinformational Systems in Application to the Water Sector

Within the chapters the abstracts are given in alphabetical order of first authors' family names. The publication is edited in English and Russian. The English texts, including foreign authors, remain in full correspondence with the originals.

Translations of the Russian abstracts were done by the authors themselves.

Abstracts were edited without changing their essense. In some works generally-accepted abbreviations sustitute corresponing word-combinations.

The publication does not contain abstracts of the papers not adopted by the Organising Committee as they do not meet the subject of the Congress.

Unfortunately not all the authors submitted the abstracts in conformity with the terms stated by the Organising Committee. In this connection, publication of these abstracts is impossible for technical reasons.

The Organising Committee takes pleasure to express its deep gratitude to the Sponsors of ECWATECH-98 whose financial support made the present publication possible.

The Editoral Board believes that the present edition will be of great use for a wide range of scientists and engineers and for examining, managing and planning organisations staff.

Dear colleagues, participants of the 3rd International Congress and Technical Exhibition on the topic Water: Ecology and Technology (ECWATECH-98)

Two years have elapsed since the 2nd International Congress and Technical Exhibition was held. The high authority of the forum was confirmed by participation of representatives of the most prominent International bodies and leading specialists from European, American, and Asian countries.

The forum determined the strategy and tactics of sustained water management activities in the current environmental and economic situation, elaborated recommendations on the choice of optimum management and economic decisions, and was conducive to expansion of the markets of the respective equipment and services. It was characterized by scientific-practical direction.

The public's interest to the water resources and water use arose not by chance. More than any other natural resource, water is a decisive factor of the environmental situation, condition of the social sphere and economy. The ever-growing awareness of the necessity to evaluate all developments in this sphere from the viewpoint of human interests, human health and comfortable life changes priorities in the approaches to the economy of social development and environment condition. In this aspect water and its quality acquires an exceptional importance.

The resolutions and recommendations of the 2nd International Congress found wide application in the International and national practice of solution of water management and water ecology problems, supply of quality water to the population and economic agents on the basis of sustained rational use, protection and rehabilitation of water resources.

The materials of the 2nd Congress have become a deskbook to specialists in water management, being conducive to wide application of advanced technical and economic solutions and methods. To further development of the theory and practice.

The contacts established during the Congress and Technical Exhibition between theoreticians and practicians and the contracts signed by the producers and consumers of equipment and materials are fruitfully realized in practical activities in Russia and other CIS countries.

In the last quarter of the current century the mankind has entered an epoch of a deep environmental and economic crisis.

A qualitative exhaustion of water resources is occurring, water reservoirs are degrading, major technical breakdowns occur with a growing frequency, acts of God inflict sizable damages. To ensure national and territorial water safety and, as a result, sustained socio-economic development, we have to restore and preserve natural water sources (rivers, lakes, underground horizons, etc.) and stabilize water use.

A uniform approach to water use as a limited and vulnerable resource, combination of regional and basin problems of water use in the state's water management policy are of a great importance for taking Russia's economy out from the crisis and its transition to a model of sustained development, which would ensure a balanced solution of socio-economic problems and those of preservation of environment and natural resources for the present and future human generations.

Russia's transition to a sustained development model presupposes creation of the legal system, perfection of the current legislation, introduction of an economic model of water use.

The priority directions in implementation of a sustained water use policy should become:

1. Supply of quality water to the population and economy of Russia in the required quantities and regime.

2. Restoration and protection of water reservoirs, reproduction of water resources.

3. Prevention and liquidation of the consequences of the harmful impact of floods, rise of the ground water levels, and water erosion.

4. Restoration and preservation of a stable environmental situation in the sea, lake and river basins.

5. Protection and rational use of water resources, protection and rehabilitation of small rivers.

6. Enhancement of the management level of the regime of water reservoirs' and water management systems' functioning in order to ensure stable water supply to enterprises and population and reduction of the damage inflicted by floods and water deficit.

7. State control of safety at water management structures, especially large hydro-electric power developments.

8. Reconstruction of water management structures.

9. Reduction of water intensity of production and of water loss, improvement of the quality of potable water.

10. Perfection of water resources management on the basis of new forms of economic activities at water management structures.

11. Creation of an economic mechanism of water use in accordance with the market conditions, which would stimulate rational use of the water resources and sufficient financing of the water management activities.

The state policy of development of the water resources complex will be conducted through implementation of the federal programs: *Revival of the Volga, Potable Water Supply to the Russian population, Anti-flood measures, The Ob river, The Caspian, The Tom River, Improvement of the Environmental Situation in the Baltic Basin,* etc.

It is necessary to transfer the water management activities stagewise to self-repayment and self-financing in the period between 1998 and 2000 in order to solve radically the problem of improvement of water use and protection of water management structures, including those of rehabilitation of the water quality.

The 3rd International Congress and Technical Exhibition on the topic of *Water: Ecology and Technology (ECWATEch-98)* will consider the circle of problems related to ensurance of stable, sufficient and environmentally safe water use by the population and economy. The specific features of the new congress, besides discussion of the technical, technological, economic and management questions of water management, must become discussion of such novation in the water management sphere as geo-information systems and technology. One of the structural programmes of the Congress will be the Conference on Ozone.

Broad representation and spectrum of the Congress and Technical Exhibition participants give a chance to further accelerate and expand the process of implantation of scientific and technological achievements in the current water management practice.

N.N. Mikheyev

Chairman, the Organizing Committee;
first Dt. Minister of natural resources, the Russian Federation

SECTION I
WATER RESOURCES RATIONAL USE AND PROTECTION

SUBSECTION
SURFACE WATER

ECWATECH

POSSIBLE ENVIRONMENT CHANGES CAUSED BY MINE WORKINGS IN DEPOSIT SUHOI LOG

Alecseeva N.V, Hitskaya N.V.
"Sibecom"

Gold deposit Suhoi Log is located in the Northern-Eastern part of Baikalo-Patomski plateau, related to the Southern Siberian Mountains. The gold deposit is considered to be a promising object for mining. It was the reason for:

- exploration of contemporary condition of the environment surrounding the gold deposit area;
- environment change estimation in this area.

The area of deposit location already has been explored by human beings, the main reason for it was scattered gold procurement for 150 years. Great area of river valleys is subjected to washing and processing that completely changed the condition of river slopes and bottoms. Activation of criogenecal processes, e.g. melting, bogging, and swelling, is caused by deviation or change of the earth covering. No quantitative changes in drainage, water balance, surface and subterranean water have been noticed. The only exception is riverbed process, alluvium and the quality of the water in the water current where drags were used. No significant pollution of the ground covering and atmosphere in the deposit area has been noticed. Today, forest biotical surrounding is destroyed by 20%, less significant disturbance occurred in animal and ichthyological kingdom.

Mine workings will result in drastic enhancement of human influence on environment components. The most difficult ecological situation will remain in the river valleys.

The influence will be composed of many factors. First of all, it is erosion affecting the area of several thousands hectares, many parts of the area will be deprived of ground and flora covering, permafrost and subterranean water regimes will be significantly changed. The most significant aspect of this impact will be pollution. Most dangerous pollution is that of atmosphere, which can cause partial floral destruction on areas of 900 km^2 in 20 years and 1250 km^2 in 50 years. The most significant impact on surface and subterranean waters is expected from reservoirs and rivers turbidity increase, which also is very dangerous for hydrobions.

Less intensive impact will be brought by disperse and local influence, which is related to goldmining and industrial construction, e.g selective felling, linear communication creation, geological research continuation, increase in hunting, and wild flora collecting, and etc. Nevertheless, this type of influence may be of great importance, for exogenous geomorphologic processes and animal migration.

Besides that, following factors should also be considered:

- erosion increase caused by tree felling, fires;
- forest fires increase caused by growing number of visitors;
- Increase in flora vulnerability to frosts and pests, etc.

In general, about 90% of the deposit area will be affected by human influence in more or less degree. Approximately, 10-15% of the area will be crucially impacted. Nevertheless, no drastic changes are foreseen.

REGULATION AND COMPLEX UTILIZATION WATER RESOURCES OF AZERBAIJAN REPUBLIC

Aliyev F.Sh., Shekinski E.M.
State Committee on Geology and Mineral Resources of Azerbaijan Republics, Baku, Azerbaijan

Water resources of Azerbaijan Republic (30 km /year), especially superficial, very limited, note that 72%, river gutter formed out of Azerbaijan Republics territory. The drainage-basin of Kura and Arax which is the biggest rivers of Azerbaijan, included 79% of territory. Kura formed its superficial river gutter on the territory' of Turkey and Georgia, Arax formed its superficial river gutter on the territory of Turkey, Iran and Armenia. The water using for irrigation before XX Gentry had symbolic character and it hadn't some interstate problems, but during Soviet System authorities existed no ordinary form of managing the water resources and some interstate problems haven't its decision. In 1969 Azerbaijan calculated the exploitation reserves of underground water of river Samurchay for building water-supply system for the population of Baku and Sumgayit cities. Three thousand m of explored water located on the territory of Dagestan Republic. The Counsil of Soviet Ministers gave permission for exploration works but it couldn't decide that problem during project works. As another example, this is watersheds which was built on the territory of Azerbaijan Republic (the fan of Talachay river's for water-supply the population of Tsiteli-Tscaro district of Georgia. The underground river-bed of Sartichala rivers (Georgia's territory) using for irrigation both republics lands. Georgian authority demand payment for water-using. At last years , neighboring republics changed direction of rivers and as result of this policy the water balance of our republic is bad changed. It seems, that regulation natural river gutters depend from interstate agreements. Unfortunately, we haven't this agreements yet. Deficiency of superficial water reserves and its uneven distribution for square forced using the fresh underground water for national economy, especially for irrigation and technical needs.

Development of virgin and unused lands and new industrial objects oriented to underground water .in spite of deficiency of drinking water for population. It hasn't common scheme for water-using needs of national economy, which registrate all water sources: rivers, underground water-basins and Caspian See reserves. Azerbaijan Republic hasn't

water using. regime, its economical characteristic, and not elaborate conception of protect water reserves from exhaustion and pollution, especially about new marketing conditions.

An a base of long standing hydrogeology and geoecology explorations, F.Sh.Aliyev elaborated next key problems for water-quality preservation:

- Supplying or unsupplying of exploitation reserves about its natural and artificial tributaries:
- Level lowering of ground waters during water-using, create condition for withering plants, decrease of debit and dry up of water sources and kagrieses, decrease of river gutter:
- alteration possibilities of mineralization and chemical composition of underground waters on the territory, where waterlogged stratum spreaded during stable underground water using quality :
- availability or absence centers of pollution on the territory, where waterlogged stratum spreaded.
- natural defense of underground water superficial pollution.

Besides that the report has conception of use underground water taking into account peculiarities of it deposits and objects of national economy.

ELABORATION OF WATER ECOLOGICAL TECHNOLOGIES COMPLEX INTENDED FOR REDUCTION OF WATER CONSUMPTION SCARCITY AND IMPROVEMENT OF WATER QUALITY IN WATER SOURCES OF CHELYABINSK INDUSTRIAL REGION

Antoshenkov Yu.P.
South-Ural Affiliate of RosNIIVKh, Chelyabinsk, Russia

The Chelyabinsk industrial region (CIR) has an intense water-management balance where the water consumption scarcity is equal to 172-216 mln m^3/year in dry years of 75-95% frequency. The Shershnyovskoye water reservoir is the most important source of CIR water supply which functions in the system together with the Argazinskoye water reservoir, located above and used resources of the river flow of the Miass river basin (about 400 mln m^3 per year). The main problems of the Shershnyovskoye water reservoir are caused by the low water quality and possibility of the irregularity in average long-term yield. Besides water resources of drinking quality of the Shershnyovskoye reservoir are used irrational for the technical water supply to the industrial enterprises of Chelyabinsk at the rate of 83 mln m^3 per year.

The total volume of underground water used in CIR is equal to 19 mln m^3 per year. The reserve of underground water supply approved is 26 mln m^3 per year.

The Shershnyovskoye water reservoir as a source of centralised economical-drinking water supply has the 2nd quality class by chemical parameters, the 3rd quality class by biochemical and biological parameters. This is the eutrophic water body of the 3rd water quality class in the ecological classification. Its water quality is affected by the Argazinskoye water reservoir the water quality of which belongs to the 3rd quality class as the source of centralised economical-drinking water supply. The Argazinskoye water reservoir feeds on water of the mountain rivers of the 1st quality class, however it is affected by wastewaters of Miass and Karabash towns.

The experience of long-term researches and modelling of ecological processes has revealed the expediency of the development of ecotechnological direction of the problems solution.

In order to improve the water quality in the Shershnyovskoye water reservoir it is necessary to reduce significantly the pollutants discharge from its catchment, improve the hydrodynamics of this very reservoir (especially the deep-water reach and zone of the Sosnovsky water intake). The achievement of the second class of the Shershnyovskoye reservoir water quality should be an immediate objective. First of all it is necessary to form the hydrological reserve "Argazinskoye water reservoir", the objectives of which should include the restoration of self-purification capacity, formation of the ecological balance ensuring the second class of water quality in this water body (as the water source) in the water space adjoined the Bairamgulovsky hydrological complex. It is necessary to work out maximum permissible levels of pollutants discharge for individual pollution sources especially for the biggest of them in Miass and Karabash based on maximum allowable impacts in Miass at the areas adjoined the Bairamgulovsky and Shershnyovsky hydrological complexes. The next step is to introduce the efficient operating regime of the sanitary protection zones, water-protection zones of the Miass shoreline, water reservoirs.

In order to remove the negative influence of the stagnant zone in deep water of the Shershnyovskoye water reservoir on the quality of its water the Shershnyovsky hydrological complex should be reconstructed forming the water outlet from the bottom water layer. The work intended for the water reservoir purification should be organised in the area of water intake in order to improve the hydrodynamics of the Sosnovsky water intake zone and increase the outwelling yield of the Shershnyovskoye water reservoirs at the expense of its level regime regulation.

The scientists of the South-Ural Affiliate of RosNIIVKh work out the system of circulating water supply to the industrial enterprises of Chelyabinsk on the base of the Chelyabinsk hydroelectric power station (CHPS) pond on the basis of the self-purification capacity intensification of the Miass polluted river water between the CHPS and Solnechny settlement. The intensification is made at the expense of the increase of the turbulence of the moving river course by mechanical barriers, bed narrowing, aerators by means of the artificial wetland and transportation of self-purified waters into the CHPS pond (directly or through the desalinated lake

Pervoye as an additional stage of the self-purification capacity intensification and regulating reservoir). The construction of this autonomous source of water supply to the industrial enterprises of Chelyabinsk enables to reduce by 80-85 mln m3 per year the discharge into tail water of the Shershnyovskoye water reservoir (and consequently the Argazinskoye water reservoir), removes the risk of the outwelling yield irregularity of the Shershnyovskoye water reservoir in dry years using it only for the economical-drinking water supply.

The hydrotechnical system of diversion a portion of the Ufa run-off into the Miass, constructed in the end of 80s, is inactive: there is the risk of the deterioration of the transit lake Uvildy water quality. The development of the theory of maximum allowable impacts on water bodies enabled to assess the possibilities of this lake feeding by small portions and using of them in the regime of the recurrent running water body.

The available potential of water ecotechnologies enables to plan the development of Chelyabinsk by the number of population from 1.1 to 1.5-1.6 mln persons.

MODEL STUDIES OF DIFFUSION OF OPEN WATER SYSTEMS IN AGRICULTURAL LANDSCAPE

Asoskov G.N., Dobrachev Yu.P., Mazhaiskii Yu.A.
All-Russian Research Institute of Hydraulic Engineering and Land Reclamation

Studies of the process of pollution of open water systems by the diffusion of biogenic substances were carried out on the catchment area, typical for the Meshcherskaya Lowland, considered by us as a physical model of agricultural landscape.

The catchment area of about 3000 ha, belonging to the Oka River Basin, is located in Ryazan' oblast and includes the lands of the experimental farm "Polkovo". The structure of a physical model is represented by the following elements of land use: forest (72.4%0, arable lands (13.5%), pastures (6.0%, urbanized area of rural type (3.0%), lakes (0.1%), straightened channel of a small river (receiving water body for drainage system.) Arable lands and pastures (298 ha) are drained.

The results of topographic, geomorphological, hydrogeological, hydrological studies and soil surveys, carried out on the catchment area, are depicted in the geoinformation system.

To investigate the ways of migration of biogenic pollutants , the area was equipped with automated meteostation, hydrological wells of regime observation (24 pcs.), spatially distributed by the elements of land use, gauging stations for monitoring of drainage and channel flow (4 pcs.), lysimeter stations (2 pcs.) with samples (36 pcs.) of all types of soils available on the catchment area. The dynamics of different groundwater levels, typical for the Meshcherskaya Lowland (from 0.7 to 2.0 m), and agricultural technology, traditional for zonal plant growing, are modeled in lysimeters.

The regime observations over migration processes of pollutants included regular sampling of water from the wells and drainage water from receiving body to determine the content of biogenic elements. Soil samples were investigared annually by the end of vegetation period to determine the content of biogenic elements in arable and subsurface layers by all type of land use.

The dynamic simulation models of agro-and bioocenoses (such as "atmosphere - plant - soil") are developed. The base of meteorological, soil, agrotechnological and cenotic data and

results of lysimeter experiments is formed, securing functioning of these models, used for calculation of the flux of elements of water and salt exchange on the plots of land use, and (with regard for lysimeter data) biogenic elements into groundwater was assessed differentially. The rate of removal of biogenic elements, introduced into soil as fertilizer, was assessed according to the data of hydrological observations.

It is revealed that the use of intense technologies of growing of agricultural crops, irrigation and drainage on the background of high doses of mineral fertilizer results in proportional increase of removal of biogenic elements with time lag of one and a half or two years. The reduction of anthropogenic load on agricultural landscape due to exception of irrigation and refusal from application of high doses of fertilizer resulted in proportional reduction of removal of biogenic elements with time lag of four-six and more years.

It is noted that the removal of pollutants with flood water is increased by 30-50%, depending on the volume of precipitation, accumulated during fall-winter period. Apart from that, on sandy soils, having poor sorption properties, drainage is conducive to emergence of short-time peak concentrations of nitrogen-containting substances (ammonium) in a receiving water body, ten times and more exceeding the values of maximum allowable concentrations.

According to the data of field studies and model numerical experiments there were implemented balance calculations of water exchange of catchment area, which made possible to obtain dynamic pattern of migration fluxes of biogenic substances in the agricultural landscape. Average values of removal of nitrogencontaining substances from agricultural lands during vegetation period made up 24.9 kg/ha in ratio: 13.7 - nitrates (NO_3), 1.6 - nitrites (NO_2) and 8.6 kg/ha - ammonium (NH_4). In this case the largest amount of biogenic pollutants is removed from dried peat soils and orchard and garden plots, located along the bank of a small river, and minimum amount is removed from sandy soils of pine forest.

WATER PROTECTION AREAS PARAMETERS EVALUATION

Avakian A., Lantzova I., Iakovleva V.
Water Problems Institute of the Russian Academy of Sciences, Moscow, Russia

The existing ecological disbalance within the "watershed-waterbody" system requires that a "Water Protection Area" (WPA) should be determined for each particular lake or reservoir.. In view of the the complex interdependence of each natural component of the area, its landscape structure peculiarities, and mass-energy transfer it is necessary to work out a metrhod of resoureses potential evaluation.

For methodological purposes we use the following terms:

- "Watershed-Waterbody" system;
- Water Protection Area;
- addmissible loads on aqua-terrestrial complexes;
- resourses potential of the Water Protection Area.

The following nature components are to be taken into account:

- Climate parameters: mean summer and winter temperatures, total season precipitation distribution, winds velocities, humidity, insolation and other parameters, which are influences on the scales, intencity and complex use of natural resourses.
- Lithological and geomorphological base of the WPA and additional feed-back influence of the human use of the WPA which will transform the above litho-geomorphologic base.
- Hydrogeological parameters, which determine nature resourses usage structure in conjunction with other nature parameters. The mass-energy trasferring prosesses in "shore-water system" depend on the hydrogeological parameters of the enviroment.
- Soil and vegetation types determing the variety and attractiveness of the shore complexes which are primarily influenced by anthropological factors and which are indicators of the shore echosystem digressions.
- Surface waters as the basic natural phenomena, their main components (chemical structure, temperature and level regimes, hydrological and hydrobyological characteristics, the speed of self-refining, the specialities of the bottom, the presence and distribution of shallow waters etc.) being all determined by the nature.

In order to elaborate the resource WPA potential evaluation technique the authors have done the field investigations on the watershed of the Ivankovo reservoir on the Volga river. Each component was tested by equal number of essential parameters as required by exact mathematical treatment. To make the treatment and comparison of the data easier each quantitative criterion is given by three-level scale: the highest value shows that the given criterion is best suited for the given nature use in the area .

The highest value corresponds to the top position in the resoures classification, i.e. the territory in question fully corresponds to the required exploitation needs, and that the detriment to nature will be the least possible. The paper analyses a concrete example of. resources potential assesement of. a regulated river system in the limits of WPA. The chosen watersheds differed greatly in their natural characreristics and anthropogenic load. Medows and croplands were the basic objects of comparison since the main object of analysis in this paper is the recreational and agricultural use of the area.. The plots in question were grouped into six categories according to their natural peculiarities.

The following types were the most widely spread:

- valley lands with variable grass growth on turfed loamy soils;
- swaps and meadows on swampped soils;
- high hill grass growth on turfed sandy soils;
- crop land on turfed podzol loamy soils;
- crop lands on loamy soils partly podzoled;
- crop lands on sandy podzols and sands.

The chosen natural complexes were evaluated according to 10 criteria. Recreation and agriculture were tested against the same parameters. Additional parameters were used in cases when it was necessary to work out recommendations concerning the appropriate type of land use.

The comparative analysis of agricultural and recreational land use on the studied area made it possible to introduce a new scheme of natural resources use.

It has become obvious from the research that the descibed above approach of similar evaluations is extremely beneficial for ugriculture, tra.isport, forestry and other kinds of water protection area use.

The given results may serve as the basis of WPA determination and the evaluation of acological detriment resulting from all possible kinds of resources use, the nature and aim of WPA and reservoirs included.

ECONOMIC AND ENVIRONMENTAL PROBLEMS OF CONSTRUCTION AND OPERATION OF RESERVOIRS AT THE TURN OF THE CENTURY

Avakian A.B.
Water Problems Institute, Russian Academy of Sciences, Moscow, Russia

1. Construction of reservoirs began before the Christian Era, but they became water bodies scattered all over the Earth only in the 20th century. Their total capacity amounted to a mere 15 km^3 at the turn of the 19th and 20th centuries. Now, it exceeds 6600 km^3. The area of the water surface of the world's reservoirs is equal to 400000 km^2. Reservoir construction changed natural conditions over an area of 700000

km² and transformed the infrastructure over 1500000 km² in connection with reconstruction of economic facilities.

2. The sharp increase in the population and the development of power production, industry, irrigation in agriculture, and transport necessitated the large-scale use of water resources. This requirement and the necessity for flood and mudflow control resulted in runoff regulation in many regions. Hundreds of large and medium rivers became chains of reservoirs. The usable storage of these reservoirs, exceeding 3000 km³, was responsible for a 25-percent increase in the stable component of the runoff of the world's rivers.

3. Reservoir construction permitted solution of many economic problems, but the creation and operation of reservoirs posed many new problems because they caused undesirable complications for the nature and economy in the regions of their constructions (waterlogging, flooding, degradation of reservoir shores, and changes in microclimatic and ecological conditions) and in the regions located downstream, particularly in the lower courses and deltas of rivers.

4. The main abiotic parameters of reservoirs substantially differ from natural parameters, which disturbs to some extent the natural functioning of ecosystems. The water level regime and runoff redistribution are the important factors, which influence the other parameters of the environment and the functioning of the biotic subsystem. These factors influencing directly the ecosystem change as a starting mechanism the other components of the environment: the regime of currents, temperature, formation of bottom sediments, and the wave and ice regimes.

5. Almost the general dissatisfaction about reservoirs is explained by objective (see points 3 and 4) and subjective causes. The principal of them are: lack of large-scale and profound studies of the aftereffects of the construction and operation of reservoirs for nature and economy; lack of the necessary exchange of experience between design engineers and scientists both within the country and outside, with their colleagues abroad; hasty decisions; gigantomania; insufficient understanding of environmental problems; disregarding of psychological and partly social, medicobiological, and economic problems; the use of chains of reservoirs for remediation of emergencies and errors, which is possible in other sectors of economy; and misleading of the public in mass media.

6. Their is no single point of view concerning the improvement of the situation in basins of regulated rivers. The suggestions made may be divided into three groups:

(1) to cease the construction of new reservoirs and to eliminate the existing reservoirs;

(2) to lower the normal water level of existing reservoirs;

(3) to improve, in every possible way, the design, construction and operation of reservoirs, placing emphasis on the environmental problems involved in the entire process.

7. Profound examination of the first two suggestions revealed their complete unsoundness because emptying of reservoirs without solution of environmental and economic problems will result in the full destruction of the existing system of water supply and water diversion, power supply, and transport and, thus, will deteriorate sharply the environmental, social, and economic situations.

8. The only way of improving the unfavorable conditions existing in the basins of regulated rivers is the all possible improvement of the processes mentioned in point 6 (3) and the realization of the conception, suggested by the author of this paper, of the efficient use of reservoirs under the increasing human impact, consisting of three interrelated elements:

(1) affirmation of the status of reservoirs as a biogeosystem, the main designation of which is provision of the water of proper quality for normal functioning of aquatic and terrestrial ecosystems;

(2) an ecosystem approach to all types of economic activity both in the area of the reservoir and in the area of the drainage basin;

(3) regionalization, planning, and layout of the water surface and shore of reservoirs for improving their structural organization and optimal state.

THE CHANGES IN MORPHOLOGICAL FEATURES OF MIDDLE EUROPEAN FLOODPLAIN'S SOILS UNDER CONTROL OVER FLOW CONDITIONS AND AFTER DAM CONSTRUCTION

Avetian S.A.
Moscow Lomonosov State University, Moscow, Russia

Soil cover of the Saale (the Elba's affluent in its middle stream) flood plain consists from, due to our information, the combinations of alluvial soils including the alluvial sod soils on the near -bed swell, the alluvial meadow soils, the alluvial meadow swamp soils and the alluvial swamp soil on the sufficiently developed central part of flood plain with pronounced local swamping hollows and also alluvial soils, covered by flood plain forests.

The flood plain, which was investigated, is at present time as in uncontrolled state, so in influencing zone of dam, which is situated in the upper parts of river stream.

The ground water table lowing, the drying process of landscapes, the decreasing of soil hydromorphic degree are noted at the controlled over flow state parts. Morphological signs of alluvial soils drying process are manifested in weakening of gley formation process display under these conditions. Signs of so called "remain gley-formation process" are appeared, the gley spots do not form the continuous front in soil profile, but localize in the form of separate zones, whereas the upper gley-zone limit lets down in soil-ground thickness.

However, it should be noted that soils in comparison with vegetation are characterized by the relatively slow reaction to

the changes in hydrological conditions. They are as if too late in their evolution transformation that in whole corresponds to their conservative role in landscape. Nevertheless, thinning, changes in species composition, distraction of plants, changes in soil microorganisms function lead afterwards to abrupt deterioration of soil structure quality and humus loss. In some cases favorable conditions for the accelerate erosion are formed.

The dams construction and control over flow initiate often also processes of hydromorphization in flood plain landscapes under flood plain's over damping. This type of landscape was investigated in the Danube flood plain and in the Izar (affluent of Danube) flood plain.

Over-damping of flood plain territory led to the essential changes in the morphological features of alluvial meadow soils. In particular, the rise of ground water table (despite of relatively light granulometric composition of soils and grounds), obvious strengthening of gley formation signs manifesting in gley horizon upper limit rising and in gley formation process degree increasing, structure-loss process of soil mass increasing in soil profile middle and down parts, are observed.

Further strengthening of flood plains territory over-damping, due to our assessments, can lead to the accelerate soil swamping, to the gley formation process expansion in whole soil profile, to the soil structure loss, to the loss of nutrients, organic matter removal etc.

The soils in this case as a whole landscape, degrade intensively, transforming into alluvial swamp soils.

THE USE OF ACTIVE EFFECTS UPON CLOUDY PROCESSES FOR THE PURPOSE OF AGRICULTURAL WATER SUPPLY CONTROL

Badakhova G.Kh., Ekba Ya.A., Kaplan L.G.
Scientific-and-Production Geophysical Center, Stavropol, Russia

Efficiency of agriculture, specifically that of plant-growing, depends in great degree on weather conditions. In the southern regions where radiation and thermal providing is rather high the main limiting factor for plants development is the moistening of both the air and the soil. Not sufficient moistening as well as excessive one have negative effect upon the plants conditions and, consequently, upon the quantity and quality of the crops. The decisive part in plants water supply belongs to precipitations.

Great positive part in agricultural water supply control may be played by active effects upon cloudiness with the purpose of precipitation artificial control. Precipitation artificial control may be conducted in two directions.

Artificial precipitation enhancement (APE). AEP may be conducted in autumn for the purpose of creation of good conditions for the beginning of winter crops vegetation, and in winter - for the purpose of hightning of the soil moisture content in spring; in spring-summer period - for the purpose of the plants water supply during active vegetation. The influence is effected from a meteolaboratory aircraft board which are usually such types as Jak-40, An-12, An-30.

When effecting the stratified (St) clouds of winter type, as a reagent is used hard carbonic acid CO_2 which is seeded in parallel pathes at the rate of 0.5-3.0 kg/min. Stable positive but not high effect is achieved at that: 1 mm of rain per 8 hours of cloudiness treatment. In order to obtain a significant effect it is necessary to keep introducing a reagent by large portions and during long periods of time. Due to this use is made of CO_2 reagent which is very convenient for use, but - cheap.

Cumulus (Cu) clouds are effected with an ice-forming reagent in order to provide effective crystallization of the cloud overcooled liquid-and-drops part what will subsequently stimulate intensive rain. It is necessary to create at that ice crystals artificial nuclea concentration of order. Seeding is effected from an aircraft with the help of special pyrotechnic cartridges PV-26 and PV-50 containing 2 % of AgI. The optimum consumption rates for one cloud make 1-3 pieces of PV-50 and 6-15 pieces of PV-26. From a cumulo-nimbus (Cb) of 4 km diameter the lower boundary of which is at the altitude of 1700 m and the upper one - at 5700 m at the mean liquid water content of 2 g/mя53я0 it is possible to obtain (during 2 hours of the cloud existance) up to 2.5 mm of rain over 16000 ha, or 400000 ton of water.

Activities on APE have been carried out by the Stavropol SPGC an the North Caucasus in the spring-summer period since 1986. The annual positive effect makes 15-20 % of precipitation enhancement as compared with its natural quantity, what provides, only at the Stavropol region, for more than 100000 ton of additional winter weat crops.

Artificial precipitation minution (APD). For the purpose of precipitation prevention or diminution the cloudiness is influenced in accordance with one of the below-given conceptions.

The first conception - suppression of the development of thick Cu and Cb clouds at the artificial initiation of descending currents in convective clouds by means of powder reagents introduction into their peaks. This method is effected is effective when influencing single celled separate clouds. It makes it possible to destroy thick Cu and Cb clouds and thus to diminish precipitation quantity over the target area (TA).

The second conception is based on the influence upon thick Cb clouds on the TA approaches. A cloud is seeded with an ice-forming reagent, and at that the quantity of rain falling down from it gets increased, but its intensity and that is much lower as compared with the intensity characteristic for typical Cb clouds.

The third conception is precipitation diminution over the TA by means of mass seeding of the frontal St clouds on the approach to the TA with a crystallizing reagent. Such seeding

of St cloudiness with the increased doses of a reagent leads to precipitation or - to its intensity diminution.

Activities upon cloudiness with the purpose of precipitation prevention or diminution has been effected for a number of years in many countries on the days of mass celebrations, large-scale sporting competitions, etc. The experience of these activities as well as the carried out calculations prove that such influences may be successfully effected for the benefit of agriculture protecting the crops from e[cessive water supply, from catastrophical heavy showers and the consequences.

MAIN PROBLEMS OF WATER-ECOLOGICAL SITUATION IN SIBERIA

Belonenko G.V.,
East-Siberian Affiliate of RosNIIVKh, Novosibirsk, Russia
Vinokurov Yu.I.,
Institute of Water-Ecological Problems, Siberian Division of RAS, Novosibirsk, Russia
Popova N.B.,
Siberian State University of Communications, Russia

The water-ecological situation in Siberia is the consequence of the economical utilisation of surface and underground water, point and diffuse wastewater discharges, pollutants emission into atmosphere, regulation of the river flow by a great number of water reservoirs, economical activity in the river basins which is not regulated by the ecological requirements.

Pollutants emission into atmosphere was equal to 7.5-10.2 mln tons in a year in 1990-1995 and about 30-35% of total emission in Russia in a whole. In Russia pollutants emissions into atmosphere fluctuate from 0.3 t per km^2 (Tyva) up to 10.7 t per km^2 (the Kemerovo Oblast) and are equal to 1.28 t per km^2 in average.

Calculations show that the concentrations of pollutants in wastewater over almost all river basins in the region exceed maximum permissible concentrations (MPC) in many times and the water-ecological situation keeps on being intense in spite of the fact that volumes of pollutants discharge reduce everywhere.

For instance, the concentration of phosphorus in the region rivers exceeds MPC in 7.0 times, nitrates - in 33 times, oil-products - in 4.4 times, phenol - in 2.0 times. The water-ecological situation in the individual river basins is worse. In particular the concentration of phosphorus in the Yenisei river exceeds MPC in 4.3 times, in the Ob - in 8.7 times, in the Irtysh - in 12 times, in the Tobol - in 11.5 times.

High values of the pollution index are evidence of the progressive pollution of surface water in the Ob-Irtysh basin. These values fluctuate from 8.68 till 10.9.

The water-ecological situation in the Tom river basin is being exclusive intense. About 1/3 of total West Siberia industries is concentrated there. The progressive deterioration of the water quality in this basin is caused by coal mining and coal mining enterprises functioning. Besides open-cut coal mining has led to the reduction of the river network and removal of about 200 small rivers of the Kuznetsk basin, disturbance of the underground feeding of the big rivers.

The banks eroding is one of the sources of water reservoirs pollution in the region; it is caused by the waves impact, landslides, taluses, etc.

Waters of the Sayano-Shushenskoye and Krasnoyarskoye water reservoirs contain oil-products at the level of 5-15 MPC and a number of specific pollutants. The steady pollutant for water reservoirs of the Angarsky system is timber submerged during the water reservoir construction and appeared by virtue of banks eroding and reconstruction. There is collected about 500-600 thnd m^3 of timber annually only at the Bratskoye water reservoir and about 700 thnd m^3 of timber floats by virtue of banks eroding.

The lakes and small rivers in Siberia keep on being under the powerful economical press. The progressive increase of the lakes water balance deficit is caused by the ploughing up, retention of snow on fields, ponds constructions and other measures.

The significance changes of the natural water regime of the Ob, Irtysh, Angara and Yenisei were caused by their energy application. At the Irtysh the conditions of flood-land irrigation have deteriorated considerably in the spring-summer period that has led to the reduction of its efficiency up to minimum. The limits of the river bed deformation in tail water, according to the Novosibirskaya hydroelectric power station design project, have not been proved to be correct. The erosion zone spread by 40 km lower; the decrease of the water level was 1.6 m and was aggravated by the exploitation of the underwater mining pit. Consequently the navigation conditions have become worse, the ports activity has become complicated, the steadiness of port hydrotechnical constructions has been disturbed, the number of spawning places has reduced and so on.

The damages of oil-pipe lines and consequent pollution of water bodies affect fishery negatively.

By virtue of the public domain removal and transformation of former public ports into the joint-stock companies and appearing of the private ship-owners as well the system of environment protection on water transport has been destroyed completely.

The problem of settlements underflooding keeps on being urgent in the forest-steppe regions since there are no engineering constructions intended for water disposal.

CONCEPTUAL APPROACH TO WATER MANAGEMENT POLICY

Belyaev S. D.
UB CPPI, Ekaterinburg, Russia
Lvov A. P.
CPPI, Moscow, Russia
Chernyaev A.M.
RosNIIVkH, Ekaterinburg, Russia

The general objective of water management policy (WMP) is to satisfy needs of people and economy for standard quality water with minimal damage to the environment.

The objective can be concretized by using the definition of the major implementation tasks:

- regular provision of people by sufficient amount of standard quality drinking water;
- provision of industries for their normal functioning by sufficient amount of water of the required quality;
- protection of the population and economic complex from the destructive impact of floods, overflowing and droughts;
- step-by-step recovery of water bodies «natural» guise, native habitats of flora and fauna.

The first task is the prior at the present period.

We can underline three basic problems within the ones are to be decided on the way of the mentioned tasks achievement:

- water bodies pollution by point and non point sources (from the watershed);
- leakage and water loss;
- non-adequacy of the technology of drinking water production and waste waters purification to the raw waters quality, dire depreciation of water supply and sewerage pipeline networks.

Have underlined objectives and problems we can define the basic principles of the water management policy as of a sustainable system of opinions and rules which lays on the basis of the whole activity:

- basin approach;
- permanent and orderly minimization of the destructive impact on people and environment (implementation of adequate water production technologies, reduction of pollutants discharge, reduction of specific water consumption per capita, implementation of industrial water saving technologies, etc.);
- water sector self-financing (including capital costs);
- step-by-step, order and precise substantiation of reformations;
- broad public awareness.

Basing on the formed principles we can define mechanisms of achievement of the settled objectives and the complex program of measures.

Mechanisms of WMP implementation could be divided into three profoundly mutually connected groups:

- economic;
- institutional;
- legal.

Finally, all of them are directed to the provision of the technical measures which have direct impact on water bodies, watershed areas, water supply and sewerage systems, etc.

SEDIMENT POLLUTION IN THE DELTA OF THE RIVERS RHINE AND MEUSE: PRIORITIES FOR REMEDIAL ACTION BASED ON LONG-TERM RISK FOR THE ECOSYSTEM

den Besten P.J.
Institute for Inland Water Management and Waste Water Treatment (RIZA), Lelystad, Netherlands

As a result of the construction of compartmentalisation dams in the delta of the rivers Rhine and Meuse in 1969-1970, tidal movement and current velocities in the delta dropped. At present, the Rhine-Meuse Delta is an area with a gradual transition between the rivers Nieuwe Merwede and Amer in the east (receiving water from the Rhine and the Meuse, respectively) and more downstream the sedimentation basins formed by the floodplain forests Dordtsche Biesbosch and Brabantsche Biesbosch, and by the Hollandsch Diep and the Haringvliet situated in the West. Since the completion of the dams, millions of cubic metres of highly contaminated sediments, supplied by the rivers Rhine and Meuse, were deposited on the river banks, in the floodplain forests and in the deeper parts of the Hollandsch Diep and the Haringvliet. In 1992, research was started in this area to assess the effects of contaminants in the sediment on benthic macroinvertebrates and wildlife. At 260 sampling points samples were taken for physical-chemical analysis, analysis of the macrobenthic community structure, analysis of bioaccumulation levels and for bioassays.

The sediment quality triad approach was used to demonstrate causal relations between effects on the macrozoobenthos community structure and effects demonstrated in bioassays. In addition, toxicity identification and evaluation techniques were applied to provide evidence for the role of sediment pollution in these effects. A multi-criteria analysis (MCA) was used as a tool to compare the level of risk for ecosystem between sites. Apart from the level of risk in the present situation, information on the sedimentation patterns in the delta was used to set priorities for remedial action. Two pilot projects were carried out to investigate the short-term and long-term effects caused by

the dredging of polluted sediment. The results indicate that the removal of polluted sediments can have direct (short-term) negative effects as the result of the increased mobility of contaminants. For the long-term development of the area it is concluded that the risks for the ecosystem may in some sites be reduced as a result of the natural improvement of sediments (as a result of the lowered pollution levels in suspended solids in the rivers Rhine and Meuse), but in other sites only by remedial action.

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INTERGOVERNMENTAL PROBLEMS OF CONTROLLING THE STREAM-FLOW REGIME OF THE NARYN-SYRDARYA SEQUENCE OF HYDRO-ELECTRIC POWER STATIONS

Reznikovsky A.M., Rubinshtein M.I.
The Institute "Energosetproject", Moscow, Russia

In developing the project for the Naryn-Syrdarya sequence of hydro-electric power stations in the former USSR, the main objectives in creating its reservoirs were to satisfy, first of all, the demands imposed by irrigation along the entire course of the Syr-Darya river and its tributaries.

Irrigation was given priority in utilizing the water resources of the river so as to obtain a maximal cotton crop in the region. Power generation by the hydro-electric stations in the power pool of Central Asia was subordinated to the above objective in carrying out stream-flow control.

For electricity generation in the Central Asia power pool, local natural gas deposits, imported coal and the hydro-power resources of other rivers in the region (such as the Amydarya river) were used, in addition to hydro-power resources of the Naryn and Syrdarya Rivers.

After disintegration of the USSR and the formation of indepedent states in Central Asia, priorities in utilizing the water resources there changed. The need for growing cotton in the basin of the Syrdarya river decreased for many objective reasons. As a result, the requirements on take-off of water for irrigation and the drawdown from the reservoirs in the sequence (primarily from the Taktogul reservoir) became less taxing.

Operating the sequence of hydro-electric power stations in the power system from the energy standpoint also changed. Other economic relationships between the national power systems in the Central Asia power pool arose. The conditions of fuel supply to the thermal power stations in the power systems greatly changed.

For instance, different policies on tariffs for electricity in the various countries of Central Asia exist.

In view of the above, it would be quite interesting to study the changes in the operating conditions and the output of the se quence of hydro-electric power stations under present-

day conditions. In particular, it would be worthwhile to appraise how the electric energy output of the hydro-power station will increase when the demand for irrigation at different places in the river basin will become less taxing, and when the priorities on controlling the operating conditions of the sequence of reservoirs will change.

Preliminary analysis has shown that when the amount of water extracted for the needs of irrigation is reduced, the firm capacity of the sequence of power stations may increase by up to 85% of its design value, and the normnal annual electricity generation may increase by 20%. It should be taken into consideration that the firm capacity can be inceased in the winter months of the year when there is a maximal demand for electricity in the power system. Seeing that, at present, the various stages of the sequence are found on the territory of four independent states, we should account for the new economically substantiated relationships between these states in establishing optimal operating conditions. In order to create optimal rules for controlling the operation of the sequence, research and development work will have to be carried out. The rules for controlling the sequence should be approved at intergovernmental level. A special independent intergovernmental authority may have to be formed in order to see that these rules are carried out.

INVESTIGATION OF ECOLOGICAL CONDITIONS OF THE RIVER ECOSYSTEMS AND DEVELOPMENT OF A SET OF TECHNOLOGIES TO REDUCE ANTHROPOGENIC LOAD ON THE RIVER BASINS

Bittdorf H., Hemberle P.
Forschungszentrum Karlsruhe, Germany
Vinogradova G.N., Kolomiitsev N.V, Rainin V.E., Shumakov B.B., Scherbakov A.O.
All-Russian Research Institute of Hydraulic Engineering and Land Reclamation, Russia
Gastner K., Muller G.
Institut fuer Umwellt-Geochemie, Germany
Kerzhentsev A.S.
Institut of soilscience and photosynthesis RAS, Puschino, Russia
Novoseltsev V.N.
Ministry for Science and Technologies of the Russian Federation, Russia
Shargatova G.S.
The AC GAZ laboratory, N.Nowgorod, Russia
Naidenko V.V.
Staatliche Akademie fur Architektur und Bauwesen, N.Nowgorod, Russia
Motkin G.A.
Institute for market problems, Moscow, Russia
Popov A.A.
CAC "SPF Analitinvest", Russia

The basic results of long-term wideescale studies, carried out in the Oka River Basin within the frames of the projects "Oka - Clean River" and "Oka - Elbe" are represented. In the course of studies wide use was made of the experience and cooperation of Russian and German scientists and specialists.

There was used a basin principle, making possible to range ecological and economic as well as social priorities of the regions with regard for their natural and economic boundaries. The concept of reduction of anthropogenic load on the river basin is based on the ability of water ecosystems to self-restoration with slackening of anthropogenic press.

In the process of studies there were developed and used the facilities and methods of investigation and assessment of the ecological conditions of natural environment, corresponding to the world standards, which allowed us to achieve high level of reliability of measurements, fairly assess the trend and intensity of natural and anthropogenic processes, and form optimal complex of technologies for the instrumental control of the dynamics of these processes. To assess anthropogenic load on the river ecosystems the use was made of the methods of investigation of pollution of the river and bottom sediments, widely used in Germany and other countries.

The results of comprehensive studies of ecological conditions of the river ecosystems made possible to reveal most unfavorable areas, specify the branches and enterprises, being the main sources of pollution of the rivers of the Oka Basin. There was established a computer data bank on the composition and volume of wastewater of basic enterprises to assess the extent of their ecological hazard. Specialized geoinformation systems are created, including those for the basins of individual rivers.

The methodology is developed and a set of measures is determined, the realization of which makes possible to create conditions for reduction of the level of anthropogenic impact; measures, aimed at improvement of reliability of control of hazardous chemical and technological processes are substantiated; the systems of automated designing of progressive chemical technologies of water purification and treatment are developed.

An expert selection of formerly established technologies is implemented to reduce anthropogenic load and experimental realization of new competitive technologies, samples of equipment, water purification and treatment plants to provide population with clean drinking water, for treatment of wastewater of industrial, agroindustrial, and municipal facilities, is carried out. Preference His given to reagent-free and

combined processes, due to which a minimum amount concentrated pollutants is formed, demanding dumping, utilization, or secondary treatment.

Promising technologies and technical means of water purification and treatment, processing and utilization of wastes, sediments and sludge are developed and realized at the enterprises of Nizhnii Novgorod, Moscow, Vladimir and other oblasts of the Oka Region. Technologies of biological treatment of soils within water conservation zones, also were develosed. The technologies of treatment, utilization and processing of toxic wastes are realized or adopted for realization in the program "Revival of the Volga River". An extensive set of technologies and equipment for treatment of waste gases His developed.

An economic mechanism of forming investment resources for the introduction of technologies is suggested for successful realization of technological projects of reduction of anthropogenic load, the basis of which is ecologic insurance against risk of pollution of natural environment. Methodological fundamentals and methodical principles of establishment of conditions of interest for the enterprices in reduction of anthropogenic impact on natural environment are developed. A draft of Federal Law "On compulsory ecological insurance" is prepared.

A report of Russian and German specialists is prepared according to the results of studies and forwarded to the Governments of Russia and Germany. The implemented studies are evaluated as "an example of efficient approach to solution of ecological problems".

Long-term joint work of Russian and German specialists was awarded a prize of the Governments of Russia in the field of science and technology in 1996.

QUESTIONS OF WATER SUPPLY SUFFICIENCY IN TRANS-URAL BASHKIRIA

Bondarenko V.L.
Bashkir Affiliate of RosNIIVKh, ,Ufa, Russia
Tkachyov V.F.
State Committee on Geology of the Bashkir Republic,Ufa, Russia

Water-ecological problems can be represented as a statistics including a quantity of interrelated components of technogenic process affected water resources. Based on the basin principle of surface and ground water formation, the great number of various factors affected water milieu is the most important feature of the basin system. The contradictions arise between the factors affected and available objectives. These contradictions generate the typical problems for small as well as for big basin systems.

In order to realise the complexity of the basin system which consists of various sub-systems, the principles of differentiation are used. However the complex basin systems are not equal to the simple sum of sub-systems included. In order to realise the integrity of the basin system it is necessary to carry out the deep system synthesis including the studies of the correlation between systems.

The study of the mechanism of the correlation between the surface water sub-system and underground water subsystem in the basins of the Tanalyk and Big Kizil have fixed the basic hydrogeological and hydrological parameters enabled to solve the questions of the water supply to the population in Bashkiria by means of the use of "underground" water reservoirs and regulation of the surface flow constructing "surface" water reservoirs. The necessity of the water reservoirs construction intended for the regulation is caused by the hydrogeological conditions of the individual sections of the river basin.

For instance, as regards hydrology the Tanalyk river basin is characterised by the development of underground water in the zone of cracked vulcanogenic and vulcanogenic-sedimentary rocks. Loose alluvial quaternary sediments in the river valley and mouth sections of its tributaries have the small thickness and various granulometric composition. The clayey sediments spread in a part of the basin (below the Buzavlyk river mouth); they have the layers of aleurites, sand, gravel and pebbles.

The small amount of precipitation, predominance of open steppe spaces in the basin, lack of rocks of high capacity and filtration properties caused the general poorness of the territory as regards underground water, the spreading depth of which in the cracked zone is up to 60-80 m, in the zones of breaks and tectonic breakup of rocks is up to 200-300 m, in lenses of sand-gravel-pebbles mountain sediments is up to 200 m.

The territory poorness as regards underground water is expressed in modulus of underground flow, minimum value of which (95% frequency) does not exceed 0.2 l/sec/km^2 in the basin in general. Minimum values are typical for flat watershed spaces with clayey mountain sediments. Maximum values are typical for cirque lowering at the west slopes of the ridge Irendyk and for the zones of development of jasper rocks, siliceous schist and zones of the tectonic atomism of rocks as well.

The above-mentioned features of underground water spreading, along with the availability of saltish water at a number of sections under the heightened concentrations of iron and magnesium up to 3 and 2.3 mg/l relatively, make difficult the solution of water supply questions in regard to the revelation of sections of the rocks sufficient water-abundance as well as the underground water quality.

Based on the analysis of searching and prospecting of underground water in Bashkiria in the valleys of the Ural, Big Kizil and Tanalyk, the positive results are acquired at that sections of valleys where intensive-cracked rocks are located covered by loose sand-gravel, alluvial quaternary or mountain sediments. Loose sediments contain underground water where the water intakes are constructed. In the valley of the Big Kizil river between its mouth and Almukhametovo settlement the capacity supply of underground water is suffi-

cient for the water intake of 85 thnd m^3/day and water supply to Magnitogorsk and Sibay during 3 dry years and ensuring the sanitary discharge of the Big Kizil. During one spring flood in the years of 50% frequency the capacity supply of underground water operated for three years recovers, that is the capacity supply of underground water represents the water storage of long-term flow regulation. Sanitary water passes are kept or maintained without the construction of water reservoirs intended for the surface flow regulation.

The conditions, similar to the conditions of the Big Kizil described above, are in the valley of the Tanalyk river at the sections between Pervomaisky and Ufimsky, the river Buzavlyk and Samarskoye settlement. There is possible to construct the underground water intakes with capacity of 1.2-5 thnd m^3/day without any essential damage to the surface flow and therefore without necessity of the water reservoirs construction at the Tanalyk intended for the water supply.

The analysis of hydrogeological and hydrological conditions of the Tanalyk river basin shows that the similar conditions are at the individual sections of the valley of the Tanalyk as well as its tributaries from Pervomaisky till Ufimsky, from the Buzavlyk river mouth till Samarskoye. These sections can be used for the underground water intakes creation with productivity of 1.2-5 thnd m^3 per day. Consequently, constructing the water reservoirs in the Tanalyk river basin, it is necessary to take into account the correlation between the surface and underground flows fixed.

THE PRINCIPLES OF THE ORGANIZATION OF THE WATER OBJECTS MULTIFUNCTIONAL USAGE AT THE CITY TERRITORY

Boykova I. G., Petchnikov V. G., Palgounov P. P.
MOSVODOKANALNIIPROJECT Moscow Institute for Water & Wastewater Research & Design, Moscow, Russia

The inventory of the water fund of the City of Moscow revealed the fact that all the water objects of the City are the links of the single water disposal network which are connected to each other in hierarchical order. All the water objects are natural and engineering objects simultaneously, i.e. they are the objects which are improved or operated with the aid of engineering facilities. Thus all the river channel water bodies have (or must have) some backup facilities equipped with regulating devices. The isolated water bodies (located both in the flood lands and in the upper reaches) must be equipped with the facilities to provide the water exchange. The special engineering facilities and devices have the ponds for swimming, sporting and recreational purposes as well as for special scientific, demonstrational and museum purposes. Many rivers are equipped (or were equipped) with dams for flow regulation , navigation, decorative and other purposes.

All the facilities as well as the water objects where they are located are under the authority of various organizations (MOSVODOSTOK, the Administration of the Moscow Canal and others); many of them have been operated for over 30 years. The largest and the most important ones require urgent inspection and the declaration of their ecological safety.

Most of the facilities located at the water objects were constructed for the specific purposes of a given water body, outside the framework of the complex approach to the water network of the City as a single system. Such an approach makes it possible to substantiate the possibility of the management and regulation of the quantity and quality of the surface run-off in the City with the aid of engineering facilities and devices. This approach also creates some practical possibilities to perform with their aid the multifunctional water use at the water objects utilizing them for decorative, regulating, water disposal, treatment and accumulation purposes.

The complex approach to the problems of the water objects, the correct taking into account of their natural features and functional purpose make it possible to determine the top-priority trends in the field of their correct engineering improvement and operation as well as to distinguish the certain types of the facilities and to determine the principle schemes of the possibility of their multifunctional usage.

This is the principally new approach to the solution of the ecological problems of the City.

The work contains the analysis of the existing condition of the water objects and their relevant engineering facilities. The list of the facilities (according to their types) and the basic characteristics (data base) are made based on this analysis results. There have been performed the analysis of the functioning of the operation system and the water disposal network elements control; there have been proposed the type approaches to the application of the relevant hydraulic structures and other engineering facilities for the multifunctional usage of the water objects depending on their type.

For example: the group (the list) of the water bodies recommended for fountains arrangement - and a set of type approaches for them.

Or: the type approaches to the construction of the backup facilities for river channel water bodies of multipurpose application - for flow regulation; for decorative purposes (decorative waterfalls, mills, quick-flowing streams); for water treatment purposes (aeration facilities, filtering structures, settling facilities).

This work includes the development of the principle schemes for the water disposal network facilities reconstruction to provide the possibility of the network regulation, reliable operation and maintaining of stable ecological condition of the City water system.

This work is an obligatory stage for the transfer to the concrete designing of the facilities for engineering improvement and operation of the water objects of the City within the framework of a single complex approach to their condition evaluation.

Thus at present about 35 water objects are included in the list of the water objects where recreational zones are located and which are equipped for swimming purposes. 25 of these water objects are internal water bodies located at the City territory. As a rule, only 7 - 10 water bodies were recognized to be suitable for swimming purposes based on the results of the acceptance commission examinations made during the periods of bathing seasons. The reasons for that were either unsatisfactory water quality, or bottom contamination, or the low level of equipment with services and utilities. Among the water bodies included in the lists of the water bodies of bathing quality there are some pools located in the vicinity of large highways and not having any green protective belts as well as some pools located in the vicinity of a waterway which carry heavily contaminated water. On the other hand, there is a number of relatively safe water bodies (especially the ones located in the upper reaches and having small water catchment areas) which are situated in recreational zones but are not equipped correspondingly; these water bodies are not related to the pools of bathing quality; therefore they are not controlled properly.

Apart from that despite of all the prohibitions and warnings the population still bathe in ecologically and sanitary unsafe water bodies located in the vicinity of their dwellings. There has been considered the possibility of such water bodies reconstruction in order to bring them to the level of the water bodies of swimming quality.

Thus the water bodies of swimming quality require careful analyzing and individual approach that would provide the ecologically safe for humans and the least harmful for nature usage of the water bodies for swimming and recreational purposes.

The novelty of the given work depends on the fact that it was preceded by the careful study of the single hydrographic system of the City; this system establishes the relevant condition for each of the water bodies and determines their functional purposes that predetermine both the water quality and the requirements for a given water body. This approach to the evaluation of the condition of the water objects of the City is chosen for the first time; it makes it possible to solve the practical issues of water bodies usage for the needs of the population in the most expedient and complex way.

THE BENTHIC FAUNA STRUCTURE AS THE MEASURE OF THE ECOLOGICAL STATE OF THE IVANCOVO RESERVOIR

Brekhovskhikh V.F., Vishnevskaya G.N.
Water Problem Instute, RAS, Moscow, Russia

The ecological state of the Ivancovo reservoir was estimated by the benthic fauna structure. Qualitative and quantitative characteristics of macrobenthos, as well as its distribution all over the reservoir were studied by the use of the Shannon -Wiver index of taxonomic biodiversity.

The data obtained have shown evident changes in the ratio of main bentic groups during the last 40-50 years. There is a marked increase in the oligochaeta quantity, with chironomida prevailing in the biomass (up to 73% in 1997) and the sharp decrease in sphereida quantity (up to 1% in 1997, as compared to 47% in the 1950-th). These changes are due to the deterioration of the water quality because of the human impact and natural eutrophication processes in the reservoir.

The dredging is one of the anthropogenic factors to influence the benthic fauna: it results in changing the biocoenosis structure.

Taxonomic diversity indexes were calculated on the base of the quantity and biomass of benthic organisms in different parts of the reservoir. They happened to be low: mean values over the whole reservoir were 0,54 and 0,64 for the quantity and the biomass respectively (maximum value of the index equals to 5,0).

The data obtained have shown the macrobentos specific structure impoverishment and prevailing of only one group. Low values of the taxonomic diversity index are the evidence of the habitat deterioration in the reservoir.

THE EFFECT OF FILLING LEVEL VARIATIONS ON THE WATER QUALITY IN THE MOZHAISK RESERVOIR

Brekhovskhikh V.F., Gachkina N.A., Shakirova E.R.
Water Problem Institute, RAS, Moscow, Russia

The eutrophication rate of a water body depends on many factors including production-destruction processes. The increase of the production-destruction rate in the water column leads to the increase of the flux of organic and biogenic substances to bottom sediments. Bottom sediments accumulate these substances and so they may become the source of secondary pollution.

The study of destruction processes in bottom sediments of the Mozhaisk reservoir has shown that the contents of organic matter and phosphorus sorption capacity in silty sediments increased by many times during the last 20 years, as well as the potential supply of mobile phosphorus and its flux to the water column. The increase in the sediment processing capacity contributes to the increase of oxygen depletion rates in the hypolimnion, so the risk of fish kills and increased phosphorus release arise because of anoxia.

The low filling level in summer has shown to contribute to the increase in the rate of organic matter destruction in

sediments, thus leading to the increase in the mass exchange rate.

The analysis of year-to-year variations of the exchange and destruction processes rates has shown that these processes depend on the amplitude of water level variations in the reservoir.

The increase in the amplitude of water level variations leads to the increase in sediment oxygen demand and phosphorus release to the water column.

HEAVY METALS IN BOTTOM SEDIMENTS OF THE IVANKOVO RESERVOIR

Brekhovskikh V.F., Volkova Z.V.
Water Problems Institute, RAS, Moscow, Russia

Accumulation of heavy metals in bottom sediments in the Ivankovo reservoir has been studied. The results obtained show that heavy metals concentrations in sediments decreased by as much as several times all over the reservoir during 1990-1997. But there is a marked difference between concentrations in sections with the intensive water exchange and in shallow bays and former underwater sand-pits.

The sediment pollution level was estimated by the use of the accumulation index (AI), which is derived as $AI = (C_i - C_b / C_b) \times 100\%$, where C_i is the local concentration of the i-th element and C_b is the background concentration for the Upper Volga River.

It was shown in 1997 that bottom sediments were polluted mostly by Zn and Cu, with maximum AI values of 503 and 450 % for Zn and Cu , respectively. The number of the microelements has decreased in 1997 as compared to 1990, as well as AI values (see table 1).

Table 1. Maximum AI values (%) in bottom sediments of the Ivankovo reservoir.

Elements / Years	Cu	Zn	Cr	Cd	Ni	Mn	Pb
	sections with the intensive water exchange						
1990 r.	3230	2650	1360	13980	2220	540	25410
1997 r.	450	550	-	90	3	-	10
	shallow bays (the Omutnya bay)						
1995 r.	690	2060	1110	-	510	640	370

Note: the mark "-" means that the concentration is less than the background

One can see from the table 1 that high concentrations of metals still exist in heavily polluted shallow bays. In a moderately polluted bay (the Bortsino Bay) concentrations of most microelements were less than the background.

The study of liquid and solid phases at bottom sediments in former underwater sand pits has shown that the distribution of heavy metals strongly depends on the organic matter content in the solid phase. In sand - pits with a high content of organic matter (20%) there are high concentrations of heavy metals in the solid phase and low concentrations in the interstitial water (former sand-pits of "Ustye" and "Gorodishe"). And vise versa, when the organic matter content is low (2-6%), concentrations of metals are high in the interstitial water and low in the solid phase ("St. Helen" sand -pit).

MODELING OF THE FLOW DYNAMICS AND POLLUTION'S TRANSFER IN THE LOWER VOLGA RIVER

Brekhovskhikh V.F., Perekalsky V.M.
Water Problem Institute, RAS, Moscow, Russia

Evaluation of the pollution level of the Lower Volga River is of great importance because of sturgeon spowning-grounds there. The Volgograd Reservoir is the main source of pollutants such as phenols, nitrites, copper ions etc.

Another source is the Volgograd City with its sewage effluents, some of them being without any treatment. Concentrations of fluorides, oil-products and suspended sediments often exceed permissible levels for fish.

Flow dynamics and propagation of pollutants were studied in the section of the Volga River between the Volgograd City and the Astrakhan City, using mathematical modeling, The system of non-stationary two-dimensional equations of 'shallow water' and mass-transfer were used. In some cases one-dimensional mass-transfer equation was used.

Preliminary calculations have shown that the effect of the Volgograd City sewage effluents on the water quality is small. It can be detected only on the river section of approximately 10 kilometers long even under the 10 times increase of pollutants concentrations in waste waters..

SURFACE WATER: AN ALTERNATIVE SOURCE TO GROUNDWATER

Carbonquillo W. A.
Davao City Water District

In many parts of the Philippines. groundwater is the main source of potable water. Davao, one of the fastest-growing cities in the Philippines, derives about 95 percent of it's water from groundwater sources.

Contrary to the popular belief, however, groundwater is finite and must be utilized wisely and managed carefully. Otherwise, wanton exploitation can bring about disastrous consequences. Continuous utilization of the well fields coupled with the unregulated withdrawals by large industrial users and private well owners, can trigger the decline of water levels due to increased production. There is also the possibility of saline intrusion which could likewise affect the well fields due to the proximity of most of these to the coast.

In an effort to preserve its groundwater resources for the sake of future generations, tile Davao City Water District intends to develop a surface water source. Aside from environmental considerations, DCWD came about with this option after realizing that it has become heavily dependent on electrical power. At present, it draws water from 37 pump wells. Hence, when power outages occur, its service is seriously hampered and huge system losses are incurred.

After thoroughly studying the matter, DCWD has decided to tap the Tamugan River as all alternative source. Originating from tile slope west of the city boundary and north of Mt. Talomo, this river is capable of producing 250000 cubic meters a day- Once completed, the project. will enable DCWD 10 serve between 80-90 percent of Davao's population and ensure the city of a continuous and abundant supply of water up to the years beyond 2000. More importantly, DCWD will no longer be relying much on electrical power since water will be delivered by gravity. The project, however, is father ambitious and is estimated to cost approximately P1.5 billion. Because of the huge capital investment requirement, DCWD will undertake this project through BOT.

With this DCWD hopes to draw on the technical expertise, financial resources and utility management skills of the prospective concessionaire from the private sector. If successful, the concessionaire will sign a agreement with DCWD to undertake all facets of the designs construction, management, operation and maintenance or the system. The concessionaire will operate and manage the system over a period of between 20 to 25 years.

CENTRAL RESEARCH INSTITUTE FOR COMPLEX DEVELOPMENT OF WATER RESOURCES MINSK, THE REPUBLIC OF BELARUS

Cherepznsky M.M., Tomilina H.M.
Minsk, Buelorussia

Increase in water use and water abstraction, intensive development of the city territories upset the balance of quantitative state and led to the progressing contamination of water resources and as a result to the sharp worsening of hydroecological problems of the city of Minsk.

Scientific works of the CRICDWR aimed at the solution of Minsk hydroecological problems, are connected with substantiation and development of the city river and reservoir protection zone projects; with rehabilitation of small rivers; with research of sanitary protective zones condition of ground water intakes; with study of possible siting of ecologically dangerous objects in water protection and sanitary zones with the aim of substantiation of water protection activities for surface and ground water quality conservation; with the development of ground and surface water monitoring system.

One of the most effective preventive measures for Minsk in order to protect water objects from contamination, pollution and exhaustion. In 1994 the CRICDWR worked out the regulating documemt "Provisional regulation of water protection zones and riparian stripes of the city of Minsk rivers and reservoirs" and also the "Layout of water protection zones and riparian stripes of rivers and reservoirs of the city of Minsk".

Scientific works of the CRICDWR, aimed at the solution of the Minsk hydroecological problems, are connected with grounding and development of the city river and reservoir water protection zone projects; with grounding of possible siting of ecologically dangerous objects, rehabilitation of small rivers; with conservation of ground water quality, with the development of ground water monitoring system.

There are several ground water intakes of the municipal-drinking water supply in Minsk. Carried out hydroecological researches allowed to work out the recommendations on the main trends of the civil engineering policy in two water abstraction zones with the aim of ground water quality conservation.

In 1994-1997 the CRICDWR studied the possibility of siting of more than 100 objects within the water protection zones; 12 projects were rejected, for 46 projects the hydroecological groundings were worked out with the complex of water protection measures.

The CRICDWR carried out a number of special researches on the assessment of the river runoff reduction under the impact of technogenic factors, defined the inventory of rivers (upper reaches of the Slepnya, the Loshitsa, the Myshka rivers), where it could be possible to realize engineering actions on runoff rehabilitation, examined the possibility of rainwater discharge use after its treatment with the aim of the research of small river catchment transformation under the anthropogenic impact and the possibilities of their rehabilitation.

At present the CRICDWR is carrying out researches on the updating of the ground water monitoring system in Minsk, one of the most important preventive measures of the ground water protection from contamination and exhaustion.

Artificial reservoirs made for the landscape amenities and recreation turned out in practice into the settling places for rainwater runoff and for 'relatively clean' industrial wastwaters. Bottom sediments of Kurasovshchina reservoir contain in large amounts oil products and heavy metals. The number of carried out researches made it possible to work out measures on its purification and improvement.

The state zoological preserve 'Lebyazhy' is located in the north-west suburb of Minsk. The intensive economic activity on the adjacent territory caused the change of the pool 'Lebyazhy' (the nucleus of the reserve) into the degradating reservoir. Researches of the present condition, tendencies of natural and anthropogenic processes and based on them scientific and practical recommendations constituted the basis for the project of the pool and the reserve 'Lebyazhy' reconstruction, and also for the buffer zone establishment.

At the end of the article it is necessary to conclude that the great amount of carried out work showed the need to further develop hydroecological researches and their regulative-methodical base. Problems, connected with the environmental protection of the city of Minsk should be solved in close cooperation of the city authorities, nature protection institutions and research departments of the Ministry of Nature Protection of the Republic of Belarus.

ON DEFINITION OF UNSTUDIED MOUNTAINOUS SMALL RIVERS RUN-OFF CHARACTERISTICS (ON EXAMPLE OF ARAGATS MOUNTAINOUS REGION OF ARMENIA)

Chilingaryan L., Mnatsakanyan B., Nazinyan W.
Association of Water Problems and Hydraulic Engineering Republic of Armenia

The definition of small rivers run-off characteristics is important and difficult, especially for regions of volcanic origin. In these regions the rivers, which have strongly seasonal character, as rule are not studied. The use of thawed and silt flow formation run-off in the lower submountain regions is possible only in case of their regulation in small reservoirs and ponds of local importance.

For such small rivers the estimation of water resources and definition of hydrological characteristics has a great utility importance but are difficult to define. An example of such region is the Aragats block. In the top part of morainic depositions, the formed run-off is flowing till altitudes of 2500-2000m after which a strong decrease of run-off is observed, which have silt character of regime and bed. At the same time the decrease is caused by considerable infiltration, in the slopes as well as in riverbed.

For run-off estimation and definition of such unstudied rivers which haven't corresponding analogues, combination of the method of defining of climatic run-off by method of water-balancing estimation of snow thawed is applicable. The calculation is done for definite (designed) return period. By measured snow density and depth data, by the motion of temperature board of snow thawed up by the mountain slope, the decade hydrograph of thawed water by water-balance method is defined. The total seasonal run-off is checked by calculations of zonal climatic run-off.

The results allow to estimate the size and regime of possible accumulation of thawed water in higher zones of run-off formation, till its decrease caused by result of infiltration.

MAIN DIRECTION AND GENERAL PRINCIPLES OF WATER PRESERVING MEASURES IN THE SELENGA RIVER BASIN

Dambiev Ts.Ts., Matkhanova V.E., Legostayev S.M., Imetkhenov A.B., Bertonova A.A., Dambiev Ts.L., Dambiev Tch.Ts.
East-Siberian State University of Technology, Ulan-Ude, Republic of Buryatia, Russia

The main source of water supply of Lake Baikal is the Selenga that contributes the lake the largest volume of technogenic contaminating substances. To prevent negative consequences of the economic activity it's necessary to work out and fulfill the set of water preserving measures. A scientific base for these measures is a forecast of possible changes of quality of water both in separate zones and for the lake in the whole.

An algoritm of forecast estimations:

1. The main sources of water pollution in the Selenga basin are being determined according to the up-to-date level of national economy development.

2. A statistic analysis of the present condition of the Selenga basin water quality is being fulfilled.

3. On the base of forecast model the testing calculation of water quality for the Selenga basin is being fulfilled.

4. The requirements to the quality of water of the Selenga river basin including flow area of Baikal are being formulated.

5. The set of water preserving measures that provides standards of water quality at all checking alighments is being worked out.

6. Considering that 60% of the Selenga basin is located in Mongolia it is necessary to work out international agreements pointing out the water preserve measures on this territory.

7. It's necessary to work out the rules on diverse usage and preserve of water resourses of the Selenga basin. The main principles of these rules must be the outstripping of the

sewage purification divices equipped to economic cultivating of the Selenga basin territory.

The proposed strategy of working out of water preserve measures can be used for basing of other flows of Baikal the Barguzin and Angara rivers first of all.

REGULATION OF FLOOD RUNOFFS ON ARAKS RIVER

Djavadian Ju.L.
Scientific-Industrial Enterprise On Water Problems And Hydroengineering Of The Republic Of Armenia

Araks is a boundary river between the Republic of Armenia and the Turkish Republic.

Average monthly flow of water on the State border stretch is 3,45 billion m^. Flood discharge for the return period of 1:10000, that take place in spring is about 4000 n^/sec.

Summer discharge is insignificant and makes not more than 10-15 m^/sec. The only opportunity of increasing the summer discharge is the construction of a reservoir on Araks river with a capacity of 600 ml m^.

The construction of the reservoir is planned mutually by both states (Armenia and Turkey) at the confluence of two border rivers - Araks and Akhourian. The reservoir is aimed for complex solution of the following problems:

1) Problems of irrigation.

The planned reservoir will cover the irrigation requirements for both sides with 350 ml m of water annually. Drain of 165 ml m on Armenian territory will be used for irrigation of new lands on the area of I I,800ha, for improvement of water supply on the area of22,600ha, for replacement of water source on the area of 12,300ha. Approximately the same picture will be on the Turkish side.

2) Questions of hydro-power engineering.

The large energetic potential of the Araks river on the above mentioned stretch is not used absolutely. Drain for energetic purposes is 2400ml m .

Construction of hydropower station with a power of 48,000kwt is planned on each side.

The overall average annual generation of electric power will be 263 ml kwt.hours.

3) Problems of protection of coastal lands from inundation, prevention of protective embankments and of coastal protective constructions from destruction.

During flow of destructive flood discharges about 500 ha of fertile coastal land is inundated on the territory of Armenia, thus excluding them from agricultural consumption. Moreover, yearly floods partially flush away the protective embankments and destroy coastal protective constructions, causing considerable damage. Suffice it to say that the Armenian side spends about I ml US dollars annually for reconstruction on that stretch of the river.

The amount of damage from land inundation on the Turkish side is approximately the same.

The construction of the reservoir will decrease the river flood discharge considerably. The coastal protective constructions and protective embankments will reliably protect the coastal land from being inundated and destroyed. The coastal lands now in use will give significant income to land users.

4) Stabilization of State border-line.

Periodic floods change the State border-line, that now passes along the river bed. So it becomes necessary to carry out expensive works on redemarcation of State border-line.

After reservoir construction the flood discharges will be decreased considerably, the river bed processes will stabilize, and the redemarcation of the border-line will become practically unnecessary.

The joint cooperation of the Republic of Armenia and the Turkish Republic in the business of river discharge regulation on boundary river Akhourian was carried out in the seventieths and, as a result of that cooperation, the reservoir on the border river Akhourian with a capacity of 525 ml m^ was put into service in 1981. Construction of that reservoir was accomplished by both States together. The planned construction of the reservoir on Araks river will bring considerable economic benefits.

ECOLOGICAL AND ECONOMICAL ANALYSIS OF THE WATER RESOURCES CONSUMPTION IN RUSSIA

Dubinina V.G.
Interdepartmental Ichthyology Commission
Zelikina L.F.
Central Economics and Mathematics Institute of Russian Academy of Sciences

One of the most important modern problems is that of rational employment and protection of water resources. During the recent years (1990-1995), while the industrial and agricultural gross production cut down more than twofold , water consumption reduced by 28 % only, which is an evidence of a certain decline in the technological level of production. To assess structural changes of water employment one uses the following water consumption indicators: the specific water capacity of industrial production, i.e. the gross water consumption (fresh water plus recycled and return water) as related to the physical volume of industrial output per item; the indicator of specific fresh water consumption in total industry, as well as in its particular branches; the specific contaminated waste water

intake index; the fresh water saving coefficient (coefficient of recycled and return water).

For correlation with the international norms, one uses the indicator of fresh water consumption per unit of the Gross Domestic Product (GDP)., which is calculated by State Statistic Committee (Goskomstat of Russia) according to the UN Program of Internationally Compared Data (in US $) ([1]). Between 1990 and 1995 water consumption per unit of the GDP increased to 30% , from 0.090 to 0.117 cubic m per US$. For comparison, in 1985 specific consumption of fresh water was 0.006 in FRG and 0.032 cubic m per US$ in Sweden.

In all branches of industry, with the exception of fuel and electric power industry, specific water capacity of industrial production and specific fresh water consumption increased substantially. During the 1990-1995 period the growth of specific water capacity averages: threefold in industrial machinery and metal cutting and light industry, 1.7 times in non-ferrous industry, 1.6 times in ferrous industry, 1.5 times in building materials industry, 1.5 times in logging, wood-working and pulp-and-industry. Similar proportions are observed for specific fresh water consumption, which is an evidence of a large-scale distortion and reduction in the employment of the existing less water-consuming technologies (see Table).

The high technologies sphere, mainly concentrated in industrial machinery and defense industries, is in the most difficult position. For example, for the defense industry it took only 3 years to reduce the fresh water saving coefficient to more than 15 points - from 74% in 1993 to 58.3% in 1995.

Among the 24.5 cubic km of sewage water that stood in need of purification, only 2.6 cubic km are normatively purified, that is, a little more than 10%, which shows that the most part of the purification facilities are warn out and its functioning are highly ineffective, as well as the decrease of control by the volume of waste water containing pollution substances. There are additional data supporting that statement, e.g. those on specific contaminated waste water per item produced, which have grown in many industries by 1.5 times and, in the light industry by almost three times.

Table. Water consumption indexes.

Branch of industry	Index of physical volume of production in 1995 1990=100	Index of specific gross water consumption 1995/1990 1990 = 1	Index of specific fresh water consumption 1995/1990 1990 = 1	Index of specific contaminated waste waters intake 1995/1990
Total industry including	48	1.58	1.45	1.32
electric power ind.	80	1.01	0.95	0.71
fuel industry	68.7	0.9	0.92	--
ferrous ind	57.	1.6	1.39	1.53
non-ferrous ind	54.8	1.74	1.80	1.78
chemical and petrochemical	47.8	1.3	1.23	1.28
industrial machinery and metal cutting	40.4	2.83	1.8	1.39
logging, wood-working and pulp-and-paper	43.5	1.46	1.48	1.55
building materials	44.2	1.50	1.34	1.76
light industry	18,5	2.97	2.47	2.86
food industry	52.	1.40	1.05	1.21

Thus, the result of structural changes in Russian economy during 1990-1995 was the reduction of advanced water-saving technologies in total production , that led to substantial aggravation of all water consumption indexes in many industries. , In case of further industrial production growth this situation may lead to serious negative consequences for ecological state of aquatic ecosystems.

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ROLE OF SMALL RIVERS VALLEYS AND WATERSHEDS IN PRESERVATION OF BIODIVERSITY AND NATURAL COMPLEXES OF SOUTH-WESTERN PODMOSCOVIE

Emelyanova L.G.
Moscow State University; Moscow, Russia
Podolskiy S.A., Nikitskiy A.N.
Water problems Institute RAS, Moscow, Russia

Destruction of green belt around Moscow caused by wide-scale alienation of land for construction of cottages and organization of gardens is accompanied by loss of unique ecosystems and by significant rebuilding of biota. With a view to reveal natural complexes and ecological corridors preserved by nowadays the research works have been organized by Narofominsk ecological committee (N.I.Shkurpela - the head) for evaluation of environment state of Narofominsk region.

The work has been completed in 1995-97. The standard methods have been used: winter route registrations and "long-term close round" (Rusanov, 1986). During spring-summer period the route inspection of valleys and watershed areas of the rivers Protva, Is'ma, Tarussa, Nara, Pahra was made together with registration of traces of mammals vital activity. Total length of routes was about 400 km.

Alienation of land for organization of gardens has been the main form of anthropogenic impact on mammals in Podmoscovie in the recent years. Beginning from 1980 till 1994 years in Vereya lespromhoz 826,7 hectares of forest were alienated to dacha associations that is 2% of total forest area of Goslesfond (44,4 thousand of hectares). The similar intensive dacha construction is going on the territory of Narofominsk lespromhoz. Often invaluable for forestry, but highly significant for animals bogged up patches are transferred to dacha associations. For example in the place of urotshistshe "Mohovoe boloto" (5 km to the north-west of t. Vereya) with high density of elk and wild-boar population the large garden massif emerged. Many dacha associations are eager to receive land near streams and rivers. Only interference of Narofominsk region committee of nature protection stopped the building of settlement in the fir-oak forest with badger settlements on the left bank of Neznayka river.

Not only disturbance of habitats has negative impact on mammals, but sharp intensification of trouble factor as well. The zones with low number of mammal species emerged round dacha associations. Territory of such zones is 3-6 times higher than the territory of gardens. One can judge about sustaining ability of various mammal species to anthropogenic impact according to data in the table 1. The most sensitive to the trouble factor and disturbances of habitats are elk, roe and common marten. The species most sustainable to anthropogenic impact are squirrel and fox.

One of the most important aspect of construction impact on game species of mammals is dissociation of forest patches. On isolated patches the number and diversity of mammal species is considerably lower (table 1). Preservation of biodiversity of Podmoscovie forests is possible only by selection of intercommunicated forests that will form system of ecological corridors. This work has been made by authors for the whole territory of Narofominsk region. The main criteria for selection of ecological corridors became routes of elk during seasonal migration. Choosing of elk as model species is not casual. In the recent years elk in Podmoscovie has been one of the most sensitive elements of forest biocoenoses. Its number has decreased since 90-ies almost by order. The main reasons are: 1)sharp increase of poaching; 2)deterioration of fodder and protective properties of habitats as a result of intensive dacha constructions. Seasonal migrations of elk are very well known for Siberia and Far East (Formozov, 1990). The elk is considered to be settled species in central Russia. But during last three years (1995-1997) we have observed directed migration of elk to the north and north-eastern direction in the second half of April. Maximum recorded length of migration on the territory of Verya lespromhoz is 35 km. According to interrogatory the back autumn migration of elk takes place in the second half of November. Necessity for seasonal migration is likely caused by deterioration of fodder base. Long migrations are hard for elk in dissociated forest patches because of dacha constructions. This situation is aggravated by poaching. It is obvious that elk population needs and actively uses ecological corridors. Footprints of elk are clearly seen practically on every substrate. All mentioned facts enable us to consider elk as optimal model for "marking" preserved ecological corridors.

Table 1. Density of mammals population on the patches with various level of anthropogenic impact in Narofominsk region, 1995-97 years (animals/10 km^2).

Level of anthropogenic impact	Part of territory occupied by settlements (%)	Possibility to pass between forest massifs	species										
			squirrel	Alpine hare	European hare	roe	elk	wild-boar	ermine	pole cat	marten	wolf	fox
Low	less than 5	unlimited	57,2	29,5	-	1,0	0,4	1,8	4,0	0,3	2,7	0,1	2,0
Average	5-15	limited	22,9	19,6	0,8	-	-	0,7	1,5	0,4	1,0	0,05	0,8
Heavy	15-25 and more	strictly limited or impossible	22,9	3,1	0,5	-	-	-	-	-	-	-	0,8

While in Moscow only valleys of small rivers and streams serve as biocorridors (Avilova, 1995), role of valleys in the system of ecological corridors in south-western Podmoscovie differs. Valleys of the Oka river tributaries (Nara, Protva), which had been navigable long ago, were cultivated first of all, that's why the majority of their riparian ecosystems are disturbed. Valley forests are represented by separate fragments. In these patches of preserved valley forests hoofed animals migrate between forest massifs situated on different banks. Such migration routes are noticed on the Protva river to the north-west of Vereya town and on the Nara river close to settlement of Kamenskoe. These places are the most vulnerable main points in the net of ecological corridors.

River valleys of the Protva and Nara rivers preserve their role as ecological corridor for riparian species: ondatra, beaver, otter, mink and others. By today the number of beavers is minimal. During researches on the Protva river in Narofominsk region in 1995 it is determined that only 10 beavers inhabit it, while capacity of beaver habitats on this part of the river estimated according to methods of U.V.Diakov(1975) is no less than 90 animals. Otter is even

more rare: we have detected only solitary animals. American mink is common and sometimes numerous species.

Valleys of smaller streams such as Is'ma, Ratovka, Tarussa, Kremenka etc., are less disturbed by human activity and they are naturally included into the net of ecological corridors. The most significant are cluttered up patches of valley forests - they provide good protective conditions for many mammal species.

Some mammal species that are not riparian also often inhabit valleys. Thus 91% of badger settlements that we have found in Narofominsk region (n = 11) are situated in the upper parts of the terrace slope or ravine slope. Holes are made in sandy or loamy sand ground. Fodder paths of badgers lead to the floodplain and to the watershed. Only one badger hole is noticed far from the river valley.

So in the south-west region of Podmoscovie preservation of species diversity and stable number of mammals is possible only by preservation of normal net of ecological corridors. The main part of this net is represented by forest massifs situated on the watersheds. Preserved patches of valley forests are main points and binding links of this net. They are often the most vulnerable elements of the system of natural complexes stability. Meanwhile valleys of small rivers are focuses of biotic and species diversity. Today the mass dacha construction often made without analysis of possible ecological consequences became the most significant factor of anthropogenic impact on mammals of Podmoscovie.

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WATER AND ECOLOGY: LESSONS LEARNED AND FUTURE PROSPECTS TO MANAGE TRANSBOUNDARY WATERS IN EUROPE

Enderlein R.E.

Secretariat of the United Nations Economic Commission for Europe, Palais des Nations, Geneva, Switzerland

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 (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.

Particular 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. This culminated in 1992 in the adoption of the Convention on the Protection and Use of Transboundary Watercourses and International Lakes, which entered into force on 6 October 1996. Among 21 other Governments, the Russian Federation is a Party to this Convention.

Cooperation on transboundary waters

The lecture will provide lessons learned from the drawing up and the implementation of agreements on transboundary waters. It will highlight the most pressing problems of transboundary water management and inform about steps taken to prevent, reduce and control adverse impact on the environment, including human health and safety.

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. Two problems will be specifically dealt with: joint bodies (e.g. river commissions) as well as water and human health. The latter will also be part of the round table discussion).

ASSESMENT OF CONDITIONS OF WATER QUALITY FORMATION AT RIVER BASINS OF CONTIGUOUSSTATES

Eremeeva B.B., Viktorovsky I.V.,Khoroshko L.O.

St.Petersburg Scientific Research Center of Ecological Safety, Russian Academy of Sciences, St.Petersburg, Russia

Deterioration of the ecological conditions of water ecosystems during the last 20-25 years is mainly due to the increase in anthropogenic effect on the drainage basins and atmospheric streams. This problem can not be solved without a complex natural investigations of water ecosystems directed to estimation of anthropogenic effect on a water object on the basis of data on landscape structure of a drainage basin and a character of industrial activities. The effect on a water system is a result of pollutants appearance in the channels of the basic rivers and their inflows from the waste waters, from the surface and ground runoff of non-

point sources (agricultural and development), and from atmosphere also.

To determine the transboundary pollutants transfer and to find the main originators of the natural waters pollution the natural and research studies were carried out of lake-river ecosystem of Seleznevka river (Finish Rakkolainiioki). The drainage basin of this river is situated in the territory of two contiguous states (Russia and Finland). Conditions of water quality formation and development of practical recommendations for prevention the negative changes in ecosystem "drainage basin - water object" are the main goals of this study.

A course of hydrological and hydrochemical observations was carried out on a Seleznevka river and its basic inflows: rivers Khouniioke, Buslovka, and Gusinaya. Determination of the basic hydrological-hydrochemical indices within the gauge lines was dated for the basic phases of hydrological modes of the river (spring flood, summer low-water, and autumn rain floods). Determination of water chemical composition was performed by the standard procedures.

System of integral indices developed in Saint-Petersburg State Hydrological Institute was used to estimate an anthropogenic effect and to generalize the data obtained. The basic of those indices is the index of the total effect of the river stream indicating the effect by limiting or representing substances and taking into account its variability due to the changes in hydrological-hydrodynamic stream elements (water consumption, streams rate, and depths). To determine the total anthropogenic effect on the objects under study the annual (seasonal) runoff of the limiting substances was calculated as well as their mean-annual concentrations. These indices of water stream pollution allow us to take into account the natural pollution from both point and non-point sources. Along with these two indices, so called index of water pollution (IWP) was used, characterizing the sum of mean-annual concentrations of pollutants (in terms of maximum permissible concentrations - MPC) in the river gauge line.

According to our studies, water in the rivers under study are characterized as medium polluted and polluted. Therewith river waters from the Finland territory income already as medium polluted. Additional anthropogenic effect in the Russian drainage basin results in the fact that waters of Seleznevka river become "polluted" according to IWP classification.

The main water pollutants are: ammonium nitrogen, petroleum products, and heavy metals. Calculated mean annual concentrations of NH4 exceed MPC by 2-3 times, that of petroleum products - by 5-11 times. The main pollution with petroleum products is stipulated by the petroleum intake with the rain runoff from the development land in summer - the period of the greatest vehicle influence on the area. The main amount of ammonium nitrogen comes into the river during the spring flood, that of petroleum - during the summer rain floods. According to the data of balance calculations the value of polluted NH4 runoff, coming into the water system with the runoff from non-point sources of pollution from Finnish agricultural region, attained approximately 117 tons in 1996 hydrological year, while the entrainment from Russian area is 15 tons per year. Dynamics of the NH4 runoff increase complies with the increasing anthropogenic influence on the Finland's drainage basins and is induced by the agriculture intensification in the country in 80-90ties.

The runoff pollution with heavy metals displays the similar tendency. Analysis of the data available testifies the increase in heavy metals concentration in the river water since the latter 80-ties. Copper, manganese, and lead are the main pollutants of Seleznevka river. As compared with early 80-ties concentration of manganese in the river has increased by 10-15 times, that of copper - more than by 5 times. The reason of such an abrupt increase in heavy metals concentration is their entrainment with the surface snow-melt and rain runoff from farming lands and cattle farms into the unit river catchment, arranged on the Finnish area.

Along with the standard hydrochemical monitoring of the water quality, adopted by the Rosgidromet, analysis for all the organic compounds was carried out for the first time.

The studies performed testify that the main sources of pollution in the water ecosystem of river Seleznevka and its inflows are non-point sources (farming lands, cattle farms, and development lands). The main entrainment of pollutants comes from the Finnish part of the drainage area. The materials of natural studies were used for creation of a conception model of "drainage basin - water object" system functioning, which regulates the streams of anthropogenic influence on a water system.

WATER PROBLEMS REPUBLIC OF KARELI

Filatov N.N.
Northern water problems Institute, Karelian Research Centre, Russian Academy, Petrozavodsk, Russia

Karelia located in eastetrn part of Fennoscandia and occupies territory about 172000 km2. It has the well advanced hydrographic network, which make 23.6 tous.rivers and 61 tous. lakes, in which is concentrated 245 km3 of water, annual runoff - 57 km3. In Karelia situate the largest lakes of Europe - Onego and Ladoga, and also White sea are located. The modern condition of water resources is determined by natural, climatic features of the egion and antropogeneous influence. The chemical structure of waters of Karelia is formed in conditions of the Baltic crystal sheald which has been well washed out quartenery depositions. The natural quality of waters changes as a result of influense of waste water, agricultural, ameliorations and atmospheric pollution by trunsboundary flows. The sustainble development of the region is largely defined by a condition of water objects.

The most important water-ecological problems of region:

• Natural and antropogeneous changes of a climate and their influence on water ecosystems,

• Acidifications of water bodies,

• Eutrophications and tocsic influence on Onego and Ladoga lakes and number of other waters,

• condition of the White sea, espesially Karelian coastal zone,

• drinking water supply in connection with poor quality of rural waters from lakes,

• high mutagenious of waters from the centralized sources of water supply,

• estimation of water-resource potential, character and features of its use in new socio-economical conditions.

Waters quality.

For an estimation of modern quality of surfase and underground waters and its changes as a result of antropogeneous influence in Northern Water probles institute is executed mapping of water qulity by a set of parameters.

Waters with high quality are characteristic of the greater part of water shead of the rivers Kemi, Suna, Wodla and also for Onego lake.

Underground waters.

The chemical structure of underground waters of Karelian hydrographic area differs by a large variety: on mineralisations waters from ultra fresh (less than 100 mg/l) up to waters with concenmtrations more than 1000mg/l are submitted. Underground waters on the basic part of territory ђЃb are dated basically to sandy qartenery to adjourment and a crystal sheald. Miniralisations of underground waters varies from 0.03 up to 1.0 g/l. Waters with higt miniralisation are located along coast of Ladoga lake and Onego and Salmi, and also in a coastal region of White sea. Mineral waters with mineralisation up to 1 g/l contain biologically active components - radon and iron. Radon water with concentration of radon more than 185 Bc/l are investigated in northern Ladoga, eastern and western Onego and central Karelia.

Major factor of antropogeneous influence on water objects of Karelia is a waste waters of industrial centres. Total water supply about 226 mln.m3 per one year. For the drincing water supply is necessary 38 %, industrial - 56%. Maxima of water supply is necessary on a paper industry (about 75 % from industrial).

Condition of the largest lakes of Europe.

The Onega lake nowadays is at a stage of destabilization of ecosysten and initial stages of eutrophication. Some bays, especially Kondopoga, already have replaced originally oligotrophic status and corresponding mesotrophic level

The Ladoga lake is a none alternative source of drinking water supply of and Leningrad area and S.Petersburg. It has oligo-mesotrophic status. The reduction of industrial pressure and almost five times of fertilizers for an agriculture have resulted in delay of speed of process of eutrophications.

Acidiphication.

Waters of the region have very low miniralisation and buffer capacity and weak stability to acidiphication. The atmospheric precipitation which are dropping out on territory of Kareliya are acid. They represent potential danger as a source of pollution and acidiphication. The precipitations contains about 90 % of sulfur of an industrial origin. Mostly loss of strong acids is connected with trunsboundary flows. The consequence of acidiphication of waters increase of the contents of mercury in a fish and aluminium in water.

Some features of influence of changes of a climate to water systems.

Changes of a climate, appreciable warming can result in changes surface and ground waters. At increase of temperature of air temperature of water of lakes will be raised will increase a period withouth ice, the amount of atmospheric precipitation will increase, that will cause increase of water level of a lakes. Such changes of the hydrometeorological characteristics will result in changes water and ground ecosystems. The changes of a climate will result in necessity to change the approaches in an agriculture and make some corrections of water supply activity in region.

Quality of water in open water objects more often very low because of the high contents of organic substances, iron, manganese and other components. As a whole it is necessary to aspire to transition, where there is an opportunity, on use of underground waters. From more than 700 settlements in Karelia only 104 of them are available water supply networks. Chlorination of high coloured waters with rich contents of organic matter is the result of very high mutagenic effect.

ON WATER QUALITY FORMING IN VOLCHIKHINSKOYE WATER RESERVOIR - YEKATERINBURG DRINKING WATER SUPPLY SOURCE

Fyodorova E.V., Borissova G.G.
RosNIIVKh, Yekaterinburg, Russia

The Volchikhinskoye water reservoir is the central one in Yekaterinburg water supply system. Nevertheless, its water sanitary-hygienic indicators have become worse recently due to great catchment area anthropogenic loads. Great amounts of organic substance are produced in the reservoir resulting in color of water and pathogenic microflora reproduction. This can be accounted for both by big quantities of pollutants from point and surface sources and by the reservoir inner processes.

To develop a number of measures to enhance the reservoir, main flows of chemical substances, forming water quality, have been determined. It's common knowledge that a reservoir is filled up by river flow, regional flow from particular catchment area, ground water discharge and atmospheric fall into catchment area and reservoir water area, the per cent ratio of the sources mentioned above vary depending on hydrological flow phase.

For the last 5 years the analysis of the inflow into the reservoir has shown that its volume is mainly filled up by release from Verkhnemacarovskoye water reservoir, situated upwards (from 70% up to 85%). The part played by the flow from particular area is greater in times of spring floods and freshets when quota may reach up to 50% of the whole flow. At the same time the greatest biogenic substances washout from catchment area is observed.

The research on the particular catchment area structure has made it possible to determine parts played by various flow-forming complexes in biogenic elements run-off processes. The greater part of its area is taken by nature lands, represented by forests, meadows and marshy lands. Agricultural areas amounts to 8% of the whole territories with no system of sewers to 3.4%, urban ones to 2%, recreation and collective gardens zones up to 1% each.

The calculation of biogenic substances run-off from different catchment area structure elements in the period of time of spring floods has shown that pollution mainly results from no-sewer territory: 25.2% mineral nitrogen, 18.6% phosphorus, 15.6% potassium. They are followed up by agricultural areas; 14.7%, 12.2% and 14.5% respectively.

Thus, no-sewer territories occupy the prior place in structure of pollution sources effused into Volchikhinskoye water reservoir from a particular catchment area. In this connection it is necessary to develop a number of measures aimed at preventing pollutant admixture flows from these sources.

At the same time, as the main part in resource-forming characteristics of Volchikhinskoye water reservoir is played by a tributary from the upper basin of the Chusovaya river, it's necessary to develop and realize water protection integrated measures within the whole catchment area to normalize it.

A REVIVAL OF SMALL RIVERS OF THE TATARSTAN REPUBLIC AND ECOLOGICALLY RATIONAL FARMING ON THEIR WATER CATCHMENT AREAS

Gatin N.A.
Joint-stock company "Tatvodproekt", Kazan, Tatarstan

A visible part of chemical contamination comes into rivers together with non-purified household and industrial sewage water.

The second, less visible part of chemical impurities and which amounts almost to their half, dispersly inflows from fields.

The surface run-off of rivers, being formed on their water catchment areas, at the same time washes out a soil cover together with applied mineral and organic fertilizers. The washed out particles are carried by water into rivers subjecting them to silting and contamination.

In connection with the above, a necessity arose to conduct a revival of rivers and of their water catchment area lands simultaneusly by a complex programme being elaborated as a basin scheme for each river separately.

At the present time such a programme has been elaborated for Kazanka river and begun for Zai river.

The basic statements of the programme for Kazanka river - the left influx of the Volga river.

The basin of Kazanka river (144 km in length) occupies 2715 km^2 area and situated on the territory of 69 farms of 5 regions with 80thous. people of rural population. A considerable part of the capital of the Republic is also situated in the basin of Kazanka river being backwatered at this part by the Kuibyshev water storage . 68.6 % of the basin territory is ploughed up, 10.5 % forested, 70 % of arable land is subject to water erosion.

The programme plans to forest 11403 ha of the water catchment area, thus bringing the basin forested area total to 20.5%. With this, the forest belts for regulation of run-offs, are to be planted with consideration of the terrain - parallel to horizontals, to show the direction of cultivation strictly across the slope all along the cultivating machinery movement. This measure in combination with the counter-erosion agricultural practices of soil cultivation, and building of 484 counter-erosion water-development structures of different purpose will reduce the surface run-off by 2 times and the sediment run-off by 4 times.

The programme plans the pasture-lands, situated in the water protection zone, to turn into the haymaking, by organizing the irrigated cultured pastures for public and private cattle on the area of 10.8 thous. ha, including 3.37 thous. ha of the now existing irrigated lands. To regulate the water level and aeration in the water courses, it is planned to construct 48 river-bed barrages with waterlocks, with installation of the compact water power plants and for regulation of run-off at the upper reaches of the river - 75 ponds additionally to the existing 33 ponds.

It is foreseen to move 101 installations out of the water protection zone, to dike 386 installations, to arrange 257 springs, to build 69 sites for solid domestic garbage at central farmsteads.

In the basin of Kazanka river at 80 locations there are the discharging points of organized sewage. Of them, at 20 locations there are the sewage purification works, for 7 locations the sewage purification works are being designed; at 53 locations the run-offs of the Kazan city waste-water disposal system are discharged without purification. Their purification is planned by the programme. Domestic run-offs from the rural settlements, after biological and mechanical purification, are to be used for inner soil irrigation of non-food technical crops and forests on 1994 ha area.

The scope and costs of the planned works are considerable, and their realization will take about 20 years.

The programme is to be fulfilled in complex, basin by basin, starting from the upper reaches of run-offs. For this, it is suggested to create a non-departmental board for the

Kazanka river basin, which would organize tenders on work designing and fulfilment of planned works.

In order to widely inform the inhabitants of the basin and to improve the reliability of this programme implementation, the materials of the programme for the first time have been submitted to the customer not only for the basin in whole, but for each region and each of 69 farms occupying the part of the basin territory. This additional information is given in a popular way - to be understood by any local countryman and to be used as a school handbook on ecology.

The reviving Kazanka river is a part of "Revival of Volga" programme to be realized in the Russian Federation.

OPERATIVE FORECASTING AND NORMALIZING OF TECHNOGENEOUS-CAUSED INFLUENCES IN SCANS OF PERM REGION

Gelphenbuim I.V.
Perm State Environmental Protection Committee
Lepikhin A.P., Miroshnichenko S.A., Sadokhina E.L.
Institute of Ecology and Genetics of Microorganisms of Ural Branch of Russian Academy of Sciences

The traditional approach to the normalizing anthropogeneous influences on water objects in the framework of the system <<separated water outlets>> - <<river receivers>> in the area of high density of technogeneous loads can not be considered acceptable today. It is necessary to introduce the basin principle, which includes total account of polluting outlets within observed basin, analysis and co-ordination of interests of all water users.

On task and under the direct participation of Perm State Environmental protection Committee the program complex of operative forecasting and normalizing of technogeneous influence on water object on name "Kama" was designed and introduced in experienced-operation and maintenance phase.

It includes:

- informational databases on:
  - hydrological, hydrochemical mode and morphometry of water objects - receivers waste waters;
  - technological characteristics of regulated water outlets;
  - characteristics of potentially dangerous technological objects;
  - toxicological characteristics of pollutants;
- package of models for calculations of processes of diluting, transformatiors and migration of polluting materials in water objects. The optimum models choice is automatic and depends on:
  - fullness and accuracy of task 'of source hydrological, hydrochemical and morphometrical features of water object - waste water receiver;
  - water outlet mode behavior of pollutants;
  - length of forecasting period.

The package of models, which is included into the program complex, together with informational databases allow to decide following problems:

- to conduct dynamic normalizing and determination of standards of the most possible concentration of pollutants with the usage of basin principle for the water outlet system which has been declared;
- to execute analysis othydrological and hydrochemical mode of water object receiver;
- forecasting of possible areas of soiling of surface water objects taking into account possible migration and accumulation of hetherophaseunconservative pollutants in separate sections of system <water> - <weighted alluviums> - <bottom deposits>;
- to evaluate parameters of emergency waste water discharge on the base of measurement of pollutants distribution in water objects.

The efficiency of that system is determined first of all by adequacy of source information, timeliness of its reception, objectivity of criteria of safe pollutants content in water objects. As known the modern system of regulating of anthropogeneous polluting influences on water objects is based on the sanitary-hygienic and fishing limit admitted concentration. That system does not take into account natural background contents of pollutants in protecting water objects. At the same time the real account of watershed is important for the designing of objective criterion of safe contents of pollutant, particularly on the areas with difficult geochemical structure. Perm region is one of such area.

In this connection for pollutant, which high content determined by natural factors, was suggested to design criteria of ecological safety on the base of analysis of statistic of changing of their concentration in natural mode.

For ensuring objectivity of evaluation of these factors computer databases have been made which include official hydrochemical data about water objects of Perm region during all period of measuring.

Till the last time the estimation of technogeneous influence on water objects have been made on the base of declared wastewater discharge. According to multiple researches, the important contribution in the polluting of water object is made by hidden sources, which appeared first of all as the result of surface washing off, different diffusion sources and recurrent contamination from hetherophaseunconservative pollutants from the bottom sediments and weighted alluviums. The objective estimation of these sources is possible only on the base of detail balance researches. It is necessary to do during regulation of technogeneous influences on water objects.

In the condition of difficult ecological situation, low technological discipline the problem of emergency, which considerably influent on the environment, becomes more and more actual.

That is the reason that it is necessary to take into account potential dangerous objects when one makes the complex estimate of technogeneous loads on water objects.

Designed program complex "Kama" let make forecasting estimates both as hard link to concrete potential dangerous objects, as free variant for the emergency on the any part of water object. The calculating model depends from the character of water object and may be one-, two-, or three-dimensional.

For Kama's and Votkinsk reservoir have been made special model, which can detail calculate for mostly important part of water objects and for the whole object.

In the report will be made the analysis of some calculating modules and databases of above mentioned complex in the conditions of Perm region.

THE ISOLATION EFFECT ON THE TROPHIC NET INTERACTIONS OF AN EUTROPHIC WATER BODY

Gerasimova T. N., Pogozhev P. I.
Water Problems Institute, Russian Academy of Sciences

The interaction between zooplankton and phytoplankton in an eutrophic pond when isolated from ichthyofauna using enclosures with different wall permeability is discussed. The isolating materials were selected so that the walls of one enclosure were permeable for phytoplankton and impermeable for cladocerans, the walls of another enclosure were semipermeable for small-size cladocerans, and the walls of the third enclosure were permeable for the latter. (fig. 1)

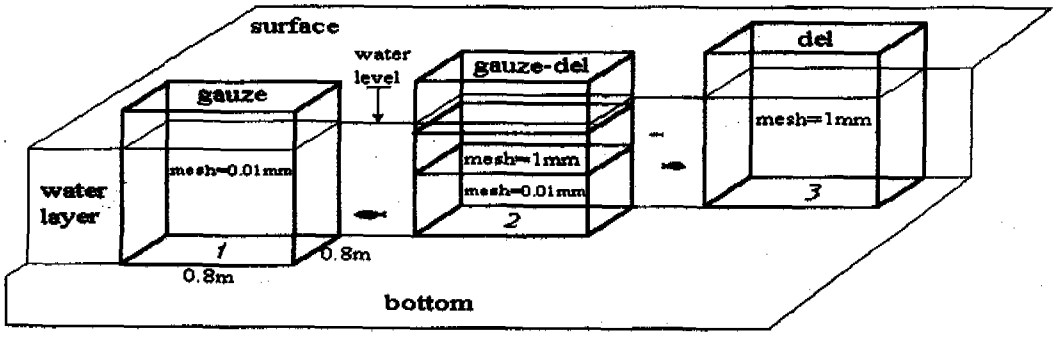


Fig. 1. Scheme of experiment.

Isolation of the zooplankton trophic link from ichthyofauna in the pond using an enclosure made it possible to assess the role of *Daphnia longispina* in controlling algal bloom. It is shown that zooplankton can play the role of a natural filter in water bodies with a high biogenic load and subjected to phytoplankton bloom.

It is demonstrated that *D. longispina* are able of substantially decreasing the number and biomass of phytoplankton, reducing the number of different-size cyanobacteria filaments (*Anabaena flos-aque*) more than 1000 times to the level of 13 filaments per milliliter and increasing water transparency down to the bottom. (fig. 2)

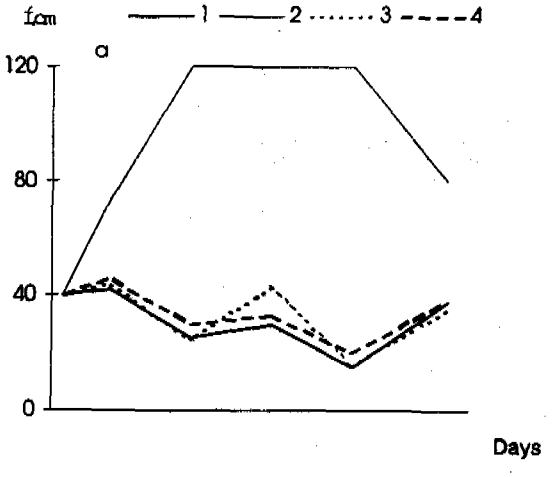


Fig. 2. Graphic of dynamic of water transparency in cm by Secci disc.
(1 - waterbody, 2 - mesocosm from gauze, 3 - combined gauze-del mesocosm, 4 - mesocosm from del)

Under conditions of isolation from fish, the *D. longispina* population eats, at first, the biomass of green algal and, then, the biomass of small-size blue-green algal, and, at last, the biomass of *Euglena*.

When *Daphnia* consume algae to the level of food limitation in the isolated ecosystem of the enclosure, conditions for development of colonial forms of the blue-green algal *Microcystis aeruginosa* are created. Food limitation also brings to a decrease in productivity and an increase in the percentage of ephippial females in the *D. longispina* population.

The absence of predators results in increasing the size distribution of the *Daphnia* population. The response of the *D. longispina* population on fish predation in the pond is the decrease in the size of broods.

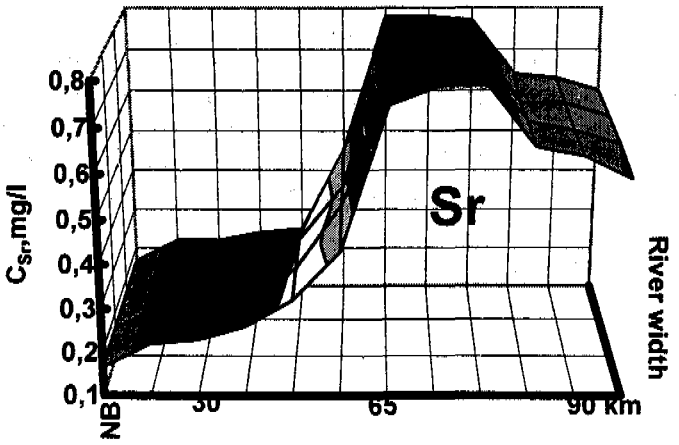
The spatial separation of trophic links of the aquatic ecosystem using enclosures may permit the transfer of the water body into the required state of ecological balance and allow controlling and planning the functional designation of the water body in advance.

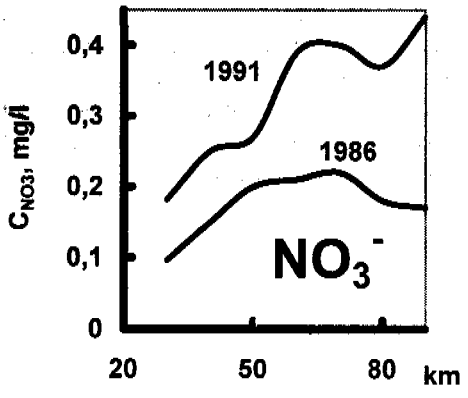
TRANSFORMATION OF A HYDROCHEMICAL CONDITION OF THE SMALL RIVER UNDER THE ATTRACTION OF THE TECHNOLOGY LOAD OF TEK

Golovin Y.G, Golovina V.V., Eremina A.O.
Institute of chemistry of natural organic raw material Siberian division of a Russian academy of sciences,
Krasnoyarsk, Russia

On territories of a disposition of fuel and energy complexes, including coal minings, energy plant and ancillary factories (TEK) have appeared under negative technology influence a series surface channels, so-called small rivers. In particular, in Sharypovo industrial zone of the Krasnoyarsk Region the Beresh river flows past. Despite its small expansion (85 - 90 kms) the river has a large value for Sharypovo industrial zone TEK because of low water supplied of region. On the average current Beresh river has been constructed the reservoir for needs of a power engineering, on the coast of the river the energy complex GRES-1, near - industrial zone of the coal mining (with opencast mining coal) is located, from the coal mining up to GRES-1 along the bank of the river there is the conveyer of coal. The population, the number of firms of a home and transport upkeep has much grown.

In the first years of the construction of basic plants TEK - GRES-1, coal a slit and firms connected to them the quality of water was not worsened because of natural self-cleaning of ability of the river. On the boundary of 90's a degree of a hydrochemical stability of the river has decreased. A content of the chemical elements, including concerning to the first - second class, on the whole stretch of the lower current of the river (15-20 km) as in water, and in floor's adjournment has increased. The concentration of bioactivity substances, petroleum, phenols, surface - active substances has increased. Presence in some tests of the increased content benz(a)pyren is marked.





A variation of concentration Sr and NO_3^- along current of the r.Beresh.

In Figure a characteristic variation of concentration of the chemical elements and byoactivity substances in the water of the Beresh river on the example Sr and NO_3^- is shown.

If till 1991 the performances of a natural hum noise of the Beresh and Uriup rivers were close, now waters Beresh river as a rule exceed a hum noise of region (for a hum noise of region a site is accepted Uriup river on the boundary of the Kemerovo province and the Krasnoyarsk region and by virtue of natural singularities not the subject to influence TEK and inhabited of territories) on all indexes, used for an evaluation of fitness of water for drinking and economic consumption.

The development of methods of long-term prediction of

an ecological condition of region is braked by shortage hydrochemical data of the small rivers of zone of TEK. Has historically developed so, that the basic attention was given larger channels. Laboratory and natural of a research on modeling of the condition ecosystems, obtaining the development recently, are labour-consuming, there is no precise evaluation of criterions of a similarity of models ecosystem to real conditions channel. A real exit from the created situation could be joined of gains of various organizations and departments (both regional, and central) for study of the lower current Beresh river as of the most real model of a hydrochemical condition and modification of the larger rivers (Uriup, Chulym and other) in conditions TEK.

THE METHOD FOR EXPRESS PREDICTION OF ACCIDENTAL WATER POLLUTION

Gorsky V.G., Shvetzova-Shilovskaya T.N., Shvyryaev B.V.
SCS SRIOCT, Moscow, Russia

We developed the method for express prediction of the accidental pollution of water flows. The method is based on the use of ready analytical expressions which describe the space and time distribution of pollutants in the flows of water in the conditions when the pollutant emission takes place practically immediately and is localized in space. It means that the mixture of pollutants and their uniform distribution in the cross-section of water flow takes place at the minimal distance from the emission point.

The convection transfer of pollutant by the river flow, the longitudinal and optional transverse turbulent diffusion, pollutant transformation according to the one-way transformation reaction of the first order are taken into account.

The longitudinal and transverse turbulent diffusion are taken into account in the mathematical model in application to the broad rivers, and the longitudinal - in the application to the narrow rivers. Hydrologic and hydraulic characteristics of water flow are reflected in the coefficient of turbulent diffusion.

The method gives the possibility to determine:

- the configuration of a pollution spot corresponding to the fixed moment of time;
- the spatial and time positioning of polluted zone borders from the moment of an accidental emission up to the moment of time when the pollutant concentration becomes equal to the normal one;
- the moments of time when the front, the center, and the back part of the pollution spot, given by normative reach the control cross-section (predefined point);
- the maximal concentration of pollutants in the given control cross-section (at the given point) of the river;
- the level of danger for river pollution.

The appropriate algorithms and personal computer programs are developed. The efficiency of the express method is proved using control examples.

PROTECTION OF CATCHMENT OF THE NEVA RIVER - THE NEVA BAY - GULF OF FINLAND

Gumen S.G.
The State Unitary Enterprise "Vodokanal of Saint-Petersburg", Saint-Petersburg, Russia
Lapshev N.
The Saint-Petersburg's State Architectural University, Saint-Petersburg, Russia
Frolov K.
"Lenkomekologija", Saint-Petersburg, Russia

Saint-Petersburg surpasses many cities of the world in reserve and quality of fresh waters in spite of a number of some non-positive factors. Provision of water per capita is three times higher than in the country as a whole. Water system Ladoga - the Neva River - the Neva Bay - east part of Gulf of Finland is a main natural element that determines the activity and economic and social development of Saint-Petersburg's region.

For the first time, some elements of the water system Ladoga — the Neva River — the Neva Bay — east part of Gulf of Finland were examined in the later half of the XIX century. Since that time, a lot of the hydrological, sanitary-and-chemical, bacteriological and hydrobiological researches were conducted in order to solve a great diversity of hydroeconomic problems. Beginning in 1966, systematic observations of water objects' quality were conducted. Materials of these observations are systematically published in the information bulletins of the Lenkomekologija .

The water content in the Neva River is determined by water content of the Ladoga Lake which is a main source of water supply of the river. Small extent of the river, and, accordingly, small areas of its catchment and that of the tributaries determine a small variability of the hydrochemical content of the Neva River from the source to the mouth. Minor seasonal variations of the river water content may be explained by the same factors.

Excessive moisture of a ground layer determines the hydrochemical features of the Neva River year-round. This feature determines a washing off easy soluble salts (chlorides and sulfates) from the ground layer of the river

catchments, with the result that carbonate compounds of calcium and magnesium are mainly dissolved.

The Neva River (distance from its source up to the city of St. Petersburg is 47 km) receives wastewater (of various degree of treatment and without treatment) from 35 large industrial enterprises, 14 settlements located on the banks of the Neva River and 15 other settlements which discharge the wastewater into the tributaries of the Neva River. Besides, the river is polluted from a surface wastewater, water transport, farming lands etc. The total volumes of polluted discharges into the Neva River from the source up to the Novosaratovka River are characterized as follows: about 90% of $BOD_{tot.}$ (6.6 thousand tons annually) are supplied with domestic and industrial waters; 63% of $N_{gen.}$ (3.5 thousand tons annually) are wastewater from the farming lands; and more than 50% of petroleum products (0.6 thousand tons annually) are brought by the water transport.

Despite of a considerable amount of the supplied impurities, their influence on quality of water of the Neva River is limited by the local zones of wastewater discharges and coastal zones adjacent to the lateral tributaries and does not cover the central part of river wastewater.

As per the data of the Lenkomekologija, it is possible to observe the dynamics of supply of the main pollutants into the water objects of Saint-Petersburg between 1985-95 (Fig. 1 and Fig. 2). Similar data may be also given for other polluting substances. The Lenkomekologija analyzes the reasons of change of the mass of disposal of polluting substances into the water objects in their pollution survey reports for Saint-Petersburg. Explanations given for the ingredients shown in Fig. 1 and Fig. 2 are as follows:

- Mass of the organic substances (as per BOD) is being decreased at the expense of effective operation of the aeration stations (CAS , NWWTP and KAS) as well as at the expense of commissioning of the 3-rd starting facilities of the first stage of the NWWTP (650 cu m/day);
- The variations of supply of nitrogen and phosphorus depend on volumes of domestic wastewater; and receipt of heavy metals is decreased at the expense of construction of local treatment plants in 1980s, decrease of share of industrial wastewater in a total volume of water drain and recession of the production.

Except that the water system is a receiver of wastewater, it is utilized for other economic purposes. The combination of these effects creates an antropogeneous load on the water objects of Saint-Petersburg.

As the receiver of a main mass of wastewater is the Neva Bay, the characteristics of this catchment will be specially examined. Water quality in the Neva River Bay is determined by the quality of waters of sources forming the volume of water masses. The volumes of wastewater do not exceed 2% of a total volume of water masses in the Neva Bay. However, they essentially influence the water quality in the catchment. For example, their share according to BOD_5 is about 40% and is up to 60% according to phosphorus. Therefore, the quality of water in the Neva Bay is mainly determined by water quality of the Neva River as well as by nature of the wastewater discharged into the catchment both after the treatment plants and without treatment.

At the final stage, the water drain system of Saint-Petersburg is the aeration stations performing the total biological treatment of wastewater and wastewater discharges into the Neva Bay and its fairways. Determination of degree of treatment of wastewater at the aeration stations is closely connected with diluting and self-purifying abilities of the water objects at the places of local wastewater disposal.

Wastewater dilutions were calculated at all the stages of designing, in that case, the numerous versions using the various initial data were examined; the design parameters of the flows at the intended places of wastewater disposal were systematically updated, the designs of the dispersing discharges were varied: number of the lines and heads , initial diameters of the holes, discharge velocity etc.

Concentration of the pollutants at the wastewater discharge C_0 was determined on the basis of the calculations of the ratio of dilution, in that case, the greatest difficulty was the setting of the values of concentration of the pollutants at the approach to the wastewater discharge (background concentrations). Their values were determined by the prognostic calculations on the basis of the analysis of the ecological conditions, with due allowance for quantitative characteristics of the polluters in the Neva River catchment where the conformity of the level of concentrations of the substances to the volumes of the supplied impurities were determined.

Summary data on calculations of the required ratio of dilution of wastewater, used when deciding on degree of treatment, are presented in Table 1 below.

Table 1. Ratio of dilution of wastewater at the aeration stations

Parameter	CAS	NWWTP	SWWWTP(project)
Calculated waste water flow rate, thousand cu m/day	1500	1250	585
Flow velocity at the discharges, m/sec	0.4	0.1	0.03
Average depth, m	5.0	4.0	3.0
Calculated values of dilution ratio			
Initial dilution	5.592	4.893	11.240
Main dilution	2.099	2.000	2.000
General dilution within 500 m from discharge	11.741	15.786	22.480

Note: Data of calculations for SWWWTP are presented for conditions of arrangement of the discharge in the vicinity of the Marine Channel.

On the basis of the dilution calculations, a full biological treatment of wastewater was accepted for all the aeration stations; it was foresaw to achieve the parameters as follows: 15 mg/l as per BOD_5 and 15 mg/l as per suspended matters. If the required ratio of dilution of wastewater as per BOD_5 will be calculated on the basis of the accepted parameters for the degree of wastewater treatment disregarding of processes of self-purification, then we will have with due allowance for values of the background content C_s = 1.5 mg/l and permissible value $C_{add.}$ = 3.0 mg/l.

Thus, total biological treatment will solve the problems of protection of the Neva Bay against wastewater pollution at all the aeration stations of the city of Saint-Petersburg.

THE QUESTION OF INFLUENCE OF THE ORE-MINING ACTIVITIES ON WATER RESOURCES OF THE SAMUR RIVER BASIN

Guruev M.A., Tagirov K.K.

Numerous researches showed that environmental and ecological problems of today result in crisis conditions of the Samur natural complex, a unique nature study corner of Daghestan. First of all it was water-economical transformations that caused hydrological and hidrogeological changes in water resources of the Samur-Gyulgerychay river basin.

Today sources of antropogeneous pollution of the Samur river basin don't influence the river waters quality. The qualitative compound of the river waters depends on natural factors and on the existance of non-ferrous metals ore which is perspective for industrial assimilation Glob-Mineral International, an american company, is working out the project on the exploitation of Kyzyl-Dere copper-pyrites layer. According to Technical-Economical Grounds, annual volume of ore extraction will make 2,5 million tons. It can be assumed that waste rock tailings, rich in sulphur (25-30 %) will bring lead, copper, tin, bismuth, cadmium, cobalt and, especially, arsenic, into the Samur river waters.

The modern concept of perspective irrigating and drinking water-supply of cities and the territories of Southern Daghestan want for drinking water is focused on use of Samur deposit with 142 m^3 per year running (exploitation) stocks of pure underground waters. The primary factors, forming water bearing systems consider receipt of river waters in the Samur river spacing Samur-Gyulgerychay that makes 4,5 m^3/s. Taking into account such close hydrolic connection between superficial and underground waters it is excepted the Samur underground water resources to be polluted progressively with the beginning of the extraction.

The Samur is a boundary river. According to the report, drawn up in 1967 Azerbaijan is to use about 50 % of annual river drain for irrigation of 213 thousand hectare and for municipal water supply of Baku and Sumgait. The exploitation of copper-pyrites Kyzyl-Dere layer may intensify the situation in Southern border of Russia.

The Daghestan public is against of the project. But attraction of foreign investment can lower socio-economic intensity and that can become the convincing argument for the benefit of the positive solution of the problem. The carried out preliminary analysis reveals a spectrum of negative processes that may reveal with the beginning of ore-mining works on a Kyzyl-Dere deposit. That might result in degradation of the economical-drinking characteristics of underground and superficial waters and may intensify socio-economic conditions and interstate political situation.

That is why it is believed to be important to take the following measures first:

- carrying out a thorough ecological examination enlisting public and international experts, apart from the state ecological examination;
- to sanction the plan of Building-assembling works, that suggests water purifying buildings;
- at the expense of the investor to set up an observation post, equipped with modern analytical devises to contact all year round observations (supervision).

DISPATCHERING RULES OF OPERATING STEPS OF RESERVOIRS IN NATURAL GUARDING REGIME BY USING LONG-TERM PROGNOSIS OF TRIBUTARY

Guskov V.G.
Moscow State University of Natural, Moscow, Russia

On example of operating Volga-Kama steps of reservoirs has been worked out mathematical model optimazing of natural guarding regimes of explotation of steps of reservoirs with rational decreasing of full volumes of reservoirs.

That reserve volume between new and old levels of reservoirs may be used for short cut of large high water and distribution of high water by using fishing-economical diagram also.

On base correlat connection between volumes of tributary of predecessoring inter high water and followering real volumes of tributary of high water has been worked method of beforehand long-term prognosis of tributary of high water with considerable degree of reliance.

This is allowed to have been worked strategy of operating steps of reservoirs by natural guarding demands of regimes flowing off with dispatchering rules.

.t is important especially when is prognosed catastrophical high water.

PROBLEMS OF DRINK WATER PROTECTION FROM POLLUTION IN THE REGIONS WITH LARGE GAS STORAGE FACILITIES (WITH THE EXAMPLE OF THE KASIMOV UGS)

Ilchenko V.P., Kirijshkin V.M., Levshenko T.V.
VNIIGAS

While the need for drink water grows steadily, its protection from pollution becomes a more and more difficult task, particularly for gas field facilities with a great technological load on geological medium as at the Kasimov undergraund storage (UGS).

Drink water is here produced from the Podolsk-Mijchkovsk horizon (carbonic period) laying at the depth of 50-80 m and presented by fracturing Rocks of high permeability.

The horizon is an opened hydrogeological system because of its not deep position and the lack of reliable caprocks that became a reason of its good hydrolic connection with the surface, the river Oka, the underlying Kashirsk horizon and may be with the other layers of the geological section thanks to the bad casing and cementation of the wells which had been in large quantities drilled

on a relatively small area of the Kasimov UGS. An active hydrodynamical regime produces an intensive water exchange between these spheres.

So far as more than 40% of drink water inflows into the water-bearing horizon from the surface, the quality of produced drink water depends to a great extent on the purity of surface water.

The pecularities of the productive horizon determined the sources of its pollution, the main of which are:

- domestic, industrial and agricultural wastes;
- the river Oka, the water of which may be polluted or infected during spring floods;
- saltwater intrusions from deeper horizons and technological liquids of boreholes, corrosion products of underground equipment (casing pipes etc);
- material of ion- exchange process of the electrochemical protection and stray currents;
- storage gas which may saturate the drink water.

The long period of development of the UGS and its water intakes have created adverse environmental impacts growing with every year.

The most important of them are:

- the beginning of the exhaustion of the water- bearing horizon in some perts of the territory;
- the growing accumulation of iron (ions), manganese, cadmium nitrate and other toxic elements and substances, and also the generation of H_2S, intensifying corrosion of the underground metal structures;
- formation of a zone (areal) at the central part of the structure with polluted water, the growth and migration of which are capable to destroy the water intakes of surrounding settlements whereas the lowering of the drink water horizon's hydrostatic levels on some parts of the UGS is a contributory factor for the inflow from the Oka and different aquifers, the water of which may turn out to be polluted, infected or high mineralized.

Processing the field and laboratory data on the hydrodynamic and hydrochemistry of all the aquifers concerned (piezometric levels, physical-chemical characteristics of water etc.) has indicated that to ensure improvements in the geoecological conditions at the Kasimov UGS, from hydrogeological point of view, a number of measures should be done, including:

- revision of the available materials (geological, hydrogeological etc.) for the past years to restore the systems initial state and its change with time: the dynamics of variation of the piezometric surface, hydrogeochemical characteristics (physical, chemical, isotopic, biological and others), the hydrolic bonds between different strata, both in space and in section;
- evaluation of the engineering condition of the casing and cementation;
- pasportisation of the wastes of all kinds: agricultural, domestic, industrial, airborne etc.), including the ones of the past years(if possible);
- conducting of an appropriate complex of experimental, methodical and laboratory researches (hydrodynamical, hydrogeochemical and the others) to reveal the mechanism of generation and accumulation of the toxic heavy metals and substances which have been found in the drink water. For example, sound confirmations have been got about the effect of the electrochemical protection on the horizon water quality;
- location of the zone (areal) filled with polluted drink water and forecasting its possible growth;
- forced pumping- out of the polluted water from the zone (areal) and by controlled quantity withdrawal of water from surrounding water intakes form in the productive horizon a hydrodynamic regime such that the polluted areal would turn out to be in the zone of the least water levels (piezominimum);
- pumping of chemicals and the air (for aeration) into the drink water horizon to slow down or stop the process of water pollution;
- location of the sites for new water intakes should be made with regard to the results of the measures considered above.

The findings and proposals of this report have with some reserve been reinforced by a number of experimental and laboratory researches which gave ground to hope for positive results in solving the tasks in question.

The problem of drink water emerged at the Kasimov UGS is in large part the one of the others gas storages with similar equipment and hydrogeological conditions, therefore without delay it requires a deep study on the Kasimov UGS where it has manifested itself very distinctly.

PROSPECTS OF USING NATURAL WATER OF BURYATIA

Imethenov A.B.
East-Siberian state technological university, Russia
Molotov V.S., Shaibonov B.B., Batueva R.Ch.
Committee on the water facilities of Buryatia Republic, Russia
Vasiliev Y.P.
SC "Aquabur" Ulan-Ude, Republic of Buryatia, Russia

Water facility of Buryatia Republic is represented by worldwide known Lake Baikal, big and small rivers and a great number of lakes. Besides, reserves of clean underground water has been explored in the republic; there are more than 300 mineral springs with large water and mud reserves. Cool and thermal carbonaceous, nitric-carbonaceous, carbonic-nitric, nitric and mehtane therms, cool unaerated sulphide, chalybeate and rodone waters stand out among others.

More than 23 thousand n.c.m of high-qualified water of low (about 0,1 g/l) mineralization with the high contents of oxygen and nearly full absence of organic materials is concentrated in Lake Baikal. Baikal water from depths of 200 and 500 m. was examined at different years in the scientific lab NOBUKI TAKAMATSU (Japan) on number of basic macro- and microelements' indexes in October,29,1990 and in August,16,1991. A comparative characteristic of Baikal deep water CRM 398, CRM 399 standard was made approximately in the same period. "Baikalskaya" water was examined by Irkutsk medical inspection in May,12,1992 and was recognized corresponding to 2874-82 standard as "Drinking water". Baikal water, taken from depths of 100 and more metres, does not contain chemical and bacteriological polluted components, so it can be used not only to drink, but to be a raw material for food industry and produce nonalcohlic and alcoholic drinks of high quality. While bottling the water without chlorination and ozonization and practically without any correlations can be used as a table and medical water with little mineralization.

Buryatia is refered to the number of the most perspective regions on mineral water reserves with different physical characteristics, chemical and gas composition.

At present all known mineral springs are taken under the protection and are broadly used in medicinal and sanitarian purposes. On some of their territories sanatoria and resort complexes (Goryachinsk, Arshan), hydro-pathics (Nilova Pustyn, Kiran, Pitatelevsky, Khangar-Ulla, Kuchiger, Garga, Alla,Umhei, Baunt and others.). The great value for non-resort treatment is mineral water bottling. Siberian and Far Easten demand for mineral water (table and medicinal) bottling is more than 15-17% out of powers available in Russia. On counts the population of Buryatia will require for about 25 mln. bottles per year with 0,5 l capacity. Apart from Arshan's carbonaceous waters SC "Aquabur" has organized poluster chalybeate water bottling (Fe - 50 mgs/l) with little mineralization from the Selenga river delta.

In the prospect it is planed to use rich hydro-carbonated chloride magnesium-sodium-vapor waters reserves (Fe about 45 mgs/l)of Eravna trough (pos. Sosnovoozersk).

Constant consumption of poluster water with big contents of ferric helps anaemia, raises blood haemoglobin. Besides, since 1998 SC "Aquabur"will use the water on a par with Baikal water to produce nonalcohlic and alcoholic drinks. In the nearest 2-3 years on the base of ferrous mineral waters a construction of bottling plant is planed in the region of the Selenga river delta. Buryat scientific centre and Governing of Lake Baikal complex usage's scientists expand monitoring service for water quality controle.

Alongside with using mineral water in balneology as well as drinking water, they can be used as sources of cheap heat energy. So, hot house facilities are built on the base of Pitatelevsk and Gusikhinsk's deposits (debet, accordingly, 25 and 5 l/s) nitric therms, where the temperature of water reaches 60-80-50°C.

In the prospect thermal springs will be also used for apartment houses, industrial enterprises and agroindustrial complexes heating. Underground water reserves can be found in oil-searching bore holes with temperature about 100°C and more with debet to 500 c.m/day on depths of 2500-3000 m. Together with thermal waters a greater amount of methane (more than 1000 c.m/day), that can be used in heat-and-power engineering purposes rises on the surface. Only 10 l/s of water with the temperature 70°C and 500 c.m/day of methane forms 382 excrements/day that is equal to 9 t. coal.

Thereby, Republic of Buryatia, possessing enourmous resources of natural mineral and Baikal waters, can satisfy requests of population with drinking water not only neighbouring regions, Russia as a whole, but foreign countries as well. Good location of transport arteries makes cheaper in 3-4 times a prime cost of bottled water on russian and international levels.

YOUTH ECOLOGICAL CENTRE OF THE BLACK SEA COUNTRIES

Isakov M.I., Bashkirov G.S.
Odessa Regional Academy of Sciences (ORAN), Odessa, Ukraine

The Black sea Strategic Plan of Operations (BSPC), signed in Istanbul by six Black sea countries in a 1996, is inconceivable without the reformed ecological education. In this case only youth will be capable to realizing the concept of stable development of the society that will make it possible to solve the problem of reanimation and preservation of the Black sea and Black sea coast for present and future generations.

For this purpose it is necessary to consolidate gains of youth organizations of the Black sea countries, and then and the countries of the whole Black Sea basin in the field of ecological education. The first step in this direction has been made by ORAN by means of establishment of Youth Ecological Center of the Black sea Countries (YECBC) on the basis of Youth Ecological Group (YEGORAN).

Since 1993 ORAN together with other institutions began to conduct the ecological monitoring of water-swamp territories of the Black Sea coast of Ukraine with the purpose of reviewing the condition of natural landscapes and their degradation under the anthropogeneous influence. The research theme "Ecological Consequences of Land and Sea Waters Interaction of the Azov-Black Sea Coast of Ukraine with Allowance of Growth of Anthropogeneous Loads" conducted by ORAN contains a section on the problem of attracting the society to management and regulation of nature-protection activity in the Black Sea region. The primary point of the mentioned problem is the geoecological monitoring of Kuyalnitsky liman, as an object with the unique stocks of medical muds and most important in recreation. The priority of this direction is explained by the possibility of participation of higher schools students and various public volunteers of Odessa. In the long-term relation such form of ecological education of youth will give a positive effect in realization of measures on preservation of nature-reserves and unique marine limans.

The main purpose of YEGORAN is the attraction higher classes' students to the studies of hydrological processes and phenomena. The process of study is carried out by means of solving separate problems and conducting of various kinds of observations over the salt and water regimes in the rivers, reservoirs, limans, estuaries, floats and other water objects.

As far as in each Black Sea oblast of Ukraine and, we hope, in each country of the Black Sea coast there are similar youth organizations, it is supposed by means of their consolidation to speed up the fulfilment of BSPC's problems. The consolidation can be conducted, both by joint expeditions, and by creating a common data bank on negative consequences of human economic activity; and also by joint summer ecological camps, actions on of park territories cleaning, conducting of joint seminars and conferences. So, for example, in 1996-97 YEGORAN participated in youth expeditions to the Danube delta, organized by fund "Natural Inheritance", regional eco-naturalistic students' centre, sponsored by the Odessa enterprises. About 150 school students took part in the expeditions there.

NECESSARY CONDITIONS FOR PRESERVATION OF GENERATION OF KUYALNITSKY LIMAN'S UNIQUE PELOIDS

Isakov M.I.
I.I. Mechnikov Odessa State University, Odessa Regional Academy of Sciences (ORAN) , Odessa, Ukraine

The uniqueness of the balneological properties of the peloids of Kuyalnitsky liman, located in the Black Sea region of Ukraine is doubtless. The special concern arises in connection with emerging of the stable fluctuations of dry years of natural origin with simultaneous growth of anthropogeneous effect. The main motive of anxiety — the possibility of degradation or full loss of curative properties of peloids and, as a consequence, the loss of one of the national resource riches. The problem of clearing and preservation of the balneological resources of the limans is connected with the problems of overregulation of the small rivers drain and its quality. The optimum regulation of drain in any river basin depends on:

1. reliabilities of hydrological performances;
2. degrees of the correspondence of an accepted structure of probabilistic water-economical estimates to the actual structures of stochastic connections of elements of water balance;
3. harmony of dynamics of water balance elements and structures of the industrial relations in dominant branches of economic activity of the given region.

The practice of water economy design in the south of Ukraine is far from the comprehensive approach in the solving of the economy problems with reference to the small rivers basins. Unreasonable overregulation of the drain into the small rivers basins results in dehydration of the mouth plots and loss of the initial appearance, and the capability of biological filters of water masses. Large spaces of water-swamp territories, ensuring life for ichthyofauna and being the habitat of many migrating species of birds are irrevocably lost.

The progress in the solving the problem of Kuyalnitsky liman waters is possible only after realization of field inspections of all ponds and reservoirs in the basin of Bolshoy Kuyalnik river.

The absence of both the laws of Ukraine about resort-recreational zones and seaside territories, and the state program of recreational development of the Black Sea coast constrain the construction and development of the resort-sanatorium complexes. This results in persistent region-by-region degradation of coast under the influence of industrial and transport stress. In connection with this, the preservation of liman territories and Kuyalnitsky liman itself, as a whole, is coherent with the necessity of development and extension of systematic control of the liman's condition and conduct of analysis of the available researches on the liman. The outcomes of the analysis are to form the basis for normative-legal act (Statute of Kuyalnitsky liman), which will define the legal status of the territories and object with all the implied consequences and, first of all, ecological ones.

Such document should determine:

- requests on protection and use of recreation resources with introduction of economic means of stimulation;
- all varieties of boundaries with their implementation in nature;
- scientifically reasonable management of the liman;
- increased responsibility for legal violations.

RECREATIONAL PROBLEMS THE UKRAINE'S BLACK SEA LIMANS

Isakov M.I., Volin N.P., Degtyarenko V.I.
Odessa Regional Academy of Sciences (ORAN), Odessa State Academy of Law, Odessa, Ukraine

One of the constituents of the recreational strategy of use of the Ukraine's Black Sea coast is the curative mud complexes on the limans. The estimated volumes of annual production of peloids of limans Sasyk, Budansky (Shabolatsky), Kuyalnitsky, Khajibeisky (after restoration of the due quality of its medical mud and brine), Tiligoulsky make about 43 thousands of cubic metres. Data on chemical composition of the brine of the Kuyalnitsky liman and its peloids testify that for the recent years (and maybe decades) among the usual ingredients there have been found new mineral and organic elements of anthropogeneous origin. The waters of Berezansky and Tiligoulsky limans also contain all kinds of polluting substances.

Tiligoulsky liman, being on the junction of the various natural, administrative, branch and social forms of multiplane usage, represents a complicated natural-economical complex. With the purposes of duly prevention of possible social-ecological conflicts the controlled approach to a solution of complex problems of rational nature exploitation is required. While saving the elements of wild nature, the Tiligoulsky liman's region predetermines the idea of creation of National (landscape) park, the attributes of amateur recreation are the substantiation to that: the population of the water-reserve zone by amateur gardening sites, modification of the hydrological regime as a result of anthropogeneous factors, contamination of the reservoirs by household scraps, uncontrolled hunting and other. The existing sanatorium network's capacity, quality of services and efficiency does not satisfy today's standards of the resort business.

The problem of restoring and preservation of the balneological resources of the liman is connected with the problem of overregulation of the small rivers drain and its quality. The important point is the legal relations of the subjects of various branches of industry and agriculture located in the basins of the rivers, flowing into the limans.

The searches for the structure of integrated management of the Ukraine's Black Sea coast conducted by the authors have not yet been crowned by success. The representatives of the industrial branch practically do not react to the nature protection measures, which fall outside the limits of their direct industrial activity and territory. The solution of these problems is completely assigned to the structures of the regional and oblast subordination. The regional and oblast structures themselves are experiencing personnel and financial shortages and consequently are not capable of displaying effective influence on the branch formations. The absence of actions (just actions, instead of solutions) allows to conduct the activity in compliance with the branch interests and the level of understanding of the problems of "guard" of an enclosing natural medium, that frequently results in negative ecological consequences, as it does not meet their interests and purposes on the one hand, and on the other there is no effective legal mechanism of protection. Thus, today there is no integrated management of the Ukraine's Black Sea coast.

Today it is necessary on the legislative level to start developing the strategy of the compatibility of interests of various branches and water consumers of the Black Sea coast, with the priority to resort-recreational industry. First of all it is necessary to:

- define the legal positions of each concrete water object with allowance for all ecological consequences;
- formulate the requests on protection and use of recreation resources with introduction of economic means of control;
- increase the responsibility for eco-legal violations.

The solution of the stated problems will ensure, in particular, the creation of the modern pharmacological industry on processing mud resources (using the biotechnology available in ORAN), that will allow to create the whole series of extremely necessary pharmacopoeial and non-pharmacopoeial means for the population of Ukraine, the CIS and other countries. In the future the recreational potential of the Black Sea coast and the efficiency of the economic response of the marine and coastal balneological resources will be increased.

THE ECOLOGICAL REHABILITATION OF POLLUTED LAKES LOCATED IN FLOOD-LANDS

Ishtchenko I. G., Kouzmina N. P.
MOSVODOKANALNIIPROJECT Moscow Institute for Water & Wastewater Research & Design, Moscow, Russia
Shoulgin A. V.
Spetzbioftekh, Moscow, Russia

The dewatering and disinfection of bottom sediments as well as dewatering of domestic and night soil containing sewage is a remarkably difficult technical and technological task because of the high content of high-disperse mineral and hydrophilic organic substances.

Exceptionally simple and available sanation methods were tested for a lake located in the flood-lands of the Klyazma River in Vladimirsky Region. This lake is related to the water bodies of fishing quality.

The lake is related to hyper-eutrophic type since it is subject to strong anthropogenic influence.

The lake water contains high concentrations of phosphorus, nitrates, ammonia and heavy metals - iron,

manganese, chromium, molybdenum, cadmium and copper that exceed the MPC levels.

The bottom sediments of the lake include black sludges having specific hydrogen sulfide smell. The concentration of manganese in the bottom sediments is 200 - 500 mg/kg; the concentration of zinc is 50 - 470 mg/kg; the concentration of copper is 40 - 150 mg/kg; the concentration of chromium is 30 - 50 mg/kg and the concentration of cadmium is 0.10 - 0.50 mg/kg.

According to the existing classification the bottom sediments (from the point of view of industrial wastes) are related to non-hazardous 4th class. We considered it expedient to rehabilitate the natural condition of the lake since it was related to the water bodies of fishing quality and during flood periods it could have communication with the Klyazma River.

Activated humic acid in the form of 15 % aqueous gel was introduced during agitation into the initial volume of the bottom sediments taken from the lake. The molecules of activated humic acid bind the heavy metals and are sorbed on the surface of the mineral and organic compounds of the bottom sediments, eliminating thus the contrast in their surface physico-chemical properties realization.

Up to 7 % of crushed limestone should be added to the bottom sediments to improve the dewatering results.

The treatment of lake sediments with the excess of activated humic acid provides the sludge mass with good water-proof properties.

The impermeability of sludge sediments mixed with activated humic acid eliminates the possibility of any washing out or migration of the ecotoxicants contained in the sediments. The same property makes it possible to utilize such sludges as insulating soil for recultivation of dumpsites for the burial of solid domestic wastes and the industrial wastes equated to them.

COORDINATION OF THE RUNOFF ALONG THE LENGTH OF THE RIVER WITHIN THE ESTIMATIONS OF VOLGA-KAMA CASCADE

Ismaiylov G.Kh., Shatalova K.Yu.
Water Problem Institute, RAS, Moscow, Russia

Transformation of the Volga river hydrograph under the influence of reservoirs is considered.

For the estimation of river runoff transformation with the help of the simplified method we used a model on the basis of method of residual deviations and cubic spline.

Two stretches of the Volga basin were investigated.

Below the dam of Volgogradskaya Hydroelectric Station up to the section Verhnee Lebyazhie about 500 km in extent. In this stretch Volga river flows in dry zone and has not tributaries. Availability of the huge flood land spaces with several water flows between Volga and Ahtuba, wide delta with many branches in the combination with climatic conditions cause essential redistribution of the runoff and its losses.

Aquatory of the Kuibyshevsky reservoir. The reservoir has a complex configuration as though a repeating outlines of the rivers-beds of Volga and Kama, small depth and very large flowing ability (0.10-0.24 years). The reservoir length along the ship course between Volzhshkaya Hydroelectric Station, Cheboksarskaya Hydroelectric Station and Nizhnekamskaya Hydroelectric Station makes up accordingly 480 and 540 km. It gives the basis to consider this river stretch as a peculiar one.

As a result of the researches for the first stretch the dependence between the average monthly runoff in the section of Volgogradskaya Hydroelectric Station (X), which is the main determining factor, and the required river runoff in the section Verhnee Lebyazhie(Y) was constructed for a period 1962-1987 in the cubic spline form.

$$Y = A_i + b_i (X-X_i) + c_i (X-X_i)^2 + d_i (X-X_i)^3,$$

where a_i, b_i, c_i, d_i, - coefficients of spline, for each interval X_i-X_{i+1}. The required dependences were constructed both for a year as a whole and for different seasons. The correlation coefficient (for a year) between observed and estimated values is equal 0.956, that shows the stability and efficiency of the obtained equation. The error makes on the average 8.5 %, and has a spread between 0 (one case) and 43 % (one case), which is in conformity with the input data accuracy.

In comparison with the result, obtained from the usual equation of linear regression, the estimations accuracy is increased on 7-8 %.

It should be noted, that unfortunately the seasonal dependences are not stable, and the values of spline coefficients vary depending on the length of series.

For the second stretch as the first approximation we constructed the dependence on average monthly water levels. The reservoir aquatory according to Hydrometeoservice data is divided into eight similar stretches for the estimation of average level.

The stretch N 8 - Staraya Maina - Toliatti is served as the closing - output stretch. This stretch is rather great and covers about 40 % of the reservoir aquatory (8 acting stations of hydrological observations).

The estimations were conducted on average monthly values for the period since 1958 (after the reservoir filling) till 1980 - (200 cases of series), each fourth element of the file is verifying (76 cases). As a result the required dependence was constructed in the form:

$Y = -0.96795 + 1.01948\ t_{i1} + 1.0768\ t_{i2}$, where $t_{i,2}$ - transformed variables

$$t_{i1} = a_i + b_i (X_1-X_{i,1}) + c_i (X_1-X_{i,1})^2 + d_i (X_1-X_{i,1})^3,$$

$$t_{i2} = a_i + b_i (X_2-X_{i2}) + c_i (X_2-X_{i2})^2 + d_i (X_2-X_{i2})^3,$$

where a_i, b_i, c_i, d_i, - spline coefficients for each interval X_i -X_{i+1}.

Thus, it turned out that water levels on the stretch № 4 (Vyatka river stretch) do not give the significant contribution, and Volga and Kama compounds are only essential.

A multiple correlation coefficient makes up R=0.875 with an interval 0.842-0.907 At the first stage of the research we did not take into account lateral inflow into the reservoir bed.

The analysis of estimations for the verifying series in both cases shows, that the developed methodics gives relatively steady results.

DEFINITION OF ALLOWABLE LOADINGS ON GEOSYSTEMS WITH LAND RECLAMATION AND WATER ENGINEERING ACTIVITY

Issaeva S.
All-Russian Research Institute for Hydraulic Engineering and Land Reclamation

The antropogeneous loadings on natural environment for last years has reached those scales, when there is a question on allowable limits of intervention in natural processes. In particular, the usual adverse ecological situation in a number of regions in Volga basin determines necessity correspond rendered water engineering and land reclamation influence on natural environment with its potential opportunities and to correct character and degree of this influence. One of possible ways to improve a situation in Volga drainage-basin is to research of geosystems sustainability to these types of human activity. The technique of researches includes:

- development of the concept of stability of natural systems to land reclamation and water engineering impact;
- distinction of geosystems of global, regional and local levels as geostructure bases of consideration of formation hydrogeochemical flows;
- definition of laws and features of formation hydrogeochemical flows within the limits of geosystems of various hierarchical levels;
- drawing up of physical models of functioning of the interconnected geosystems from a global level to local;
- definition of system variable, geosystems, describing an ecological condition, in view of their hierarchical level, natural zones of territory and other conditions;
- definition of area of allowable meanings of variable and allowable speeds of their changes;
- definition of a period of an estimation of sustainability with the account periodicity of natural processes;
- specification on the basis of mathematical models of laws of formation hydrogeochemical flows;
- composition spatial-temporary predictions of sustainability using scenario researches of variants of land reclamation activity;
- substantiation of restrictions on size of land reclamation and water engineering of loading on landscapes;

choice of sustainability development of geosystems from set of acceptable human activity.

Nowadays according to this methodology of researches the certain concept of stability of geosystems to land reclamation and water engineering activity is already developed. The principles of allocation of geosystems and their hierarchy are developed too. The geosystems of different levels in Volga drainage-basin are allocated. For normalization of a situation the revealing of connections between antropogeneous impact and reaction of natural environment is necessary. It is possible to remove the reasons of infringement of ecological balance during functioning geosystems on this basis. The physical models of formation of hydrogeochemical flows are made within the limits of geosystems for the decision of this task. For particular geosystems Average part of Volga basin of regional and local levels on the basis of the analysis of their functioning with use of imitating modeling are established essential variable, describing their condition. In view of natural ash value of territory their allowable meanings are defined. Proceeding from revealed essential variable the orientation survey is determined with ecological monitoring of geosystems. The restrictions on land reclamation and water engineering loading on geosystems of different hierarchical levels will be reasonable on a basis of scenario model researches of various variants of land reclamation activity. Probable spatial - temporary prediction of estimations of stability will be use too. As a result of researches the desirable script of existence of geosystems without crisis will be define and the specific offers on improvement of ecological conditions in regions of Volga basin are developed.

TRANSFORMATION OF WATER AND ICE RESOURCES DURING MINING EXPLORATION OF THE CRYOLITE ZONE'S TERRITORY

Ivanov A.V.
Institute of Water and Ecological Problems, Far East Branch, Russian Academy of Sciences

The change of the state of water and ice bodies is closely linked to the transformation of land and biotic resources. In the most general case, their transformation belongs to the categories of primary and secondary purposive, spontaneous and indirect transformations.

Extraction of placer gold, exploration and extraction of ore gold in the conditions of permafrost, revealed the following purposive transformations of water resources: 1) making of water diversion canals; 2) formation of settling basins; 3) making of drainage and water diversion ditches; 4) expansion of watercourse channels. Secondary purposive changes involve 1) formation of brooks in hillside ditches; 2) degrada-

tion of lenses, sheets and veins of subsurface ice.

The most numerous are spontaneous transformations of water and ice resources: 1) temporary watercourses along road ruts in the rainy and snow melt season; 2) filling of various artificially formed basins with water, snow and ice; 3) recreation of brooks on their natural watercourses; 4) interception of groundwater and surface runoff by hillside, water diversion and drainage canals and ditches; 5) origination of new waterways; 6) new possibilities of infiltration and filtration of surface and underground waters; 7) formation of artificial groundwater runoff through the system of settling basins, imitating the disturbed natural groundwater runoff; 8) formation of condensation and overicing ice in underground mine workings; 9) crystallization of schlieric ice in the dump composed of silt.

Secondary spontaneous phenomena include: 1) formation of icings at the expense of water runoff from settling basins in winter; 2) thermokarst, solifluction, landslides, alluvial fans, ravine formation; 3) evaporation from the surface of artificial reservoirs. The other aspect of secondary spontaneous and indirect transformation of water resources is conditioned by their primary purposive and spontaneous transformation, and has direct and evident ecological consequences: 1) increase in water mineralization in settling basins as a result of evaporation, a greater share of groundwater runoff in water feed; 2) formation of new and unusual for the given locality, water ecosystems; 3) formation of near-water biotopes.

The analysis of the state of the transformed water and ice resources allows the devising of new methods of land and water body recultivation, management and use of the new water economy being created.

ECOSYSTEMS OF SETTLING BASINS ON THE POLYGONS OF PLACER GOLD DEPOSITS IN PRIOKHOTIE

Ivanov A.V.
Institute of Water and Ecological Problems, Far East Branch, Russian Academy of Sciences

Purposive transformation of water resources leading, in particular, to settling basin formation, results in the formation of unusual water ecosystems. Their state substantially depends on their "age".

The size of artificial basins is different; they are generally rounded and rectangular, with a diameter of 50-150 m. Sometimes settling basins 250 m long and 30-70 m wide are formed. Their depth does not exceed 1.5 m, but under permafrost conditions impeding water exchange this value may reach 2.5-3.0 m.

Bottom deposits are formed on the bedrock as a result of sedimentation of clay particles and gravel material, which are rejected in the process of sluicing gold-bearing rocks. They are a substrate on which evolve microphytobenthos, zoobenthos and aquatic vegetation. Then, bottom deposits are transformed at the expense of diagenetic processes and detritus formation.

Basins 2.5-3.0 m deep displayed temperature stratification (gradient of 5° and above), caused by cold groundwater runoff and frozen rocks underlying the bottom.

Water mineralization in settling basins reaches 600 nag/dm^3, which is much higher than that in brooks (200-300 mg/dm^3) on whose place settling basins are created. The type of water chemical composition – hydrocarbonate-calcium – is similar to water composition of natural surface and subsurface flows. Settling basins water showed elevated concentrations of SO_4^{2-} (at the expense of FeS_2 rock oxidation) and NO_3^- with different genesis.

The "age" of settling basins affects water transparency, quantity and quality of suspended matter, water colour in the basin, species diversity of plant and animal organisms, community types, biological productivity of water mass. The "older" the basin (4-6 years), the better transparency, the less quantity of mineral suspensions and the relatively greater quantity of organic ones (phytoplankton), the greater species diversity and forms of life activity of plant communities, the more stable photosynthesis. Basins with a direct surface runoff into the river system contain small and juvenile fish of valuable breeds.

As compared to natural small lakes belonging to diastrophic type, settling basin ecosystems are mesotrophic. They are noted for 02 diurnal dynamics conditioned by algoflora photosynthesis and increased BPK_{full} and BPK_5 values, in contrast to water flows.

The information on ecological conditions in such artificial basins is used for prediction of water quality of reservoirs which are to be constructed for potable and production water supply. The prediction is made by the analogy method. Simultaneously, ecosystem modeling is carried out, and pertinent engineer calculations are done.

NATURAL WATER AND ICE POLLUTION BY NITROGEN COMPOUNDS CAUSED BY EXPLOSIONS IN THE COURSE OF GEOLOGICAL EXPLORATION

Ivanov A.V.
Institute of Water and Ecological Problems, Far East Branch, Russian Academy of Sciences

On the studied territory in Priokhotie, NH_4^+ and NO_3^- concentration in atmosphere precipitation does not generally exceed 0.7 and 0.3 mg/dm^3, respectively. In the surface water it is a little higher. They emanate from wood and grass vegetation in the vegetative period and are washed out from wood litter and peat soils on marshes and swamped lands.

Nitrogen compound concentration rises sharply in atmosphere precipitation, in surface runoff waters and in settling basin water in the excavating explosion period of prospecting and trial-commercial exploitation of ore deposits. NH_4^+ concentration at this time did not go below 0.84 mg/dm^3, rising to 1.20 mg/dm^3, and NO_3^- concentration sometimes reached 3.4 mg/dm^3.

The most substantial proof of explosion impact on the level of contamination by nitrogen compounds is the level of their concentration in natural surface and subsurface ice as compared to antropogenic ice. Thus, subsurface ice broken up by a common, mechanical method , when extracting placer gold, contained 0.04-0.73 mg/dm^3 NH_4^+ and 0.05-0.72 mg/dm^3 NO_3^- In contrast, antropogenic ice (condensation, accumulated, overicing ice) formed in the adit, driven by explosions, was characterized by a notably higher concentration (0.8-1.5 mg/dm^3 NH_4^+ and NO_3^-). In the ice sheet in a ditch, exposed by an explosion, NH_4^+ concentration reached 1.9 mg/dm^3; NO_3^- – 2.3 mg/dm^3.

Explosion products are actively washed out by atmosphere precipitation. Their aerosols are characterized by intensive dry precipitation. So, one year after the explosions, the concentration of the above compounds goes down to background values. However, near the explosion sites, secondary and ruderal vegetation is noted for high productivity within several years after the explosions. This is indicative of the fact that nitrogen compounds are held in cryogenic soils for a long time. Their content in the perched water during slow migration in the cryolite zone, conditions lasting increased NH_4^+ and NO_3^- background concentration in surface runoff water. This may lead to significant consequences for water artificial and natural ecosystems.

STRATEGY OF WATER SAVING IN THE ZONE PRODUCTION OF COTTON IN THE UZBEKISTAN

Kambarov B.F., Horst M.G., Alibaev K.V.
SANIIRI, Tashkent

Glowing deficit of water resources in the zone cotton production demand reconsideration of strategy water use according to news conceptions achievement of science and practice in domain of chemistry, genetic of plants, agrotechnics, melioration and irrigation. In the point of view of SANIIRI - this direction of scientific progress, which was experienced in research fields:

1. Use of chemical and polymer, fertilizer, also ecologic harmless fertilizers: chlorells, lakes silts and aquatic plant, manure.

2. Use of sorts of cotton with stability against salt in soil, in combating drought and diseases: research economic of other resources and environment In different condition nature, also in condition soil water of precipitations.

3. Use of optimal regime of irrigation with research full supply factor from irrigation methods: by drop, subsurface and perforated polymer-hose irrigation. Use of furrow irrigation: contour, surge and zigzag furrows methods.

4.. Use of polymer and polycomlex for raise field carrying capacity of soil in condition difficult for melioration land.

5. Distribution Irrigation methods In condition natures: sating soil, subsidence, local piping, erosion and slough in the fields, for economize water for crops in the development land.

PRINCIPLES OF HYDROGEOCHEMICAL ZONING OF MOUNTAINOUS COUNTRIES ACCORDING TO THE CONDITIONS OF ECONOMIC-AND-DRINKING UNDERGROUND WATER SPREADING (ON THE EXAMPLE OF THE TERRITORY OF THE REPUBLIC OF ARMENIA)

Kaplanyan P.M., Grigoryan L.A., Ananyan A.L., Roubeikin V.Z.
Institute of Geological Sciences of the National Academy of Sciences of the Republic of Armenia,
Yerevan State University, Yerevan, Armenia,
Institute of Mineralogy and Geochemistry of rare Elements, Russian Federation

In the connection with the upcoming standardization of drinking water in the territory of the Republic of Armenia the paper attempts to set up basic criteria of water quality estimate.

The existing system of concentration restriction and element normalization does not take account of all the wide variety of natural factors existing in such complicated regions as mountainous folded provinces. A wide range of existing bioclimatic conditions, diversity of lithological-and-petrological compositions of water enclosing rocks and metallogenic orientation of the region cause a unique specificity on natural water, which determines its quality as drinking water. To this end, diligent application of unified regulations on drinking water quality to the whole territory of such a small mountainous country, as Armenia is not correct from the environmental-and-geochemical viewpoint. Thus, one of the basic tasks of drinking water standardization should be differentiated regulation of mineralization components, applicable to various regions in the territory of the Republic of Armenia.

We have divided all the components of natural water mineralization into four groups:

1) Inorganic elements and their compounds;

2) organic compounds;

3) radioactive elements and compounds; and

4) sanitary and bacteriological indices.

A main forming components of natural water is undoubtedly the first one.

Formed ecological systems for each particular case have geochemical indices intrinsic to the given region only. First of all, it is related to a macrocomponent composition, which forms the hydrosystem as a whole and specifies classes of chemical compositions and mineralization. By the way, this category is not included into any known standards, what is a substantial drawback of the standards system.

One of the most substantial objects for development of drinking water standardization basics is its microcomponent composition. The important aspect of this problem is regularity and efficiency of the applicable principle for normalization of drinking water microcomponents in particular regions in dependence on their metallogenic confinement.

A substantial drawback of the accepted system of element mineralization in drinking water is the following condition: having strictly restricting the upper limit of concentrations the mentioned document absolutely does not take account of another, not less important threshold of element concentration - a minimum necessary concentration.

Taking account of the arguments above, a new target-oriented taxonomic division based on a schematic hydrogeological zoning of the republic's territory to study the geochemistry of drinking water.

The first taxonomic level (which corresponds to the third order of the All-union hydrogeological division), so called "a hydrogeological province", divides the republic's territory into zones according to its confinement to this or that regional of water flow.

The second classification level, so called "a hydrogeological subprovince", characterizes underground sweet water circulation type within the two upper hydrodynamic stages -zones of local and regional water flow.

A basic unit of our proposed division within a subprovince is "a hydrogeological region", which is contoured both in vertical section and in plan by regional erosion basises for each particular case.

Thus, two hydrogeological provinces comprising three subprovinces consisting of 26 regions are distinguished in the territory of the republic.

ON SOME PROBLEMS OF WATER RESOURCES OF AZERBAIJAN AND THEIR RATIONAL USAGE

Kashkai R.M.

The special point of the problem of water resources focuses on drought territories including Azerbaijan. The main source of water resources is the rivers, but underground waters, lakes, reservoir lakes to the subsidiary ones.

Azerbaijan is the country of small mountain rivers with an average annual expense less than 5 m^3/c. It's river networks runs to more than 8350 rivers from which 8188 are less than 25 km in length.

The territory of Azerbaijan with the exception of rivers falling into the Caspian Sea enters into Kura river basin, i.l. almost 3/4 of all square is supplied with waters of the basin. Being partially in the middle and in foiser reaches of Kura and Araz rivers, it has mainly riverine water flow from neighbor countries such as Georgia, Iran, Turkey, Armenia and Dagestan. That's why from common water resources of the republic equal to 30,9 km^3, it's considerable part (20,6 km^3) enters from neighbor countries. The flow formed in the territory of republic makes up only 10,3 km^3.

One of the main water consumers in the agriculture to which part 14 km^3 irretrierable water consumption includes, which is almost 4 km^3 larger volume of the local flow. Taiking into account the water supply of growing population and industry this water shortage will reach 10 km^3 in near future.

Yhis shortage of water resources allravates more with unequal distribution of the glow within year. The construction of reservoirs on small mountains rivers, in deep canyons with small smooth square is more effective in these conditions.

The situation with the water supply or the republic is getting more aggregated with the pollution of rivers. This firstly refers to Kura and Araz rivers and to the great glows Razdan, Ohchi and Arpa. That's why rational usage and protection of water resources is of great importance for numerous settlements situated across these rivers and for Baku using this waters for drinking purposes.

In these conditions the source of water resources for the water supply of population should serve underground waters, rich with the foothills of Great and Small Caucasus and do not need cleaning.

Unfortunately at present because of unrational usage of water resources they fill channels with water and are used for irrigation.

These problems, as well as problems on the usage of intergovernmental rivers lead to the creation of united body, regulating and controlling the usage and protection of water resources of Kura river basin.

UNDERFLOODING IS ECOLOGICAL DANGEROUS PROCESS

Kazakova I.G.
Production & Research Institute for Engineering Construction Survey (PNIIIS) Moscow, Russia

Underflooding is dangerous natural-technogenic process. In this country all built-up territories are exposed to underflooding. It causes great losses.

Especially dangerous is the displaying of "unexpected" negative consequences of underflooding. Deterioration of ecological situation plays the leading role among them, and if acquired catastrophically character. It confirmed by various factual materials.

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 source of contamination, it's intensity and hydrodeological process specificity in various natural geological conditions. During the underflooding on contaminated territories, begins the acceleration of poisoned components migration in clean groundwater and aquifers, which serves water supply. Impact of formed highagressive groundwater on underground construction and communication cause gradually destruction of buildings foundations, corrosion of metal constructions and intensive ageing of water bearing piping and pipelines. So, increasing of losses from water bearing piping leads the development and activation of karst, suffosion, landslides and other dangerous geological processes. In dwelling houses with always underflooded cells, conditions of living become worse 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. This situation appears in cities and towns where the combinations of inhibition's concentration and dangerous technogenic impact are most intensive.

There are lot of facts of development emergencies appearance in various towns.

We work out hydrogeological methods for solving the problem of underflooding for different construction stages.

Hydrogeological investigation for the purposes of estimating the underflooding development hazard on different urban territories gave an opportunity to suggest some ways to get out of current situation.

For every stages of town planning work out recommendations for prediction development and activation of underflooding process, and therefore, emergency development.

One of the most important stages are engineering construction survey. They define the following errors of designing and constructing. To escape defects during new construction it is necessary to take into consideration specificity of engineering construction survey on underflooding territories depending on hydrogeological conditions. It is also suggested the methods of engineering hydrodeological substantiation for predictions of hydrogeological conditions changes and underflooding predictions with estimating the ecological hazard.

"INTEGRATED MANAGEMENT AND EFFICIENT WATER USE IN THE NORTH CAUCASUS REGION" SUB-COMPONENT AND ITS PLACE IN MANAGING NATURE PROTECTING ACTIVITIES IN THE ROSTOV REGION

Khlobystov V.V.
Center of Preparation and Implementation of International Projects for Technical Assistance, North Caucasus branch, Rostov-on-Don, Russia

The principle purpose of Integrated Management and Efficient Water Use in the North Caucasus region Sub-Component is improvement of water resources management system in the Lower Don.

In accordance with Terms of Reference and Working Plan the main objectives of the Project are as follows:

- creating and testing the Integrated Information Management System (IIMS) for managing Lower Don water resources;
- designing an upgraded cost-effective monitoring system of the Lower Don water resources condition and use for planning and management;
- a list of measures for pilot (demonstration) sections of small water catchments, including the monitoring programme draft, demonstration sites and measures, teaching materials, instructions on planning and managing small water catchments, a plan of institutional, legal and economic measures;
- guidelines on reconstruction of the basin water management, including necessary legal reforms, strengthening of the institutional mechanism, teaching programmes;
- computerized decision support system for the Lower Don water resources management;
- perspective plan of integral water resources use and protection in the Lower Don;
- modelling a control mechanism for the Lower Don water pollution.

During the two years from the beginning of the Sub-Component implementation stage certain progress was made. The results of this progress can be divided into two groups: those ensuing from fulfilling the Working plan and envisaged by it; and those attained alongside of the Project implementation, due to the project effect on the existing natural resources managing system.

The former group comprises the following:

- A model of inter-departmental information system was designed; computer equipment was purchased for its participants:
  - DBWD (Don Basin Water Department)
  - Regional Nature Committee
  - Hydrometeorological service of North Caucasus
  - Regional Centre of Sanitary Epidemiological Control
  - North Caucasus Scientific Research Institute of Water Economy (NorthCaucasus SRIWE)
  - "Uzhgeologia" federal enterprise
  - Centre of Preparation and Implementation of International Projects for Technical Assistance (CPPI)
- A project on the Lower Don regional water monitoring system was worked out and application for purchasing laboratory equipment was drawn up.

Water catchment managing plan for small rivers Kagalnyk Azovsky and Kundruchya was designed.

The work of "The River Kundruchya rehabilitation council " was renewed.

An agreement was signed on joint implementation of the Sub-Component.

Parties of the Agreement:

- Federal Environmental Committee - Rostov Water Committee
- Administration of the Rostov Region - CPPI
- Regional Nature Committee- DBWD
- "Uzhgeologia" enterprise - Hydrometeorological service of North Caucasus
- North Caucasus SRIWE - Scientific Research Institute of Mechanics and Applied Mathematics (Rostov State University)
- Regional Centre of Sanitary - Azov Fish Inspection
- Epidemiological Control
- Head Department Rostov Water Use organisation

The Head of Administration issued a decree on "Proposals on Fulfilling the Rostov Region Environmental Management Project".

Drafts of Regulatory acts were prepared, which should be approved for fulfilling the Project objectives and ensuring sustained water use in the river Don basin, including:

- Phasing water resources monitoring in the Rostov region;
- Order of licensing for water use in the Rostov region;
- Decree issued by the head of the Administration "On Setting and Applying charges for Water Use in the Rostov region";
- other regulatory acts aimed at ensuring sustained water use and improving the water economy situation.

DSS concept was designed for water use management in the Lower Don.

Certain blocks of the created system were tested and employed in DBWD:

- information-reference block,
- water quality assessment for emergency situations block, etc.

A plan of action for improving Tsimlyansk reservoir management and its catchment area was worked out. Options of scenarios for future water use in the Lower Don were prepared.

The latter group comprises results which can not always be given quantitative characteristics:

- For purposes of the Project management and coordination the Committee on managing International Projects was formed, functioning as Committee on Sub-Component Management (CSM). It incorporates representatives of all principle controlling agencies, who discuss, on a regular basis, not only the Project affairs, but also critical issues of the region's condition and environmental management. CSM generated creation of an unprecedented organisation - Coordinate Council and natural resources use and environmental safety within the Regional Administration.
- For implementing individual Sub-Component tasks temporal working groups were formed, employing representatives of managing structures, prominent scientists, productive workers, alumni and undergraduates of higher educational institutions. It is assumed that on various stages at least 300-350 people will be involved in the Project implementation, up to 80 at a time. Thus, in course of the Sub-Component implementation an impressive team of consultants and executives of nature-protection projects was formed. People were selected in line with cooperation rules for integral multi-disciplinary teams and are capable of solving significant scientific and practical tasks.

An evidence of the mentioned above is the fact that the Administration and various enterprises in the region resort to North Caucasus branch of Centre of Preparation and Implementation of International Projects for Technical Assistance to carry out feasibility project studies, as well as supervising and consulting on nature protection projects, for example:

- Draft proposals on "Preventing the threat of the Don river bed divergence on the stretch Razdorskaya village - Bagaevsky region";
- Reconstructing and technical re-equipping of Sukhorechensky aquifer;
- Proposals on reorganizing the regional environmental fund;
- Preparing a list of nature protection projects in the Rostov region for participation in environmental investment Russian Federation Project.

Having an impressive technical base and highly qualified staff having experience in international project management, the Sub-Component became one of the regional centres of collaboration of nature protection agencies. Its experts were assigned to the task of supporting other international projects, carried out in the region:

- Strategic action plan on environmental management of Greater Rostov (The World Bank).
- Solid waste management ("Know-How" environmental fund, Great Britain).

Realizing the incomparable role of population in the regional nature protection activities, the branch also supports public organizations and movements, i.e. gives information support to Public International Environmental Fund (Rostov branch).

ACTUAL WATER PROBLEMS AND ROLE OF SCIENCE IN THEIR SOLUTION

Khublaryan M.G.
Water Problems Institute Russian Academy of Sciences, Moscow, Russia

Intensive water resources use, particularly in the latest 50 years, has caused their quality deterioration, and, in some areas of the world, their depletion.

Construction of ecologically groundless and economically unwarranted water management objects has disturbed and significantly changed natural regime of rivers and water reservoirs.

Principle of ecologically safe groundwater use and protection, and minimal damage caused to the environment

should become a top-priority state problem, disregarding economic potential of any country.

Processes in water environment area slow, as a rule, and approaches and the most advanced methods are needed for predicting, and modelling the following urgent at present water problems:

- methods for predicting formation of water resources, water regime and quality under human impact and climate changes;
- exploration, study and assertation of groundwater reserves, particularly for potable water supply;
- new mathematical models constructing and the existing ones perfecting for modelling water resources formation and their quality, intrareservoir processes of water flows interaction in different environments, including their different properties, and so on;
- working out reliable methods for forecasting high water, floods and other unfavorable impacts on nature and living environment; measures, ways, and means for prevention; assessment of consequences and computating possible losses, caused by them;
- investigation of water flow interconnections with its quality and ecosystem;
- study and prediction of water factor changes on the environment, ecosystems, human health;
- prediction of water consumption in the main water-consuming objects of economy, considering ecological requirements;
- working out methods and models for optimal water resources system management, including multipurpose ones;
- integration of new technological processes, modern methods for analysis, and equipment, particularly for water quality control into the water consumption system;
- working out use of new legal, standardized, and economical principles, introducing of paid water consumption in countries, where it has been used before.

The essence of the problems mentioned and ways to overcome and solve them will be given in the report.

CONTAMINATION OF THE AQUATIC SEDIMENTS AS REFLECTION OF THE CURRENT QUALITY OF THE SYSTEM AND INFORMATION ON THE IMPACT OF HUMAN ACTIVITIES

Kolomiytsev N.V., Zimina-Shaldybina L.B., Ilina T.A.
All-Russian Research Institute of Hydraulic Engineering and Land Reclamation, Russia
Mueller G., Eiden R.
Heidelberg University, Germany

This paper presents the results of detailed investigations of heavy metal and organic pollution in the most contaminated part of the Klyazma River being the largest tributary of the Oka River.

The investigation of sediments from the hydrosphere has recently become a major subject of interest in research on aquatic systems, as they reflect the current quality of the system and provide information on the impact of human activities. Contaminants in river system can be investigated by analyzing either the water and the suspended material or the sediments. The measurements of pollutants in the water are not conclusive due to water discharge fluctuations and low residence time. The same holds true for the suspended material. In this situation, the study of the sediments plays an important role, as they have long residence time.

The greater part of the river basin and the main stream of the Klyazma River belong to the Moscow and the Vladimir Regions. The Klyazma catchment area is one of the regions with the highest industrialization, in particular mechanical engineering, machinery, metallurgy, chemical, textile, food industries and also with water-supply stations and municipal sewage treatment plants. The sediments from the Klyazma River and its main tributaries were sampled in September 1995. Samples were collected from 52 stations of the Klyazma-river from the Pirogovskoe Reservoir down to Vladimir-city. Due to the high urbanization and two times less water discharge of the Klyazma River the anthropogenic loading in the Moscow Region on aquatic systems is much bigger than the one in the Vladimir region. Therefore, the stations in Moscow Region were intensively sampled. The sampling density depended on many conditions but in any case it was as high as possible.

A correct interpretation of the results is possible either for sediments of the same grain-size distribution or with complicated calculations, based on a granulometric analysis. It is nearly impossible to take sediments from different sites which are similar in grain size.

The sediment grain-size distribution depends on many local conditions at the sampling station. Due to the high absorption capasity, medium and fine silt (fraction 20 - 2 µm) and clay sized particles (fraction < 2 µm) which are the main sourses of „suspended material" in river streams are useful indicators for heavy metal pollution and other contaminants.

The concentrations of the elements Cd, Co, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Zn and As were determined by AAS in the sediment fraction < 20µm after dissolution with aqua regia. The geoaccumulation index proposed by MUELLER (1979) for the quantification of metal accumulation in sediments was also calculated for the Klyazma River sediments. The geoaccumulation index consists of seven grades ranging from practically uncontaminanated to very strongly contaminated.

The most important results for the Klyazma drainage area can be summarized as follows:

Heavy metals in sediments. Total metal concentrations in the fraction < 20µm of the sediments vary in the range of 21 - 978 for Cu; 37 - 1059 for Cr; 54 3753 for Zn; 25 - 277 for Ni; 1,2 - 261 for Pb; 0,08 - 24,24 for Hg; 0,04 - 83,62 for Cd

and 18,6 - 493,2 mg/kg for As. . The average concentrations of Co vary in the range of 8,4 - 24,5 mg/kg and only two samples show that its concentration is somewhat larger than the upper limit of the 0-I_{geo}-Class. The average concentrations of Mn vary in the range of 344 - 2440 mg/kg and the maxima occur in the Upper Klyazma with 6667 and 11445 mg/kg. As a rule, the average concentrations of Fe are higher than its background value and vary in the range of 4,0 - 23,6%.

The main sediment contamination occurs in the East Moscow Industrial Area downstream from the town of Schelkovo to the town of Noginsk. According to the I_{geo}-Classes the heavy metals can be ranged as: Cd >Zn > Hg > As > Cu > Cr > Pb > Ni.The contamination of sediments with iron and manganese has its origin in the swampy catchment area.

Organic pollutants in sediments. At present, the methylmercury analyses have been done and the analyses of polar and nonpolar organic pollutants are going on. The possible sources of organic pollutants in the Klyazma River area mainly belong to the agriculture.

The highest pollution of methylmercury occurs at the same places determined by the heavy metals investigation (from the town of Schelkovo to the town of Noginsk). In addition the high concentration of methylmercury was detected at: the Klyazma River upstream from the town of Schelkovo; the Klyazma River downstream from the city of Orekhovo-Zuevo and the Klyazma River downstream of the town of Sobinka.

MODEL OF THE MASS-TRANSFER AND BIODEGRADATION OF PETROLEUM HYDROCARBONS IN SOIL AND UNSATURATED ZONE

Konnov D. V., Venitsianov E.V.
Water Problems Institute of Russian Academy of Sciences, Moscow, Russia
Pashkovsky I.S.
Geosoft-Eastlink, Moscow, Russia

The clean-up of a petroleum contaminated soil is at present made by various ways: by mechanical cleaning of a soil, pumping, air sparging and vacuum extraction, as well as method of microbiological decontamination.

The model developed by us assumes the dynamic description of interaction of polluting substance with a water and air phase and soil matrix, chemical and biological transformations. At the description of these processes parameters, received by practical consideration are used.

At modeling of processes, occurring in polluted soil and unsaturated zone, is allocated four blocks: a block of a multiphase flow, describing movement of a water and contaminant above groundwater at the presence of a gas phase, block of evaporation describing kinetics of evaporation and movement vapors of polluting substance in soil, block of biological reactions rates, intvending for determination of a time, for which microbes degradate polluting substance, and, accordingly, for valuation of efficiency of systems of a biodecontamination.

For accounts number given for a opportunity of realization of fast evaluation of a situation should be minimized, that is requirements to a system of data acquisition are developed at hit of a petroleum hydrocarbons in a environment.

The model will be used for the prediction of a fate of a contaminant, evaluation it hazard for a environment and for the help in choice of a optimum method of soil decontamination.

For parametrisation of model being present experimental data are used.

THE VEGETATION ASSOCIATIONS AND WATER-SALT EXCHANGE IN THE SOILS UNDER IRRIGATION INFLUENCE IN ARID ZONE

Korshunova V.S., Dikareva T.V.
Water problems Institute Russian Academy of Sciences,Moscow, Russia

General anthropogenic impact on environment, namely, development of irrigation construction in the regions of risky agriculture, conditioned the secondary character of influence on vegetation cover in these regions, that revealed itself in changes of composition and structure of vegetation communities, changes of halogeochemical composition of soil-vegetation complexes on these territories. In the regions of irrigative agriculture the processes of land irrigation desertification develop quickly, while halophytisation prevails as the result of the ground-water table lifting that stimulates soils salinization.

For regions of Central Asia and Turkmenistan one of the most important problems is soil salinization and losts of land due to irrigation. The consequences of this phenomenon are processes of irrigation desertification: degradation of natural ecosystems. Halogeochemical process of soil-vegetation complexes changes during year. In cold season washing by rains of the upper soil layers and their desalinization take place. In warm season - salinisation increase, especially of

upper soil horizons due to pulling up of salts because of capillary rising of dissolved salts from the lower soil horizons. Besides because of precipitation dissolved salts rise to the upper soil horizon because of intensive evaporation form the soil surface that happens because of high summer temperatures and high insolation. Salinisation reaches its maximum in autumn.

Great differentiation in biogenic cycle in different landscapes is typical for the desert zone as well as significant spatial differentiation in regional processes of matter migration. River flow that forms in the desert zone is very little and doesn't exist in all desert regions. Meanwhile a lot of salt is brought to the desert zone by rivers from humid and mountainous regions. That's why in the regions of the river flow dispersion in the deserts salt input in many cases exceeds 100 ton/km^2.Very intensive migration of matter through the atmosphere also take place.

Wide distribution of solonchaks, weak anchoring of soil by vegetation, strong winds promote to intensive output of matter into the atmosphere. In different zones consumption of the same element by plants can differ. Phosphorous is accumulated by plants of tundra and steppe; nitrogen, manganese, barium and zinc - by plants of forest and steppe zones; potassium and chromium - by plants of the steppe zone; sodium, chlorine, sulphur - by plants in the desert zone.

We received the correlation between macroelements in the soil and in plants growing on it and we revealed that quantitative ratio between ions of sodium and ions of potassium can serve as indicator of soil salinization degree. For tundra and forest zone this ratio is very low and equal for both, for steppe zone it is higher and for desert zone it is 3:1. We received quantitative ratio between ions of sodium and ions of potassium for the vegetative parts of plants in two regions of the Amydarya delta that differ in origin, water and salt balance of soils, in species composition and its macroelement composition. One of them is dry bottom of Adgibay bay, the second is desertified *Eleagnus-Populus* tugai with several plant layers. Analysis of macroelement plant composition (of vegetative parts) and its comparison with salt concentration in soil on these patches enabled us to reveal the following: the higher is soil salinization the higher is salt concentration in plants.

Halogeochemical researches had been done on the coastal landscapes of western Caspian coast. As Caspian level rose, in coastal zone rebuilding of coastal natural complexes take place, including ground water table and water salinization, vegetation plant composition and its biomass. The higher content of mineral elements is in vegetation of coastal solonchak - *Salicornia europaea, Puccinellia tenuissima, Plantago salsa*. Sodium and chlorine prevail among other salts. The least quantity of ashes is in the vegetation of dry-steppe zone. It is obvious that ground water table is at the depth of 4-5 meters, so salts can't be brought to the soil surface.

In coastal zone ground waters bring to the surface layers of soil 14-60 times more salt that vegetation exfoliation does. Easily soluble salts transferred to the surface horizons, are included partly into biological cycle, but most of them are washed out during the autumn-winter period into ground waters and then into the sea. Approximately 19 - 7 tons of easily soluble salts are being washed out annually into the sea from 1 hectare of coastal solonchaks and coastal meadows accordingly.

In conclusion we must mention that literature data as well as our own field researches show the tight correlation between macroelementary composition of soils and vegetation. The higher is soil salinisation, the higher is salt content in vegetative parts of plants. Quantitative ratio of macroelementary composition in vegetative parts of plants, in particular, ratio between ions of sodium and ions of potassium can serve as definite physiological indicator, reflecting degree of soil salinisation: the higher is this ratio, the higher is soil salinisation. Processes of soil salinisation, especially its upper layers develop very quickly in arid regions and in nearest future we may expect complete replacement of biota and transformation of productive soils into solonchaks. Development of vegetation communities will be of halophytisation type, replacement of floristic composition to halophyte type and replacement of meadow-steppe species by steppe species.

ANTHROPOGENIC IMPACT AS A MAIN FACTOR OF LANDSCAPE ALTERATION

Korzhenevskii B.I., Kolomiitsev N.V.
All-Russian Research Institute of Hydraulic Engineering and Land Reclamation, Russia

Moscow oblast is one of most intensely developed area within Russia. At the same time on this area there can be met landscapes practically without any negative anthropogenic environmental changes. Such a diversiry of conditions specifies the interest to investigation of anthropogenic impacts (AI) as a factor of landscape alteration and makes possible to assess the whole multitude of these changes. AI is a factor of disturbance of natural regime in the development of landscapes, surface perennial and ephemeral streams, groundwater and subsurface water. Characteristics of pollution of soils, water and bottom sediments can be used as one of the criteria of natural regimes disturbance. Correlation of sorbing capacity, chemical activity, solubility, and other properties of pollutants stipulates their transport to a watercourse, or their displacement on the surface in artificial or natural accumulators, or sorption in soil layers.

The types of AI on landscapes specify the regime and specific nature of pollution of landscape elements. Typification of AI is made according to the following criteria:

1) Spatial, linear, deep or complex aggregate - geometric paramerers;

2) Improvement or deterioration of landscape conditions - quality;

3) General or local - scale of impact.

Spatial AI is typical for agricaltural lands, forest amelioration zones, recultivation of lands and other types of area development, when the area of impact significantly exceeds its depth, and the depth of impact does not exceed the depth of the zone of aeration.

Linear AI is noted in the zones of construction of structures such as highways, canals, cuts-through in forests for power transmission lines, etc.

Deep AI is typical for the cities with intricate infrastructure, reservoirs and a number of special projects, such as mines, zones of subsurface water intakes, buried tailings dumps.

Complex AI is revealed on the area of cities and settlements and represents the aggregate of the above-mentioned.

On the basis of above mentioned the assessment of importance of AI as a factor of alteration of landscapes within the eastern part of Moscow oblast is made.

SUPPORT SYSTEM OF DECISION-MAKING PROCESS IN WATER MANAGEMENT IN BIG RIVER BASIN

Kosolapov A.Ye., Kuvalkin A.V., Kosolapova N.A.
North-Caucasus Affiliate of RosNIIVKh, Novocherkassk, Russia

The Support System of the Decision-Making Process (SSDM) means an aggregate of methodical and mathematical provisions, database organisation and management, software and hardware promoted the decision-making. The SSDM aim is the improvement of water management at the expense of the modern information technologies application on the base of high-performance techniques. The system of water management with the application of the SSDM is considered as the human-technical system based on a reasonable combination of the formal decision-making methods and use of the experience gained, knowledge and insight of decision-makers.

In order to ensure the decision-making such the management system should include the elements as follows: a model (mathematical and information) of water-management system, scenarios and algorithms of the decisions preparation, dialogue procedures for the decision-makers (DM) with computer, techniques for the functioning of this system, decision-makers.

As an element of the system on management of the complex object the SSDM is also a complex system consisted of the functional and subsidiary parts. The functional part includes the complexes of objectives ensuring the functions of the forecasting, on-line control, current and advance planning of water resources utilisation and protection, information service. The complexes of objectives are combined into the individual sub-systems by the functional principle. The models aimed at the solution of sub-systems objectives form a general model of water-management system. The synthesis of the general model should be carried out on the base of a bank of various functional models. Such the system of models should include: the models of individual processes and elements of water-management system, models of interacting elements and processes and generalised models that describe the process of management solutions preparation.

The subsidiary part of the SSDM consists of the subsystems: organisational provision, database organisation and management, mathematical provision and software. Its main function is to support the process of the solution of functional sub-systems objectives and solutions preparation. The organisational provision fixes the composition, structure, functions of divisions and individual persons, scheme of their collateral subordination and interaction in the process of decisions preparation.

A concept "database organisation and management" means the total data used in the process of decision preparation and making as well as the modes of data presentation, storage and reduction. The quality of decisions is determined to a considerable extent by the foundation of database organisation and management.

A condition of the SSDM efficient functioning is to keep a number of methodical principles which should be taken into consideration at the stage of design of database organisation and management such as:

- use of the united methodises of information system elements formation (classifiers, glossaries, document forms, etc.);
- formation of the aggregate of techniques and forms for the information exchange in different sub-systems;
- integration of data reduction;
- flexibility of data structures enabling to develop continuously the database organisation and management;
- independence of a user on data logical organisation, of data on programmes, of programmes on data.

The system of the mathematical provision of the SSDM unites the aggregate of methods and algorithms of the functional objectives solution.

The algorithm of the objective solution could be considered as a chain of consequent blocks (sub-objectives) included in the bank of functional models each of which processes the information and prepares interim data needed for the next blocks functioning. Working out the algorithmic provision of water management objectives it is reasonable to begin from the fact that all objectives solved with the help of the SSDM could be divided into three groups: well-structured, poor-structured and bad-structured objectives. The optimisation methods are used for the solution of the well-structured objectives. The formulation of solution algorithms for the second and third groups is a complex problem which could be solved by means of the use of the practical experience, knowledge and insight of the experts. Such the approach to the solution choosing enables to turn to the use of so-called heuristic methods. Their essence consists in the formalisation of the experience gained. Therefore the most

constructive way of the heuristic algorithms formulation is the formation of models adequate to the verbal ideas.

The most reasonable approach to the algorithmisation of water management objectives solved by means of the SSDM consists in the combination of both approaches advantages. From the one hand it enables to use the experience gained, knowledge and insight of the DM at the preparation stage, doesn't require the global formalisation of all processes, enables to eliminate the inefficient management decisions on the base of informal procedures, and from the other hand it enables to use the formal concepts for the search of optimum local decisions.

PRESENT-DAY STATE, PROBLEMS AND THE WAYS OF GOOD USE OF WATER RESOURCES IN LAND RECLAMATION AND AGRICULTURAL WATER-SUPPLY IN THE UKRAINE

Kovalenko P.I., Khoruzhyi P.D.
Institute of Hydrotechmcs and Reclamation of the Ukrainian Academy of Agricultural Sciences, Ukraine

With the purpose to increase the efficiency of scientific investigations the scientific-technical Centre "Reclamation" was created on the basis of the Research Institute of Hydrotechnics and Reclamation of the Ukrainian Academy of Agrarian Sciences for the coordination of scientific works concerning more effective use of water-resources, land reclamation and agricultural water-supply.

In one of the scientific-research programs the working out of the methods of optimisation of water balance of the territory has been incorporated; the creation of database of qualitative and quantitative natural resources state in the different regions of Ukraine with prognoses of such state changed under the influence of economical activity; creation of measures, technologies and equipment for the cleaning of natural and sewage waters; improving of ecological state of small rivers, ponds and reservoirs; creation of the system of protection the settlements from high-floods.

Practically all the surface water resources of the Ukraine were subjected within recent 10 years to the essential action of harmful anthropogenous factors.

The river Dniper is the major source of water-supply and land reclamation in the Ukraine and constitutes nearly 80% of Ukrainian resources and provides with water for more than 30 min of population, 6.200 industrial enterprises. 2.200 rural and municipal economies, the watering of 18 min of soils.

At present from the Dniper on the average within the boundaries of Ukraine takes away of water 14,7 km per year, throws down 9,9 km per year of sewage, of this amount without cleaning - 282 mln m per year, not adequately cleaned-5,2km per year.

This brings to the considerable exceeding of the allowable concentrations by many harmful substances. Today the water of majority surface water-sources of the Ukraine is classified as polluted or dirty (4-th and 5-th classes of pollution). Such unsatisfactory ecological state of surface water-resources arises from a heavy technogenous duty, imperfection of legislation and the absence of economical mechanism giving impact to the financing of water-protection activity.

Physicians witness that more than 100 human diseases were caused by the use of not qualitative water. Therefore we have at present an enclosed circle which can drive to the ecological disaster: on the one hand the progressive pollution of natural water sources by the not cleaned sewage, on the other hand the barrier role of available technologies on water supply cleaning constructions is not sufficient for the withdrawal of the majority of chemical compounds, especially if their content in initial water considerably exceeds allowable concentration.

An application of physical-chemical methods for the cleaning of natural and sewage waters under the conditions of economical crisis produces substantial problems and rises in price the cost of cleaning and rude exploitation of such technologies leads to the repeated pollution of water-source.

Therefore at present the technical policy in the field of rational and effective use of water resources in watering and agricultural water-supply should be aimed at the decision of following principal problems: working out and using of power-watering technologies, reconstruction and intensification of the work of current systems, final cleaning of drainage and sewage waters through the use of technological processes of biological and sorption cleaning, utilization of decentralized systems and optimal water- economical complexes on the group water-pipes, an enlargement of the use of underground waters for the drinkable water-supply including through the artificial replenishment of it's reserves, working out of compact units of Industrial manufacture with small productivity for the cleaning of natural and sewage waters, creation of closed water coo-systems in agricultural production with the use of finally' cleaned waters for the irrigating cultures.

In Research Institute of Hydrotechnics and Reclamation the systems of agricultural water-supply and drip irrigation, low-pressure watering machines, new materials, units, mechanisms and equipment are created and have been successfully inculcated. Some works are fulfilled on a turn-key basis: beginning from projecting to the installation and introducing into service. Many works have patents of Ukraine and Russian Federation.

For the reducing of water and power losses the manometric survey of water-pipe systems is Gamed out as well as determined an actual specifications o the constructions, the water counters are mounted and the optimization of the work of pumps is carried out. Biological and sorption filters are used for the increasing the efficiency of the work of water- cleaning stations.

THE HYDROICETHERMIC ASPECTS OF LAND WATERSITES ECOLOGY

Kozlov D.V.
Moscow State University of Environmental Engineering, Moscow, Russia

The economical opening up of land watersites (reservoirs and channels) of Russia's northern and Siberian regions require more attention to ecology matters, in the first instance to its hydroicethermic aspects.

From a position of ecology distinctions between reservoirs (such as lakes, tanks, pools, etc.) and flows (rivers, streams, channels) consist in different set of water environment limiting factors, depending on following conditions:

1) presence of water masses flowing in channels and its absance in reservoirs,

2) more intensive substance and energy exchange between water and land in the channels, in contradistinction to reservoirs,

3) comparatively even distribution of temperature and oxygen volume depending on depth in the channels, and level distribution in reservoirs.

The vastest complex of ecological problems, related to icethermic watersites habits, conditioned by regulation of flow or by reservoirs creation. Hydrotechnical engineering on large and middle rivers lead the riverside areas microclimate change. A cause of the change is accumulation of large water volumes and its significant thermal capacity. Another ecological and hydrological problem of no small importance related to formation of long unfrozen patches of water (polynias) in the afterbays of hydro-electric power stations; these patches are cause of steaming and mist-forming above the surface. Presence of power station thermic influence zone below regulating project activize processes of gorge and ice-gorge formation with following water level increasing near ice-cover edge and with development of catastrophic winter floods. Gorges and ice-gorges, forming either in zone of reservoir head wedging or in certain morphometric parts of river, show wide-scale negative influence on ecological condition of river valley. Dangerous ecological consequences of gorge and ice-gorge formation connected with water raising to marks of water-meadow flooding and high degree of pollution (for instance, radiation pollution in water-meadow of Pripyat river) and with possibility of following carrying-out of polluting substances to other parts of river. Problem, related to reforming of bottom and sides of reservoir, situated in permafrost zone, by water heat influence, which lead worsening of water environment quality, water muddening and reservoirs pollution with rising bottom sediments, peatbogs, etc., is highly significant one.

The hydroicethermic problems of projects building on mouths of rivers (estuary), where ecology requires to preserve natural types of mixing, salt and ice habits of estuary, are very important.

Ecological breaches, related to water quality worsening in the bays of hydrotechnical constructions and cooling pools of thermal electric power station, occur during the thermoenergetic assimilation of watersites. In this connection there is increased interest to ice as a source of pure water and to desalination and purification of water before freezing out.

Serious ecological problems occur in natural (lakes) and artificial (pools) reservoirs, involved in economical activity. The most difficult exploitation period of sedimentation reservoirs production systems is winter, when water quality in them forms with condition of extremal meteorology and additional intakes of heat.

List of ecological problems, connected to hydroicethermic regime of watersites, may be added by examples of foundering phenomenas and dying away of macrophites due freezing out of reservoir and small river shallow waters, due to breaches of water quality in winter period of exploitation of water-supply and general channels, etc.

Conclusions:

1) Complex of ecological problems, related to icethermic regime of land watersites, is spacious and ponderable, from standpoint of negative consequences for water ecosystems.

2) Joint researches of temperature, hydraulic, ice, hydrochemical and hydrobiological regimes of reservoirs and channels require a special attention.

3) Modern ecological requirements to economical assimilation of watersites presuppose development of complex measures, directing to minimization of damage and liquidation of water environment ecological infringements in winter conditions of mild climate, as well as in conditions of severe climate and permafrost.

METHODOLOGICAL BASIS OF WATER QUALITY MANAGEMENT OF WATER RESERVOIRS (WITH PARTICULAR REFERENCE TO THE SOUTH URAL)

Krivopalova Z.F.
South Affiliate of RosNIIVKh, Chelyabinsk, Russia

Exploiting the South Ural water reservoirs new problems arise that are not typical for the rivers where they were constructed: the concentration of organic substance and reservoir silting increase, the water body is overgrown by plants, so the water supply system is interrupted.

At present there are no standards concerning water quality management at the regulated sections of the river. "The basic provisions of water reservoirs resources exploiting rules" used now are oriented mainly the management of hydrological parameters, however they do not point out their correlation with hydrochemical and hydrobiological values showing the ecosystem conditions.

This contribution is aimed at the search of methodical approaches to the regulation of some processes in the South

Ural water reservoirs. The stages of the aim achieving are the followings:

1. Assessment of the water quality of the water reservoir and river where this reservoir was constructed. The documents intended for control and supervising services were used as regulated documents.

2. Assessment of the water quality transformation in the system "river-water reservoir". Taking into account the fact that the physical background of different processes is the hydrological regime, the correlation between changes of the chemical and water flow was used. In the case of the anthropogenic transformation we calculated the value of the deviation from the background and then fixed the current situation.

3. Determining of the character and reasons of the water quality disturbed. We used different approaches: fixation of the dependencies between ecosystem parameters and supposed affecting sources, modeling of some processes in the water body (laboratory, natural and mathematical), comparison of the balance income and expenditure.

4. Assessment of the affecting source impact on the water reservoir. The impact was fixed by stages: in production sphere, in water discharge sphere and directly on water body. In the latter case we took into account the water exchange value, the position in the system and water volume.

5. Choice of priorities in the reservoir water quality management. The objectives and strategy of the management were chosen in accordance with the reservoir status. The water reservoir is the biogeosystem that requires the special regulation and protection regime ensured the normal vital functioning of plants and animals. It is pointed out in the Russian Federation Government resolution "On water reservoirs exploiting order" (June, 1997).

The management task is the adjustment of the self-regulation mechanism of the artificial water body to the new hydrological conditions in order to prevent the irreversible changes in the ecosystem. Since the water reservoir is under two types of the influence - the regulation and pollution, so the requirements to the ecosystem protection should be more rigid than to the rivers and lakes. We used the biomass of phytoplankton and ingredients, for which the anthropogenic transformation was fixed, as the information test for the water body diagnostics. The same parameters determined the character of necessary measures of the water quality management. The measure capacity was calculated proceeding from the correlation between the values of the deviation from the background conditions of the water quality transformation and affecting source impact. The measures were aimed at the hydrological regime change, the increase of the catchment are and water body self-purification capacity and at the reduction of the affecting source impact.

6. Working out of measures aimed at the water quality improvement. Using the Shershnyovskoye water reservoir (the source of the drinking water supply to Chelyabinsk) as the example, the complex of measures was drawn out. Taking into account the fact that the coast area of the water body is of the agricultural purposes, the measures were carried out mainly in the production sphere (change of the crop rotation, usage of fertilizers of the less migration capacity) and in the water discharge sphere (forest-plantation, bordering, flow discharge). The follow measures were recommended: for the water body in the area of water intake - aeration, "green" defense, at the wastewater treatment plants - ammonisation process using.

The result of the measures implementation was the reduction of nutrients in water reservoir only in the catchment area in 3 times. The economical effect is 850 mln rubles.

DEFINITION OF THE WATER PRESERVATION RANKS FOR COMPARISON ASSESSMENT OF THE CHIRCHIK RIVER BASIN WATER QUALITY

Krutov D. A. , Kozlov D. V.
MSU of Environmental Engineering, Moscow, Russia

The Tashkent oasis of Uzbekistan is the region where irrigaton was historically the field of the population activity and the source for socio- economy development. At the same time, this region is very populated and the population growth is very high (about 2,6% per year). The main problem of the region has become portable water of appropriate volume and quality.

The main problem of economy is the problem of nature water quality. The problem links with discharge of waste waters and collector drains waters to the water sources. Main sources of pollution are collector drains waters.

The Chichik river is under the biggest anthropogenic pressure in the Central Asia. The flora and fauna degradating, recreation is impossible, water quality deteriorating. The main attention during the studies were paid to:

- establishment of the river 's parts ranks and definition of the parts that urgently need water preservation measures;
- assessment of the average (in flow) concentration of the main polluter (contamination).

A tackson was the base to rank the parts of the river. Ranking was made using the "distance" from a "standard" point. As a standard point was accepted the measuring station with the better water quality.

As the objectives for ranking were used:

- general (summariztd) water quality indicators;
- group of pollition (ingredients that grouped spekifically);
- total volume of waste waters discharge to the river;
- background concentration of pollution.

The ranking and average concentration of pollution let us made the conclusion that the water quality is constantly deteriorating along the part of the river that close to the urban territories.

ACCUMULATIVE PROCESSES IN VOLGA-RIVER RESERVOIRS

Kadukin A.I. and Venitsianov E.V.
Water Problems Institute of Russian Academy of Sciences, Moscow, Russia

In process of forming Volga-river cascade of reservoirs sharp change in transformation of organic and mineral matters occured. The problem of co-calculation of transformation and accumulation of this matters has not resolved till now.

The main sources of suspended matters (SM) in reservoirs are:

- flowing of SM and wash-out of banks and bottom;
- unbalanced development of phytoplankton and high water vegetation.

The following formula for calculation the rapidity of accumulation of organic and mineral matters in bottom sediments, acquired as result of expeditional and theoretical researches, is offered:

$$J = \frac{\gamma\rho g H}{m}\left[\frac{V^3}{gHm}\cdot\frac{h}{H} + (--)\right] + mB\,f\,(---)\cdot\frac{R_{пр}}{R_{дестр}} \qquad (1)$$

with ρ – density of SM (• 1 t/m^3);
g – gravity accelaration (9,81 m/c^2);
H – depth of reservoir in given point (m);
V – current velocity in given point (m/c);
m – average hydraulic size (m/c);
h – wave hight (m);
B – biomass (t/m^3);
f – function depending on rapidness of processes of productivity $R_{пр}$ and destruction $R_{дестр}$ (R in t/m^{3}c);
γ – coefficient, which characterizes rapidness of mineral SM accumulation and depends on hydrodynamical conditions only (speed, regime of turbulance etc.).

The value γ of for Volga-river cascade is approximately 0.1 and constant for all reservoirs.

Average rapidness of accumulation, calculated with the help of this formula, is approximately 2.10^3 t/km^2.year. There are approximately 1.2.10^9 tons of organic and mineral sediments accumulated in Volga-river reservoirs since they were formed.

There are data on sediments accumulation for main Volga-river reservoirs, acquired with using of echo sounding and by direct measurements (table).

Table. Sediments accumulation for main Volga-river reservoirs.

Reservoir	Squire, km^2	forming, year	Period of accumulation, mln. tn	Sediment
Ivankovskoe	320	1937		36
Uglichskoe	250	1940		32
Rubinskoe	4550	1945		360
Gorkovskoe	600	1956		100
Kuibyshevskoe	6400	1956		380
Saratovskoe	1800	1967		72
Volgogradskoe	3100	1958		230

This data are rather similar with those, calculated by means (1).

The using of formula (1) gives the opportunity of making prognosis for sediments accumulation in the reservoir design, and also evaluating that in existing ones using rather simple measurements.

METHODS OF QUANTITATIVE EVALUATION OF VEGETATION DYNAMICS ON THE CASPIAN COAST UNDER WATER-LEVEL FLUCTUATIONS

Kuleshova L.V.
Water Problems Institute Russian Academy of Sciences, Moscow, Russia

Vegetation cover of the Caspian coast constantly changes because of many-years fluctuations of the Caspian sea level. In our work we tried to use quantitative methods for estimations of changes in species composition for rather long period of observations - 19 years (from 1976 till 1995, with data collected by L.V. Molchanova), that coincide with intercentury transgressive phase of the Caspian sea level fluctuations.

The observations have been done on the scientific base Turali of Moscow State University in Daghestan. The coastal type under consideration is widely spread on the Caspian sea and is low abrasion-accumulative plain on the Primorskaya lowland. From the sea side this plain is surrounded by the belt of newcaspian terrace with level -22 m - 20 m and by modern terrace with active elements of beach. Beginning from the water level up to the terrace the following vegetation

communities replace each other: pioneer groups on the beach with *Salicornia europaea, Argusia sibirica, Suaeda confusa* - halophyte vegetation complex on the sea-side solonchak with *Salicornia europaea* as dominant in the microdepressions and groups of *Graminae* associations on microhills - community formed by *Juncus acutus, J. maritimus* with participation of halophyle species on sea-side meadow-bog soils - psammophyte vegetation with *Leymus racemosus, Convolvulus persicus, Alhagi pseudalhagi* as dominants of sandy soils - zonal graminae-semidwarfshrub community with *Artemisia tschernieviana, Centaurea arenaria, Bromus japonicus* as dominants on solonetz light-chestnut soils on the surface and slope of newcaspian terrace.

Our observations were made using method of transsects on 10 level profiles appointed by control points and attached to the state triangulation net beginning from the sea level to newcaspian terrace. We estimated the total density of sward and density of each species according to Drude scale, we took soil samples for analysis of water-soluble salts and we took herbs cuttings for estimation of vegetation productivity. We had opportunity not only describe the vegetation successions but also reveal the character and direction of them. Besides the high solution of topographic survey made it possible to reveal the character of changes of elementary parts of vegetation - associations and to characterize the role of each species and their spatial distribution under the Caspian sea level rise. For that purpose we used indices of frequency and activity.

While the sea level increased the territory of coastal solonchak shrank and ground water table heightened (from 1 m to 0,4 m during the period from 1976 till 1992) and halophyte belt of vegetation moved higher from more salinized soils to less salinized. On one hand it reflected in the total density of sward that had increased from 10-15 up to 25-30% and on the other hand - it reflected in increase of complexity that was conditioned by changes in microrelief, moistening conditions and salinization soil conditions along profile.

Number of species increase along profile from sea inland. Behind the belt of annual species that have low vitality, the frequency of typical (mass) species of *Salicornia europaea, Puccinella gigantea, Suaeda confusa, Plantago maritima* increase up to 80-90% and their activity increased up to 4-5 marks.

As the sea level increased the territory occupied by community of *Juncus acutus, J. maritimus* decreased (from 100 to 10 m). The most important ecological factor for this community is the depth of ground water table. Increase of the ground water table (from 0,8 to 0,2 m) became favorable factor for the total density of sward that had increased from 80 up to 100% almost everywhere. While frequency of dominants *Juncus acutus, J. maritimus* remained the same 100%, the activity of species increased up to 7 marks, mostly on the account of abundance. Besides, during the period of the sea level increase the frequency (from 11 up to 45%) and activity (from 1 up to 2-3 marks) of herbal species increased: *Cynanchum acutum, Medicago caerulea, M. Falcata, Tripolium pannonicum, Galium sp. etc.)*. We also marked the wide intrusion of some halophyle species of the seaside solonchak into the community of *Juncus acutus, J. maritimus*. It is testified by everywhere increase of their frequency. For example, this index for *Salicornia europaea* increased from 22 up to 45% and activity of this species reached 6 marks. Such transition of halophyle species of the seaside solonchak up along the profile characterize the increase of the upper soil layer salinity. During the period from 1992 to 1995 because of quick sea transgression the lagoon water inundated almost the whole modern sea terrace while vegetation changed for marshy.

Psammophyte vegetation that grew at the foot of newcaspian terrace and attached to previous coastal levees decrease its territory insignificantly. Frequency of species decreased (for *Alhagi pseudalhagi* - from 64 to 56%) or remained as it was (*Convolvulus persicus* - about 44%).

In zonal communities of the surface and slope of the newcaspian terrace some decrease of total density of sward from 25-40 to 15-20% is mentioned.

The coastal lowland is very important region of pasturing for Daghestan. The decrease of pastures territory due to the Caspian sea level rise may be estimated as negative phenomenon.

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SOLAR RHYTHMIC OSCILLATION ACTIVITY IN DEPENDENCE A PRECIPITATION AND AN AIR TEMPERATURE FOR POVOLGEE CONDITIONS

Lepnowa E.S., Parfenowa N.I.
All-Russian Research Institute for Hydraulic Engineering and Land Reclamation

As it have had shown by literary sources, rhythmic oscillations of solar activity must affect on climatic parameters changes. Authors had accomplished the yearly Wolf numbers (W) analysis for about three century (1790-1994). As it is known, between centuries cycles are continuing 11 yr usually. We have found for 26 accomplished cycles that a mean value is equal 10,9 yr with a deviation from 7 to 17 years. An increasing W- numbers is being usually 4-5 yr, a decreasing - 5-8 years; 27-th cycle is finishing now. A smooth connection of graph W=f(t) peaks have cleared a wavy curve, that shows more continuous cycles of solar oscillation activity (46- 62 yr between bottoms and 33-87 yr between peaks).

Search of solar rhythmic oscillation activity has been continued by slide veiling method for levelling intervals 10, 20 and 30 yr. Results for 30 yr levelling are most informative. W_{30}= f(t) graph may be shown by 3 rhythmic oscillation periods. In this case the graph had had 3 bottoms-peaks.

Next minimum may be foreseen to 2005- 2010 yr according a continuance of former periods. We had cleared a continuous increasing W_{30} peaks. This , very likely, reflects a tendency of more prolonged of rhythmic oscillation solar activity periods.

For lower Povolgee conditions an analysis of mean values of air temperature (T) and a precipitation (Oc) had been continued by a slide levelling method. Graphs T=f(t) and Oc=f(t) for more then 100 yr data are , basically, sinchronized, but graph W_{30}=f(t) - asinchronized for two previous. Peaks of W_{30} graphs basically are according the bottoms T_{30} and Oc_{30} values to. For accepting a present tendency of decreasing W-numbers, we suppose a tendency of increasing of levelling values of precipitation and temperature to 2010 yr, but no more further.

In total, the analysis had shown a worth of a slide levelling method of mean year W- numbers and climatic parameters for a rough prognosis a process tendency, if you would have a sufficient period of uninterrupted data for climatic parameters.

TRADITIONAL SYSTEM OF WATER UTILIZATION AS A REASON FOR ACCUMULATION OF ECOLOGICAL PROBLEMS. CONCEPT OF COMPREHENSIVE SOLUTIONS OF THE PROBLEM (CONSIDERING SAMARA REGION)

Machinya A.P., Roytman L.A.
State Research Institute of Civil Planning, Regional Department, Samara, Russia

Samara region is considered to be one of the most urbanized Russian areas 10 urban settlings with the population of more than 2 mln constitute Samara urban agglomiration (UA). The enviroment of this area is under the peak anthropogenic and technogenic load, this cocerns all its components including utilization of natural resources (such as water, soil, oil, gas, non-metallic minerals) as well as enviromental pollution (about 1 bln m^3 of waste water is discharged into water bodies, about 1 mln t of general waste - into the atmosphere, 1,5 mln t of industrial waste - into the soil annualy). Intensive discharge of technogenic waste influences the area of 6720 km^2. The enviromental pollution has been increasing recently. mostly because of frequent accients. Under these circumstances life and health conditions of the population of the agglomeration have changed for the worse.

Under-treated sewage water of miscellaneous categories is being discharged into the Volga River and its tributaries. Surface water is being utilized for drinking and household purposes in 80 - 90 % (in case of sufficient subsurface water supplies which are bodly protected and hydraulically dependent on surface water). The quality of surface water doesn't meet neither the national standart 2761-84 "water of water bodies" nor the requirements for fishbreeding and water recreation. Centralized water supply systems equipped with water treatment facilities of a traditional type are predominating in the region. These facilities don't allow the treated water to respond to purification requirements for potable water. The alternation of waste water discharge zones with potable water consumption zones is to be mentioned while evaluating the problem of water utilization. Sewerage systems of all the towns are common and this factor deteriorates the waste water treatment taking into account that the correlation of household and industrial waste water is 1:2 - 1:3. The more so, in 90-95 % the technological lines are not provibleol with Local Sewage Disposal Facilities (LSDF), there fore much depends on town Sewage Biotreatment Facilities (SBTF). This is extreemly in effective for industrial waste water often happens to be an active inhibitor of the biotreatment process.

Albeit ecological programs "The Volga River Rebirth", "Social and Ecological Rehabilitation of Samara Region and Health Protection of its Population" and current town local programs might be carried out, its appears impossible to obtain any significant improtement in the quality of surface water and to reduce pollution of subsurface water by means of izolated local efforts under the conditions of aggravation of town antagonisms.

Therefore, it is becoming increasingly important to define the full array of solutions of engineering-ecological problems related to the utilization of regional water resources within the framework of a newly elaborated program that should include, at least, the following items:

- Water supply engineering facilities are to be4come the property of miscellaneous subjects of economic management; the patterns of structural and economic organization of the facilities might be various, mostly private, and corresponding juridical dases are to be set up.
- Water as one of the natural resources and water consumption as public utilities should require payment, the prices of the world market (this factor serves as an economic base for the functioning of water supply facilities).
- Specific water consumption rates should be introduced for potable. household, industrial purposes, the rate for industrial water consumption should be reduced in the first place.
- The city water supply system should be subdivided into the following subsystems: a potable one for the population, a municipal one for household needs and a technological one for industrial needs.
- Industries should be detached from the city supply system in order to stimulate the development of local waste facilities and systems of circulating and closed water supply at enterprises.

• Iron water pipes should be replaced by plastic ones;production of pipes, flocculators, filtres, sorbents, water measuring instruments and preparative water treatment facilities meeting the present day requirements should be established.

Potable water supply that involves utilization of subsurface water resources should be of prime concern. Simulteneously, to provide the population with surface water of high quality common (for a distrist, a house) or indnvndual (for an appartment) means of water treatment should be installed and the use of bottled water (mineral water inclusive) should be promoted.

Rehabilitation of sewage discharge areas and nutrition of surface and subsurface water should be carried out.

Legal and economic arrangement that might promote the implementation of the ecoprogram should be worked out.

The following items are defined to be the national key goals:

• Water supply management which is to comprise forecasting, planning, control, investment support on the basis of state property in water resources;

• Implementation of operational flexibility by means of the automated ecomonitoring system (AEMS) based on the principle "diagnosis at once" (in contrast to the national traditional monitoring system based on the principle "diagnosis post- factum").

Efficient management requires operational information delivery which might be obtained only by means of the automated ecomonitoring system.

The research performed by the Institute made it possible to define a compleet package og the agglomeration problems and to arrive at the coclusion that imposing restrictions on water consumption might be a potential component of the induring program of townplanning development of Samara agglomeration and its suburbian areas. The considered program might allow the efficient use of natural resources, successful elaboration of investment projects and procurement of required life and health conditions for the population under the present geopolitical eircumstances.

In the near future a comprehensiveeloboration and evaluation of a wide spectrum of concept for the re-organizing of the functional-planning structure of the agglomeration and its suburbs as well as for the most advantageous methods of management, development of legislative and regulatory systems and investment attraction that might ensure economic and social progress of the region are supposed to be worked out.

Being approved by the Governor's Council, the considered concepts might be regarded as a basis for drawing up a plan for regional water utilization.

PROGRAMM COMPLEX FOR MODELLING QUALITIES OF WATER IN COASTAL ZONE

Makarov K-N.
University of Tourism & Recreation, Centre of Black & Azov Seas **Monitoring,** Sochi, Russia

The quality of sea water in a coastal zone is the rather important parameter as recreation and economic (for example from the point of view of cultivation of flora and fauna) characteristics of coasts. Therefore the control and the forecast of this characteristic is a urgent problem.

Under the direction of the author a Program Complex ("PC' M) for Personal Computer as IBM is developed to solve the following problems:

• Input of digital model of district, that is relief of a surface and underwater coastal slope, litological characteristics, lengths of dispersal and depths on dispersals for calculation of waves from all wavedangerous directions, characteristics of sources of muddiness or impurity;

• Input of a hydrometeorological situation, namely - speed, direction and duration of action of wind;

• Calculation of waves on deep water, their transformation and refraction in the coastal zone and wave breaking. Calculation of all types of currents - wave (instant and portable), wind and gradient currents . longshore power current and total field of currents;

• Calculation of height (depth) rise of a torch of waste waters from a constantly working source, located on determined depth of basing. Thus it is supposed, that density of water in basing either is constant, or is increased with depth (stratification);

• Calculation of penetration of an impurity from an instant source, located on the surface of water to the sea depth (for example after loss of the "acid" rain) without the account of currents (as only diffusion problem);

• Calculation of distribution of an impurity from a constantly working source (for example - the water output) in a coastal zone. when by vertical components of currents in the lust approximation is possible to neglect;

• Calculation of distribution of pollution after flood of a polluting liquid (for example of petroleum) on a surface of the sea;

• Calculation of background and additional water muddiness in the surf zone;

• Calculation of dilution of conservative impurity, getting in the seas as jets.

PCM was verified for calculation of additional muddiness of water in the water using region of Yantarny combine on Western coast of Sambiysky peninsula (the Kaliningrad District), for calculation mutual influence of water output and water input of a number of sanatoriums in Sochi, for delimitation of dilution of a jet with the large contents of sulphur hydrogen in the mouth of Macesta river in the Black sea and in other objects.

The demonstration versions of a number of components of PCM are available which can be shown.

CALCULATION OF IRRIGATION RATE BY THE CAPILLARY SOIL WATER MOVEMENT LIMIT

Makarychewa E.A.
All-Russian Research Institute for Hydraulic Engineering and Land Reclamation

Irrigation rate **m**, calculated for a layer of thickness h_p by a maximum capillary $\theta_к$ and critical $\theta_{кр}$ moisture $[m = h_p(\theta_к - \theta_{кр})]$ is exeeding the equilibrium water content in this layer and has irrigation water losses an aeration zone through as result.

A rational irrigation rate $m_р$ must be no more sum of stores of small-transferable water $W_{сп}$ and capillar water $W_к$, what is according to diapasons $\theta_{кр} \le \theta \le \theta_о$ и $\theta_о \le \theta \le \theta_к$. Here $\theta_о$ is capillary water movement limit (by Shapovalova O.V.). For a calculation of $W_к$-values a graphic of after irrigation equilibrium moisture must be used This graphic is charactirized by a transfer zone of thickness $H_к$ and a content of cappilar pores. The last one has a maximum ($n_к = \theta_к - \theta_о$) when $h_р / H_к > 1$, if $h_р^* / H_к < 1$ that $n_к^*$ is equal $n_к h_р^* / H_к$. An equilibrium capillary water stores in these cases is equal: $W_к^* = 0{,}5\, n_к^* h_р^*$, $W_к = n_к(h_р - 0{,}5 H_к)$. A small-transferable water store is equal $h_р(\theta_о - \theta_{кр})$, so for calculation of rationale irrigation rate may by used the formulae:

$$m_р^* = 50 h_р^* [n_к h_р^* / H_к + 2(\theta_о - \theta_{кр})],\ м^3/га$$

$$m_р = 100 [n_к(h_р - 0{,}5 H_к) + h_р(\theta_о - \theta_{кр})],\ м^3/га,$$

где $h_р$ and $H_к$. in meters, $n_к$, $\theta_о$, $\theta_{кр}$ -in % totel soil volume.

For example, a deep chestnut mean-loamy soil (Engels irrigation system) will be discussed.For this soil $\theta_к$ = 30 %, $\theta_о$ = 26%, $\theta_{кр}$ =18%, $n_к$ =4%, $H_к$ = 0,9 m For $h_р$ = 0,3- 0,5 - 0,7 - 0,9 m accordingly **m** = 360 - 600 - 840 - 1080 $м^3$/ ha and $m_р$ = 260 - 455 - 670 - 900 $м^3$/ ra.

As a result of the field studes of a soil water balance earlier the suggestion was done (Juchenkov K.K., Koliasev F.E., 1954) for m_α calculatios taking $\alpha\theta_к$ with α = 0,8. In our case, equalizing $m_р = m_\alpha$ we would received for $h_р$ = 0,3 - 0,5 - 0,7 - 0,9 m accordingly α= 0,76 - 0,77 - 0,79 - 0,80, i.e. α -values are increasing with increasing $h_р / H_к$-ratio.

As summary: for a calculation of a rationale irrigation rate is necessarily beside $\theta_к$ и $\theta_{кр}$ to use two hydrophysical parameter - $\theta_о$ and $H_к$. For their determining we recommend to use laboratory tests results of capillary moisturing of dry soil (monolith-method) for $H_к$ and a drying by capillarimeter-method at 0,85 atm vacuum for $\theta_о$.

PROBLEMS OF WATER USE WITH THE CALCULATION OF WATER QUALITY AND ECOLOGICAL RISK DURING THE LAND IRRIGATION

Mamedov A.I., Ismailov A.I. and Mikailov F.D.
Institute of Soil Science and Agrochemistry, Baku, Azerbaijan

Intensive agricultural development of Mil-Karabakh steppers economical region was accompanying with the deficit of water resource, changing for the worse of the quantity of irrigation water, intensification of migration of salt and pollutants from irrigated territory to irrigation systems, also influence of irrigation on dynamics and chemistry ofb soil resource and the indicated facts is required the analysis of present position and conducted investigation works on study and predicting these processes.

Therefore arise the necessity to scientific base the methods of mark of use and quantity of water resource, with the point of ecological consequence. It was revealed that in this region of Republic the indicated problems are stipulate for the following difficulty:

The principal difficulty:

1) the insufficient quality of dates of nature observation, absence of regular control net;

2) the weak study of mechanism of effect nature and productive factors;

3) the absence concrete fasten separate indexes for all of the regions (with the point of ecology, economy and water use):

4) the absence of analogies containing if only a few uninterrupted dates on concrete indexes;

5) total effect of different parameters on water quality;

6) a low level of mathematical and technical security, collection treatment of dates.

The required parameters:

1) the separate means of indexes forming the water quality;

2) total flow or throw of matter;

3)mark the initial quality surrour.ding and its changing;

4) mark, the practically and expected economical damage;

5) hydrochemical information;

6) management the factors (together and separate) in dependence of aim;

7) regional mark of effective water use;

8) solution the problem of optimization;

9) the select and identify of possible analysis of defined systems.

Conclusion: The proposed approach base on apply processes of probability character, which taking place in the soils, water and in the other surroundings. The law of accidental function of change and spreading allows to define the admitting limit of indexes and to realize the control for its change. At the same time the exit the principal indexes out of established limit mean the level of ecological risk. Here take into view the following characteristic:

1) selecting the principal indexes and its elements;

2) marking the top and lower limit of indexes change;

3) predicting the limit of change of every indexes (separate or together);

4) revealing ecological decline in the quantity of water and soil and so on.

Using the dates of different scientific Institutes and organization found in Republic which have connection with the water problem and problem of land irrigation we conducted the statistical analysis of the example indicated region. In the results of it was established the probability function of salt accumulation and in the irrigated water with the calculation of its admitting limit (the criteria of ecological safety) and it was revealed that the probability of change of ecological indexes in base is submit the law of normal and lognormal distribution. When revealing the dominant indexes it was made spruces:

1) the aim of criteria of risk;

2) factors influencing on dominant indexes;

3) independence these indexes from dominants.

PROBLEMS OF TRANSBOUNDARY WATER WAYS AND METHODS OF THEIR ENVIRONMENTAL AND ECONOMIC SOLUTION

Mamin R.G., Koshkina V.P.
Ministry of Natural Resources of the Russian Federation, Moscow, Russia

Problems of transboundary water ways are typical for ecological safety of neighbour countries (China, Mongolia, Finland, the Ukraine, Kazakhstan) as well as for development and implementation of conservation programs and projects between subjects of Russian Federation.

This situation is especially actual for Moscow which territory accumulates water from Tverskaya, Smolenskaya, and Moskovskaya regions and which wastewaters is being diverted to Moskovskaya region reservoirs. The following table represents the pollution volume received by water objects of the neighbouring Subjects of Russian Federation from the biggest megapolice of the country.

Table 1. Volume of pollutants in the effluents from Moscow economic units in 1992 - 1996

Ingredient	Volume of pollutants, thousand tons/year				
	1992	1993	1994	1995	1996
Suspension	27.70	24.01	24.61	24.03	23.13
BOD	17.58	23.66	23.40	22.66	22.14
Petroleum products	2.34	2.12	1.68	1.56	0.66
iron	0.66	0.55	0.56	0.57	0.76
copper	0.10	0.06	0.05	0.06	0.046
nitrates	10.75	24.21	20.85	51.50	63.61

For determination of the rate of damage caused by the semi-treated wastewaters in transboundary streams the methods of environmental economics should be used. These methods are put into practice in Russian Federation since early 90-s. In principle it is achieved through the determination of pollution charge for environmental pollution with wastewater. According to basic charge standards, which are confirmed by the Ministry of Environmental Protection and Natural Resources of the Russian Federation, the Ministry of Finances of the Russian Federation, the Ministry of Economy of the Russian Federation. The environment damage to water objects (even without coefficient of indexation) in the prices of 1991 would reach huge sums within permissible standards.

Table 2. Damage of effluents from Moscow economic units in 1996 in the prices of 1991.

Ingredients	Volume, thousand tons/year	Charge standard, rouble/ton	Damage standard, million roubles	Damage within permissible limits, million roubles
Suspension	23.13	2950	68.20	341.15
BOD	22.14	730	16.15	80.80
Petroleum products	0.66	44350	29.27	146.35
iron	0.76	22175	16.85	84.25
copper	0.046	2217500	102.00	510.00
nitrates	63.61	245	15.58	77.90

Taking into consideration that effluents are being self-purified within the Moscow area on crossing the border of the Subject of Russian Federation by the stream it is needed to carry out the monitoring in boundary points supplemented with hydrochemical indicators.

The methodological scheme can be used to settle relations between Moskovskaya and Ryazanskaya regions in Oka water basin, between Vladimirskaya and Yaroslavskaya regions in Volga water basin.

The calculation and determination of environmental and economic damage between administrative-territorial units is not the final task. This method gives an opportunity to watch the transformation of pollutants flows, to correct amount of investments in environmental projects or provide measures of ecological safety.

FISH-ZOOPLANKTON INTERACTION: IMPLICATIONS FOR LAKE WATER QUALITY MANAGEMENT

Manatunge J., Asaeda T.
Dept. of Civil & Environmental Engineering, Saitama University, Shimo-okubo, Urawa-shi, Saitama, Japan

The water quality in lake ecosystems may be to a great extent controlled by biotic factors. A number of studies show the effect of food web manipulation as a measure for water quality management ('biomanipulation'). Interaction between trophic levels has drawn much attention since eutrophication and the resulting phytoplankton blooms has become a worldwide problem. Freshwater phytoplankton assemblages are influenced greatly by the concentration of nutrients and the complex relationship between algae and herbivorous zooplankton, which in turn can be influenced by both invertebrate predators and fish. However, less attention has been paid so far to predict the predation rate of planktivores, which could be used in mathematical models analyzing the trophic interrelationships. Therefore, a simple but a detailed foraging model that calculates the feeding rates of planktivores is formulated in order get a better insight into cascading trophic interactions and to understand the mechanism of how the large bodied zooplankton are selectively eliminated by visually feeding planktivores. Selective predation of fish will favor phytoplankton growth because of the elimination of most efficient feeders on algae.

Planktivorous fish feed almost exclusively on zooplankton throughout their life, and feeding is directed by vision. Even large predatory fish are planktivorous at juvenile stages and rely on visual ability for foraging. Low light intensities decrease the feeding rates of visual predators by reducing their ability to detect prey. Therefore, it is obvious that light and turbidity play a major role in food web dynamics and trophic ecology in water bodies. The reactive distance that is the maximum distance at which a fish reacts to a prey item, depends on light level and water clarity, apart from prey and predator characteristics. In addition, fish can detect a prey item only if the relative contrast of the prey with the background exceeds predator's visual threshold. The underwater light, together with beam attenuation characteristics of water is determined by turbidity levels, which directly affect the relative contrast of the prey. However, macrophyte (submerged and emergent) presence too, causes light to extinct exponentially with depth within the canopy. The model calculates the visual field of a planktivore with all these factors being taken into consideration. Further, the model investigates and compares how the visual field of several types of planktivorous fish diminishes with decreasing light regime and water clarity.

In addition, the encounter rate of prey with a fish is predicted by the model. Fish typically do not attack all the prey encountered. The fish may exercise active choice in prey selection and choose an optimal range of prey from encountered food to maximize benefits per unit foraging time. Therefore, to predict the range of prey sizes eaten and maximize energetic intake for a given fish, optimal foraging considerations are incorporated within the foraging model. Further, The feeding activity of planktivores is analyzed in detail to calculate the total time (search time, attack time, prey handling time) involved in foraging. The energetic costs involved and the time for each activity is necessary to determine the optimal choice of the prey and finally to calculate the feeding rate of the predator. The prey vulnerability of selected prey is then calculated by the model.

Zooplankton are not evenly distributed in aquatic environments, but are commonly found in patches. Patchiness may have a large effect on fish-zooplankton encounter rates and therefore, the model is applied to analyze several prey patchiness scenarios to investigate how it affects foraging rates. Finally, feeding rates depending on environmental, prey and predator parameters are predicted using the model.

ASPECTS ON THE EVOLUTION OF THE WATER QUALITY IN ROMANIA

Mara L.
Ministry of Waters, Forests and Environmental Protection, Bucharest, Romania

The water resource, part of the national wealth and a natural resource together with the land fund, the forestry fund, the useful minerals reserves, the terrestrial and aquatic fauna and flora, represents a vital factor of the socio-economical development. Different from other natural resources which become scarce in time, the water is a renewable resource, being subjected to a continuous refreshing process, following the natural cycle which ensures its continuity.

Water resource management creates opportunities and possibilities for economic user functions, in order to reduce the

vulnerability of ecosystem and to increase the available environmental utilization space in water resource management.

The ongoing transformations of the country's political and economical system are changing in a fundamental way the attitude and policy regarding the water management and environment.

Romania's water resources are relatively poor and unequally distributed in time and space, being formed of surface waters - inland rivers, lakes and reservoirs, the Danube River and, of ground waters.

The discharge into the natural receivers, especially that of the large industrial platforms, of the non-treated waste waters or insufficiently treated, makes that the length of the degraded water courses which can not be used for other purposes without high cost treatments to be of more than 4,000 km,taking into account the provision of STAS 4706/1988, and of these in the II-nd and III-rd quality category, which can not be used as drinking water source to be of more than 7,500 km

With respect to the Danube River, the very high water flow ensures such a dilution of the received waste waters that the global quality of the water is included within the I-st and II-nd quality category limits. Even under these conditions the water supply for the riparian towns is affected, the treated water exceeding the admissible limits of potability in the case of certain parameters (ammonia, organic matters content, etc.)

The comparative analyses of the ground waters quality dynamics has pointed out an accentuated depreciation of these resources quality both from the point of view of the spatial extension of the affected areas and, of the phenomena intensity in the main pollution areas. It may be mentioned that there are many interest areas with respect to the ground water reserves, which had been more or less affected by the increase of the polluting parameters concentration.

As a consequence, these can not be directly used as drinking water, requiring necessary measures of adequate treatment from case to case.

The main causes of the water resources quality global deterioration may be synthetized as it follows:

- the development of certain gigantic industrial and zootechnical objectives;
- the keeping up and promotion of certain high polluting production technologies which in the developed countries had already been abandoned (i.e. pulp production through the sulphite process , soda production through the Solvay process);
- the rapid growth of the scattered pollution share, especially caused by the irrational use of fertilizers and pesticides in agriculture;
- the non-correlation between the production capacities growth and the urban development by the modernization of sewage works and, by the achievement of treatment plants;
- the inadequate operation of the existing treatment plants (low fiability constructions and installations, insufficient reagents, reduced energy shares, insufficient and non trained operational personnel);
- the lack of an organized collecting, storage and management system, especially for the mining, industrial and domestic wastes and for the sludge resulted from waste waters treatment, including the recovery of the useful substances.

To all these, there could be also added the fact that although the Water Law No. 8/1974 is very clear with respect to water pollution prohibition, the lack of certain efficient economico-financial measures which should determine the increase of the concerns for rational management and water quality protection made it inoperative in certain cases. Thus, although in 1980, the Government had approved a program concerning the development or the improvement of waste water treatment plants and installations for the 1981-1990 period in order to increase the treatment capacity to the level of the discharged waste waters, water quality protection measures by developing treatment plants for all the water users and, installations for useful substances recovery from waste waters and sludge; promotion of less waste waters discharged from the municipal treatment plants and from zootechny in the irrigation systems. Practically, its provisions had not been achieved but partially due to the lack of financial resources.

In the present, the activity in the field of water management is based on the new Water Law no. 107/1996 that establishes the way of knowing, turning into good account, conservation and protection of the water resources by maintaining the ecological balance, legislates the application of the economical key factors system in the water management and the large participation of the users in the decisional activity in the field of the water management planning on hydrographical basins.

GLOBAL AND REGIONAL PROBLEMS OF LARGE WATER RESERVOIRS INFLUENCE ON NATURE AND ECONOMY

Matarzin Yu.M., Devyatkova T.P.
Perm State University, Perm, Russia

Large water reservoirs, their systems in river basins have been being one of the leading factors of the environment and almost all spheres of the human activity changes for last 50 years in many countries. According to A.B. Avakyan's analysis about 60 thnd large water reservoirs have been constructed during these years, their total volume is over 6 thnd km^3. The submerging area (excluding lakes) is over 500 thnd km^2. It is necessary to include the territories adjoined the water body perimeter with the total area of 700-800 thnd km^2 where soils, flora and fauna have changed, hydrological, engineering-geological and climatic conditions have changed as well. The infrastructure of territories has changed at the area of 1.5 mln km^2 approximately. Unfortunately even today many problems concerning water reservoirs construction are not solved. These problems should be solved in different aspects: global, continental, national and

regional (basin). Let's consider the former and latter aspects as they are most important.

The global aspect is the water reservoir influence on the flow process (liquid, solid, thermal and biogenic flow) in our planet. The water balance and water-exchange at all continents have changed. The duration of water location at the land has increased in 5 times in average (Europe - in 7 times, Asia - 14 times; Africa - in 6.4 times; the North America - in 1.1; South America - 1.1; Austria - 4.1). In Russia it has increased in 4 times and in the Volga basin - in 8 times. These consequences are irreversible.

The regional aspect can be considered in relation to the big regions, basins and individual large water reservoirs. The latter are studied by many specialists of various spheres. In spite of this fact the large water reservoirs have not been studied completely by virtue of their complexity and contradictoriness. Studying them the hydrological specific character, regularities of the formation and genetic peculiarities of the objects (river, lake, lake-river, in the artificial hollows and beds, sea, underground objects) are taken into account insufficiently. The hydrological specific character includes the following: 1) water reservoirs are the azonal bodies that form "instantly"; 2) their parameters and regime are designed in advance and determined by the complex interaction of natural and anthropogenic factors; 3) intra-reservoir processes (hydrodynamic, hydrophysical, hydrobiological, etc.) change and develop in a new fashion in the water body formed; 4) the regime designed can change many times during the maintenance; 5) water reservoirs disturb the natural balance, affect the climatic conditions, underground water regime, cause the underflooding, swamping, evolution of soil and vegetation, stir up the exogenous geological processes, etc.; 6) each water reservoir is the individuality; 7) hydrological processes and extent of the environment impact in different parts of the same water body (regions, areas, zones) are unequal.

The peculiarities of water bodies formation follow from the above-mentioned provisions; the assessments of the environment impact at different formation stages are various. The areas adjoined the water reservoir are equal to the areas of its water table.

All above-mentioned provisions should be taken into account under the design, construction and maintenance of water reservoirs and elaboration of measures intended for the water protection as well. The methods worked out in the Perm State University enable to combine it with the quantitative assessment and subject to the whole complex of processes and phenomena.

ON PROGRESS IN IMPLEMENTING TARGET FEDERAL PROGRAMME "REVIVAL OF THE VOLGA"

Mikheyev N.N.
Ministry of Natural Resources of RF, Moscow, Russia
Naidenko V.V.
State Architectural and Building University, N.Novgorod, Russia
Khublaryan M.G.
Russia, Institute of Water Problems of RAS, Moscow, Russia

In November 1996 the Government of the Russian Federation approved priority measures of the Target Federal Programme "Rehabilitation of Environmental Situation on the Volga River and its Tributaries, Restoration and Degradation Prevention of Natural Complexes of the Volga Basin" ("Revival of the Volga"). The Programme was developed for the period of 1996-2010.

The Governmental Expertise and the Goverment have highly estimated the Programme conception and its content.

The principle objectives of the Programme are: improvement of environmental situation and conservation of natural complexes of the Volga Basin in order to provide favourable conditions for vital activities of the present and future generations of the country's population; transition of the region to sustainable development integrated with biological capabilities of the environment through gradual switching from resource-wasting and power intesive technoligies in economic activities of today to power and resource-saving low-waste technologies and closed-loop production cycles.

It is the first federal socio-economic programme developed in the Russian Federation which is based on the river-basin principle in resolving its main tasks. The programme has been developed with allowance made for the international experience in resolving ecological problems of major river basins and large regions, including the Great Lakes (USA), the Rhine River basin.

The main features of the Programme are integrated solution of environmental problems, i.e. creating the legal, normative basis, economic mechanism for realization of the programme; rational use and protection of water resources (providing population with quality drinking water, treatment of municipal, industrial wastes and surface run-off, optimization of river reservior operation, management of the Volga Kama cascade of hydroelectric stations, bank protection, engineering development of water protection zones, cleaning out bed sediments in reservoirs, engineering protection of areas against water logging and flooding, etc.); environmentally safe industrial and agricultural production, power generation and transport operation; rehabilitation of ecological situation in towns and cities; forestry, specially protected natural areas , flora and fauna; creating favourable environmental conditions for development of fisheries; processing domestic and industrial solid wastes; creating a

basin-wide system of environmental monitoring, continuous ecological upbringing and education, personnel training and professional upgrading; **Through consideration of ecological problems on the federal, basin-wide, industrial and territorial (republics, administrative regions), municipal levels and on the level of economic entities; the Programme incorporates 38 subprogrammes developed by the subjects of the Russian Federation following a unified conception;** the Program is integrated in the system of measures approved by the Government of the Russian Federation for providing further socio-economic development of the country and is tied up with other target federal programmes and state scientific and technological programmes implemented in the area of the Volga Basin.

The priority measures under the Programme (1996-1998) envisage elaboration of the legal and economic mechanisms for its realization . Lately, the ministries, departments and organizations, which developed the Programme, administrations of the subjects of the Russian Federation located in the area of the Volga basin have prepared and submitted for consideration by the DUMA 11 bills, 8 of which have been approved by the President of the RF and the Federal Assembly, including Water Code of the RF, Law of the RF "On Ecological Expertise", Law of the RF "On fauna", Law of the RF "On Specially Protected Natural Areas", etc. Major work has been carried out for the last two years in creating economic mechanism for realization of the Programme, including passing the laws by the subjects of the Russian Federation accompanied by approving packages of normative acts and regulations on water use tax, payment for restoration and protection of water resources, licenced use of water resources, ecological insurance, preferential credits, using resources of the regional ecological funds for environmental protection and rational nature management.

In the area of rational use and protection of water resources large volumes of work have been fulfilled in providing high quality public water supply, industrial hazardous wastewater treatment, treatment and utilization of sludges from municipal wastewater treatment plants, identification of principal sources of water pollution in the Volga basin , specifying measures for reducing and elimination of pollution.

In the area of environmentally safe industrial production main attention is paid to the problem of power and resource saving, technological re-equipment or liquidation of production processes responsible for toxic pollution of the environment.

For the last two years a number of towns in the Volga basin have switched motor transport , partially or completely, to unleaded pertol (Moscow, St.Petersburg, N.Novgorod).

In the area of rehabilitation of environmental situation in the towns large volumes of work have been carried out in developing master plans for urgan development with allowence made for the real environmental situation , causes of diseases among the population; measures have been taken for ecological rehabilitation of the town territories through the urban development methods. Considerable reduction in air pollution in 12 major cities of the Volga basin have been achieved through switching to gas-fired genegrators at the heat and power plants (Moscow, N.Novgorod, Samara, Yaroslavl, Kazan, Ufa, etc).

Of great importance in successful implementation of the Programme is ecological education, personnel training and re-training. Actually all subjects of the Russian Federation located in the area have systems of continuous ecological education. In the last 2 years they have developed methodological provisions for these systems, published 250 instruction manuals and teaching aids for pre-school institutions, secondary schools, colleges, universities, production organizations, administration bodies at various levels.

Work is being carred on in continuous improvement of environmental monitoring systems for the Volga basin. The success in this field have been achieved mainly due to productive work of the subjects of the Russian Federation (Moscow, St.Petersburg, Moscow region; Samara, Sverdlovsk, N.Novgorod, Astrakhan regions; Tatar and Bashkortostan republics, etc.)

The progress in implementing the Target Federal Programme has been impeded by the lack of capital investments from the federal budget.

Practical implementation of priority measures has mostly beed achieved through using the resources from the budgets of the Federation subjects and those of economic entities.

THE MAIN FACTORS OF FORMATION OF THE BOTTOM NATURAL COMPLEXES AT THE SHOALS AND THEIR DYNAMICS UNDER THE ANTHROPOGENIC IMPACT

Mitina N.N.
Water Problems Institute Russian Academy of Sciences, Moscow Russia

Sea shoals are the zones of maximum anthropogenic influence even at undeveloped coasts with sparse population. In this case, shoals are polluted by rivers whose influence on a sea shoal. Similar situation is observed at the mouths of the rivers flowing into the Sea of Japan in the Far East coastal region between the Nerpa and Oprichnik bays. This 60-km-long section at depths of 0 to 40 m was selected in order to compare the main factors of formation and dynamics of undisturbed and anthropogenically polluted bottom natural complexes (BNC) in the mouth regions of the rivers flowing into the sea.

The coastal line of the shoal under study runs along the mountain range oriented mostly northeast, which, smoothly winding, forms several bays confined to river mouths. Eleven streams with a low-water discharge of 0.012 to 6.11 m^3/s flow into the shoal studied. The anthropogenic influence is

maximum in the mouth regions of the Rudnaya and Kamenka rivers with low-water discharges of 5.76 and 6.11 m^3/s, respectively, whose catchment areas include mining works for enrichment of polimetallic ores.

This work has been performed on the basis of treatment of field and fund data of the Complex Eastern Expedition of Moscow State University. The detailed landscape map of the coastal zone studied was compiled on the basis of the data collected and the technique for BNC classification developed (Mitina, 1993). At the same time, the main problem of complex zoning and mapping, including the isolation of uniform territories or water areas with a clearly defined anthropogenic effect was solved. The data obtained were processed with the use of a factor analysis based upon the method of basic components (Braverman and Muchnik, 1983).

A number of difficulties exists during the description of the complex environmental state of any natural feature: the necessity for numerous long-term and continuously measured parameters and the high accuracy of measurements required. To overcome these difficulties, it is necessary to select such indicators, which characterize the state of a corresponding landscape component with respect to its main function. At such an approach, we consider a complex index state rather than numerous parameters. The technique of such an approach is most completely presented in the Solntsev's concept of landscape-forming components (Solntsev, 1948): the state and measurement of any natural complex depend on the state and measurement of landscape components. It is possible to select the variables, characterizing the integral ecosystem state, by one of the physiological components of a natural complex. Such an approach makes it possible to obtain the most general integral parameter (Pegov, 1992).

In this connection, we have constructed three matrices of the variables, characterizing all investigated shoal, noncontaminated and contaminated regions, in order to quantitatively substantiate structural changes in BNC components under the anthropogenic impact. The parameters measured, characterizing the properties of BNC components in the mouth regions, include:

(x1) The deflection of the coastal line (in degrees) characterizing the configuration and geomorphological structure of the coast. (x2) The arithmetic mean size of the predominant fraction of sediments coming from a coast (in mm). This variable characterizes the composition of sediments and the product of abrasion of a bedrock coast. (x3) The water discharge of streams flowing into the shoal area under study during the low-water period (in m^3/s). This parameter characterizes the hydrological regime of a surface water. (x4) The depth of an observation point (in m) characterizes the bottom topography, because we know the depth intervals of different genetic forms of topography determined in combination with soil mechanical composition. (x5) mechanical composition of soil (in mm). (x6) The projective covering of the bottom with coquina sediments (in %) characterizes the composition of soil. (x7) The bottom velocity of the total component of drift-gradient currents (in m/s) characterizes the hydrodynamic component of the coastal zone. (x8) The bottom water temperature (in °C) characterizes the hydrological regime of a shallow-water zone and is the indirect derivative of temperature stratification of the entire water body. (x9) The salinity of the surface water (in %) characterizes the hydrochemical and, partially, hydrological regimes of a water body.

Thus, the variables analyzed describe the integral properties of BNC components and characterize the entire complex of abiotic landscape components in the mouth regions, namely: geological-geomorphological, lithological, and hydroclimatic components. At the same time, the variables, characterizing the distribution and characteristics of alga communities and zoobenthos, are not considered. Thus, we consider the so-called environmental factors, i.e., the environmental elements responsible for living conditions of organisms (*Chetyrekhyazychnyi...*, 1980). makes it possible to distinguish the main components (general factors) of formation and dynamics of the anthropogenically polluted and background mouth regions, as well as to assess a factor significance.

While analyzing the shoal under study, we have distinguished three main factors with a total variation of the parameters studied accounting for 72.7%. Thus, we have three substantial characteristics of coastal BNC mainly responsible for the basic features of their operation and dynamics. The factors distinguished are interrelated but unequal. Factor A, which is the most significant in a factor matrix (35.3% variation), is the largest. Factor B (22.6% variation) is an intermediate and binding link between factors A and C (14.8% variation).Factor A (variables X1, X2, X7, and X9 have the highest load on this factor) characterizes hydrodydnamic and hydrochemical features of a water body at various geological and geomorphological types of coasts. Factor B (with the highest contribution of variables X4 and X8) characterizes the hydrological regime at shoals. Factor C (with the highest contribution of variables X3 and X6) characterizes the hydrological conditions of existence of mass macrozoobenthos species.

The names of the factors are the same, but factor A has become less significant than factor B, when we analyzed the factors responsible for the functioning and dynamics of background shoal areas in comparison with the entire region under study. The change in the significance of factors A and B probably means that the state of their hydrochemical and hydrodynamic features at background shoal areas are no so substantial than in the entire region, which includes the areas of local anthropogenic stresses. At the same time, the general structure of the factors governing the state of the water area has remained mainly unchanged. This indicates that the general state of the water area is rather stable, and only small, local, anthropogenically polluted areas exist.

Under the conditions of anthropogenic pollution, the factors of coast formation has become separated. Factor D, which has high final loads of parameters X1, X2, and X3 and is responsible for the formation of coastal conditions, has separated first of all. Factors C and E (variables X6 and X7 has the maximum load on factor E) has become dependent only on the BNC components formed by the sea. Under the anthropogenic pollution of shoals by rivers, the chain of interrelated factors, responsible for the structure and dynamics of coastal BNC, has become different from noncontaminated BNC. The functional relations between coastal and marine natural conditions have been destroyed due to the

unfavorable environmental state of catchment areas. The environmental factors of coastal zone formation have become isolated. The factors, characterizing the stability of aquatic ecosystems in mouth regions, have become interdependent only of marine BNC components. The combination of interdependent variables characterizing the sea and coast is not observed during the formation of the environmental factors. At the same time, factor B has remained unchanged, being an analog of factor A for noncontaminated regions, but it slightly has lost its significance, because it is the only factor that has been formed by variables, characterizing only the marine ecosystem component, regardless of the environmental conditions. On the other hand, the remained analog of one of the factors indicates that the ecosystem has been incompletely reconstructed under the anthropogenic influence. It still includes the background elements. Consequently, the anthropogenic impact is not disastrous in the case considered.

On the whole, the functioning of the aquatic ecosystems is changed under the anthropogenic influence. The loads in a factor matrix and, consequently, the loads on the submarine landscape components are changed. This is due to a selfregulating capacity of the aquatic ecosystem tending to sustain its stability.

In combination with the additional studies, the methodical approach proposed makes it possible to substantiate the forecast estimates of variation in BNC components at mouths of rivers flowing into seas under different anthropogenic impacts and to establish the threshold values of reformation of the environmental factors of functioning and dynamics of the aquatic ecosystems at river mouths under an anthropogenic influence.

IMPROVEMENT OF HYDRAULIC REGIME OF THE LAKE BAIKAL WITH ACCOUNT OF ECOLOGICAL DEMANDS

Molotov V.S.
Water Managing Committee of the Republic of Buryatia, Russia

With the construction of Irkutsk hydroelectric power development the lake Baikal's level increased on an average for 1 meter, that resulted in increase of the amplitude and change of regime of level's fluctuation.

Under natural conditions water increase was on an average in June and decreased in February. The largest water consumption from the lake was in October, the smallest in February. At regulated regime Baikal keeps hydraulic inertia between incoming and outgoing parts of the lake's water balance, but because of regulating role of Irkutsk hydroelectric power development the inertia period somewhat increases, which is connected with the time of maximal electric power consumption in cold seasons. The character of seasonal fluctuations of Baikal levels in projected regime is practically like natural but 1 meter higher.

In both cases seasonal increase of the lake level begins in May annually, when influx of water to the lake exceeds guaranteed inlet to the low bjef of the development. Lake level reaches its maximum in September. As a rule, setting of level between high and low bjef continues from October until April.

Change of Baikal's level is of a different character when Irkutsk hydroelectric power development works under regime, regulated by «The main rules of water resources usage of Angarsk hydroelectric station's reservoirs» (1988). The Rules changed the time of maximal increase and decrease of water level in the lake.

The analysis of all information on Baikal problems shows that the change of the level regime became the main factor of Irkutsk hydroelectric station's negative influence on ecological system of the lake, surrounding environment and the cost productivity.

That is why, at exploitation of hydroelectric power development spring minimum should fall on the end of April and autumn maximum should not exceed the third decade of September at the amplitude of water level fluctuation no more than 80 cm.

From the above reasoning it is ecologically necessary to bring seasonal fluctuations of water level to natural at its maximum.

With this aim there has been worked out a mathematics model, which describes the regime of Baikal water resources regulation brought to natural. It means that maximal harmony of annual water level fluctuations with natural fluctuations can be reached at maximal decrease of dam's support influence on passing capacity of Angara river root. In this case the balance between useful influx to the lake and water outgoing from it will be practically restored, which will lead to natural cycles restoration filling and setting of balance between upper and low bjefs of Baikal. The calculations are made by water-balance method by 91-year hydrological series. By this model practical transfer to the suggested regime can be made in the end of shallow period, when useful volume of Baikal will be set up in natural way, without increasing of water consumption in Angara in winter. And Bratsk reservoir will manage the regulation of Angara flow and Enisey hydroelectric stations capacity.

The results of calculations of Baikal water resources regulation by this model take into consideration modern demands to the use of Irkutsk reservoir: guaranteed water consumption for providing public utilities and industrial water-supply (1300 m3/sec), water transport (1500 m3/sec) and power of Angarsk hydroelectric station series. Agreed managing rules are worked out as applied to these demands, which reflect principles of regulation of useful influx to the lake and they let to appreciate their expediency.

PROVISIONS FOR NUMERICAL MODELLING OF THE VOLGA-KAMA HYDROPOWER FACILITY CASCADE

Naidenko V.V., Sobol S.V.
N.Novgorod State University of Architecture and Civil Engineering, N.Novgorod, Russia
Rumyantsev I.S.
Moscow State University of Nature Management, Moscow, Russia

The Volga and Kama rivers have been regulated by a cascade of eleven hydropower facilities. In modern conditions, the problem of management of the cascade in the interests of satisfying conflicting needs of hydropower engineering, water supply, irrigation, water transport, fishery, urban development, recreation and nature protection is of great prominence. According to the international practices the operation of such cascades is effected most rationally by means of numerical modelling techniques.

The modelling is usually based on the forecasts of the flow within a year. Timely and reliable forecasts can be obtained by means of geo-information technologies which incorporate multiparametrical mapping analysis of the flow forming factors.

At the present stage of the problem solution, the model makes use of the software package "Cascade" developed by the joint efforts of scientists from Germany, France and Russia for application to regulated rivers and cascades of hydropower facilities of a complex nature which proved to be very successful in operation of 22 hydraulic projects on the river Rhein.

The mathematical basis of the software package is represented by the system of Sen-Venan and continuity equations. The model reproduces non-stationary processes in the river beds and in reservoirs in one- and two-dimentional settings. The general character of the package consists in the possibility of its modular build-up following the set of practical tasks to be fulfilled and availability of some reserve for additional incorporation in the mathematical model of the branching networks of streams with all their dams, water passes, water intakes, bank protection and other hydraulic structures. The final product of the package application is a large volume of design information which can be used for optimizing the operation regimes of the cascade units, and space and time hydrological parameters of the rivers under regulation. Specifically, there is an opportunity to carry out flexible adjustment of the high-water passage and to provide the information required by the flood protection services of towns.

The stretch of the Volga river between the Gorky and Cheboksary hydropower facilities was subjected to modelling to test the application of the software package to the conditions of the Volga and Kama cascade. The paper to be presented gives the data obtained together with relevant graphical information.

The work is to be conducted in stages because of its large volume. It will ultimately result in introduction of the mathematical model into practice of managing operational regimes of the hydropower units of the Volga-Kama cascade.

DYNAMICS OF SNOW COWER POLLUTION IN KOMSOMOLSK AND BOLSHE-KHEHKTSIR NATURE RESERVES (PRIAMURJE)

Novorotskaya A.G.
Institute of Water and Ecology Problems FAB RAS, Khabarovsk, Russia

The analysis of snow cover (SC) chemical data is an effective method of indicating atmospheric pollution. Information about quantitative contamination of the environment will permit to study biota response to technogenous impact, to estimate surface water pollution in the period of spring high water. These Reserve are located right near the large industrial centres: Khabalovsk. and Komsomolsk-on-Amur, in a subzone of mixed coniferous and broad-leaved forests (30,60 km, respectively). The goal of this research is to study the degree and character of SC pollution at the protected territories, to find possible ways of putting on contaminants and their quantity. Meteorological data and chemical composition have been analysed. The study was carried out in March 1987,1990,1991 and 1997, in the period of the maximum moisture stock. The analysis of SC pollution was conducted with the help of ecological-geochemical criteria for estimating ice and water contamination (Ivanov, 1990). During observation, winters were warm, short (3-18 days) and with much snow. SC pH was closer to acid medium: for Komsomolsk Nature Reserve 5,14-6,37, the average values 5,54 in 1997, for Bolshe-Khehktsir Nature Reserve - 4,31- 5,92, 5,70 - 6,86, 5,58 - 5,90, the average values 4,87, 6,40, and 5,85 in 1990,1991,1997, respectively, the minimum was an the tops of the Bolshe-Khehktsir Ridge, except 1991, pH was lower than the permissible value. The average value of relative acidity (pH/pNH_4) was 1,2 in 1987 for Komsomolsk Nature Reserve, Bolshe-Khehktsir Nature Reserve - 1,3, 1,6, 1,4 in 1990,1991,1997, respectively, that characterizes weakly or non-contaminated areas (1,0-1,2); areas in a zone of economic development (1,4) and areas being under antropogenic impact (1,4-1,7). The maximum NH_4^+ concentration is 13 and 3 times greater than that of a background and the permissible one. Almost in all cases for Bolshe-Khehktsir Nature Reserve and in 50% cases for Komsomolsk Nature Reserve, SC NH_4^+ concentration is higher than the permissible value. By 1997, its input to the territory has been decreasing till 29,2 t that is 76% and 52% of 1990,1991 respectively. The dynamics of SO_4^{2-} concentrations is 2,16 - 3,42 - 3,85; NO_3^- 1,72-1,74-2,33mg/dm^3 in 1990,1991,1997 respectively. The maximum values of snow cover mineraliza-

tion for Bolshe-Khehktsir Nature Reserve exceed 20-40 mg/dm^3 in 1991, that are in keeping with those for Khabarovsk. The total quantity of soluble mineral substances coming from atmosphere to the territory in 1997 is reducing to 1,115 t/km per a season (75% of 1991,.but 30% greater than in 1990). As a result of economic activity, the input of these substances is 0,142 (Komsomolsk Nature Reserve), 0,431, 1,138, 0,765 t/km^2 (Bolshe-Khehktsir Nature Reserve, in 1990,1991,1997, respectively), it is 29, 55, 77 find 69%, respectively, of the total quantity of salts. The input of suspended substances in 1997 is 4,5 t/km^2. For Komsomolsk Nature Reserve, there have been determined the concentrations of microelements (Mn, Fe, Co, Ni, Zn, Pb, Cu, Cd). The distribution of microelements (excluding Fe and Mn) throughout snow cover is in accordance with their spreading in the Earth's crust. As to Zn and Fe content of snow cover, there is noted 2-3 times increase than permissible concentrations. The content of Cd, Ni, Co in snow cover is closer to that of near Khabarovsk (Komsomolsk highway). Ni in snow cover has soil genesis, and significant quantity of Pb, Zn, Cd and Mn has obviously anthropogenic nature (3,1, 19,3, 0,08, 189,1 mg/dm^3, respectively). Thus, the Reserve's territory is located in a zone of economic activity. As regards the general background of trans-border movement of contaminants from China, the role of regional and local contamination by nitrate and ammonium sulfate is dearly outlined. Their input has increased 2-2,5 times as compared with that of 1990. Due to the gradually growth of production processes and quantity of fuel incineration it should be expected the stronger impact of gas-dust outbursts on the separate elements of ecosystems.

ENVIRONMENT PROTECTION AT CONSTRUCTION OF HPS IN CONDITIONS OF ARMENIA

Oganesyan K.A.
Institute of Water Problems and Hidrotechnics, Yerevan, Armenia

In the conditions formed in Armenia the tense situation in energetics makes us to search all the possible ways of energy sources. Main sources of energy are HPS being constructed in the area of small rivers having favourable topographical and water-energetic features: considerable fall along the stream, natural regulation of the run-off, high banks of the beds and etc.

Within the limits of water discharge basins of small rivers there are formatted the main water resources of the region as well character of natural waters quality.

That's the reason that often water economy projects of energy designation are considered to have secondary and nondesirable effect of their activity on the environment.

In order to bring the Hidroenergetic construction to conformity with ecological criteria as well as to develop correcting measures on environment protection management there's been widely spread the ecological auditing based on investigation of concrete information about functioning of water system. There is given an expert estimation of possible non-favourable changes in environment, there's carried out an analysis of correspondence between the realised water-economy construction influence and tolerated ecological loadings on the concrete ecosystem, if necessary there are recommended nature protecting measures.

One of the most important decisions is the problem of ecologically founded level of extracted surface run off in the area of hidrotechnical construction. When estimating the ecologically tolerated expenditure the main purpose is to preserve of ecologically stable state of water ecosystem, in these conditions it's changes take place within the limits of natural complexes preservations and reduplication ability.

Outcoming from the highlycited conditions there have been developed methods, on the basis of which it's possible to regulate nature protecting expenditure when realising hidrotechnical construction with estimation of influence degree on the water ecosystems. Main factors are: conditions of reduplication ofhidrobionts, preservation of number and species diversity of flora, fauna, ichthyofauna population.

Ecological auditing is realised on the stage of working project development anticipating it with the purpose of making out sizes of tolerated non-damage water removal for hidroenergetic needs. That process may be continued when projecting, constructing and operating the water economy units of any designation influencing environment.

USE OF ARAKS RIVER RUN OFF AT THE BORDER SECTOR BETWEEN ARMENIA AND IRAN

Oganesyan K.A.
Scientific Research Institute of Water Problems and Hydrotechnics, Yerevan, Armenia
Sarkisyan A.M.
Institute Armhidropowerproject, Yerevan, Armenia

By the scheme it's foreseen to use the energetic potential of Araks river sector on the border sector between Armenia and Iran with total length about 40 km.

It's supposed to use that sector by two stages: Megri HPS on the territory of Armenia and Ouzhtoubi HPS on the territory of Iran.

Basin of the river Araks is typical mountainous landscape, greatly dismembered by dells of tributaries. The main tributaries are: rivers Megri, Shvamidzor, Marmarik and others, totally 27 great tributaries.

River Araks is the greatest right-shore tributary of the river Kura, it's length is 1072 km, water catchment area is

102 th.sq.km.

Natural water regime of the river Araks is greatly violated in the result of economy activity, particularly by the regulation of it's tributaries run off.

At construction of hydrotechnical unit with purpose of the Araks river sector use for energy production it's supposed to realize some water intakes into derivatives of HPS. Size of these intakes will be defined after establishment and further substraction from the sizes the run off of nature protecting expenditures foreseen for provision necessary norms of water quality, favourable water using conditions in the sections situated lower than hydrotechnical constructions, preservation of water plants and animals living activity, landscapes of environment.

BIOFILTERING AND THE SELF-PURIFICATION OF WATER BY AQUATIC ECOSYSTEMS AND ITS IMPAIRMENT UNDER EFFECT OF ANTHROPOGENIC STRESS: IMPORTANCE TO ECOLOGICAL EVALUATION OF INDUSTRIAL PROJECTS AND ECOLOGICAL MONITORING

Ostroumov S.A.
Moscow State University, Mocow, Russia
Donkin P., Staff F.
Plymouth Marine Laboratory, United Kingdom

Planktonic and benthic organisms which use filtering as a way of feeding contribute significantly to the biofiltering and purification of the sea and bodies of fresh water. Accordingly to some estimates, aquatic organism are able to filter daily 5% to 90% of the total volume of body of water (Gutelmaher, 1986). The biofiltering rate in our experiments with bivalve molluscs (mussels Mytilus edulis) was over one L/h per one mollusc of about 8 g (wet weight). As a result of this biofiltration some effects on various parameters of the aquatic ecosystems may take place, which is of importance for purification of the water (A.Yablokov, S.Ostroumov, Consevation of Living Nature and Resources, 1991, Springer-Verlag). The processes and parameters of aquatic ecosystems that are directly or indirectly controlled or regulated by the effect of water biofiltering by bivalves include the following:

(1) Maintaning the transparency of the water and removing particulate materials;

(2) Removing the cells of bacteria and algae from the water;

(3) The amount of dissolved organic matter that undergoes oxidation and determines such aquatic parmeters as biological oxygen demand (BOD);

(4) Circulation of water at the bottom layer of the aquatic system;

(5) Sedimentation of particulate material;

(6) Affecting the species abundancles in the ecosystems;

(7) Biosedimentation of particles of organic matter from the water column at the bottom and in the process, the maintenance of a certain rate of carbon flux between the atmosphere (via assimilation by photosynthesis) and the water column towards the bottom sediments, thereby decreasing the level of carbon in the atmosphere.

Various organic and inorganic pollutants can inhibit the filtration rate by bivalves (P.Donkin, In Handbook of Ecotoxicology. Vol.2. 1994, pp 321-347; Donkin et al., 1989; 1991). It has been shown in our experiments with mussels that the pollution of the water with anionic and non-ionogenic synthetic surfactants caused destabilization and decrease in water biofiltering. At the concentration of sodium dodecyl sulfate 2 mg/L the filtering rate was 55% of the control, at 4 mg/L it was 23% of the control, at 5 mg/L it was only 4% of the control (all the numbers refer to the first 30-min period of time after the start of the experiment). Using another surfactant, Triton X-100, we got analogous results. Triton X-100 represents a broadly used class of oxyethylated alkylphenols.

Since synthetic surfactants are in common use in various branches of industry, mining, energy production and municipal household and are present in the waste waters at concentrations of up to 10 g/L, they may enter aquatic systems with sewage and waste water and as a result, synthetic surfactants may affect the well-being of organisms of aquatic ecosystems (S.A.Ostroumov, Introduction to Biochemical Ecology, Moscow University press, 1986; Ostroumov, 1990, 1991). The decrease in biofiltering by aquatic organisms including bivalves, may impair the natural functioning of ecosystems and the natural purificarion of the water. Eventually it may accelerate such processes as eutrophication and the decrease in the quality of water, and the water system may loose traits important to water users.

In 1995, some new federal laws were put into effect in Russia, including the law on the ecological evaluation of the environmental impact of new projects on economic development, the Water Code of Russian Federation, the law on the conservation of the animal world. Also, the Presidental Decree On The Concept Of Transition Of Russia To Sustainable Development was issued (N 440, 1.04.1996). Our new data and analysis are contributing to the proper implementation of those documents. Therefore, the above-mentioned aspects of effects of the chemical pollution on aquatic ecosystems, including effects on bivalves and other biofilters, must be given most serious attention in the process of the ecological evaluation of the projects on economic and industrial development. The well-being of organisms-biofilters should be included into the system of the ecological monitoring of aquatic systems. (Part of this research was sponsored by The European Environmental Research Organization and The International Biospherics Group).

ECOLOGICAL ROLE OF THE SOLUBLE ORGANIC MATTER IN THE UNDERGROUND AND SOIL WATERS (BASED ON THE GEOCHEMICAL LANDSCAPE METHOD)

Perelman A.I.
Institute of Geology of Ore Deposits, Petrography, Mineralogy and Geochemistry- IGEM, Moscow, Russia
Ivanova T.K.
Museum of the Earth Science at Lomonosov Moscow State University, Moscow, Russia

The waters rich in soluble organic matter (SOM) are distributed over the landscape of tundra and taiga. Such waters are easily visually determined due to the characteristic color of "strong tea". SOM has, as rule, the fulvic acid composition.

The SOM study based on the landscape geochemistry methods. The study of fulvic waters compositions on various geochemical landscapes have shown that formation of such waters is the result of the geological structure, hydrogeological conditions, relief, climate, plant cover and also soil and other biogeochemical processes. Based on the landscape-geochemical characteristics it becomes possible to create the map of the SOM distribution.

The important geochemical feature of the fulvic waters is the formation of the soluble complexes with radionyclides and heavy metals. Such natural waters can be used in the regions of their distribution for disactivating the polluted objects. Such methods seem rather perspective as it can be applied over large territories and are economically proved.

In many regions the SOM rich waters have been used for the fresh-water supply mainly in the forest -marsh low planes of the European Russia and Western Siberia. They also occur in taiga-frozen ground landscapes of the Eastern Siberia, mainly on low planes and in mountains. Such waters greatly influence the health of the population and home animals.

Many generations of the northern native people have been drinking the SOM water. However, there problem of the " SOM and ethnogenesis" arises, based on both positive and negative factors of the water usage. Thus, to solve this problem the ideas and methods of anthropology and ethnography should be carefully correlated with the landscape geochemistry

THE PECULIARITIES OF SOIL SOLUTION MOVEMENT IN CONNECTION WITH GLOBAL CHANGES OF CLIMATE

Pervova N.E.
M.V.Lomonosov Moscow State University, Department of Soil Science, Moscow, Russia

Global climate is projected to change rapidly during the next half century as a result of alterations in the chemical composition of the atmosphere.

Considerable uncertainty exists regarding responses and feedbacks of tundra, boreal forest ecosystems to global climate change. There are also large uncertainties in our ability to project changes in the moving of soil solution from soil ground due to climate change.

The movement of water was studied during long cycles by means of the lysimeter technique.

Lysimeters of the open type were laid down in 1967, the area of each being 9 square meters the depth being 2 meters.

The lysimeters were covered with loam and taken up by different vegetation. The major part of the research is studying the peculiarities of migration of natural waters under different vegetation (depending on meteorological conditions of the year).

The long-term experiments carried out on the territory of the stationary of the Moscow State University are unique; there has been no date in scientific literature on carrying out of waters from lysimeters of 2 meters - power for last 30 years.

The data obtained as a result of the long-term observation allows to determine average seasonal indices of carrying out of natural waters from lysimeters with different vegetation.

Spruce to a great degree detains winter precipitation and in the summer months it saves up moisture, while with broadleaved the maximum of precipitation consumption is close to perennial grasses on all indices. With the age of the vegetation and increase of the period of observation the correlation between consumption and waste of moisture changes. A washing out type of water regime is typical of all spring seasons. It's extremely important to have climatic parameters for the summer months as it's the summer season determines the trends of many natural processes of the season «autumn».

Four dry summer periods have been noted during the period of observation from 1976 up to 1996, i.e. on extremely warm summer of 1972 (summer, precipitation came to about half the norm) an anomalous hot summer, of 1981); a dry summer of 1992 (July's precipitation came to only 29% of the norm) and a dry summer of 1995. This four periods make up about 15% of all the summer seasons during the observation period.

It is shown that in dry summer seasons going out of water into lysimeter receivers begins with precipitation higher than 60 mm per month. In the range of 22-60 mm lysimeters do not function.

Lysimeters didn't function under wooden vegetation in August 1992 with precipitations of 41-90 mm.

In July of 1972 in lysimeter receivers the following quantity of moisture was registered: under the perennial grasses - 3 liters, under the spruce 12 liters, in July of 1992 under spruce - 6 liters, under perennial herbs - 2 liters.

The obverved ups and downs in washing out of the soil very much effect the regime of moisture in the subsequent

autumn season. Thus, in the season of «autumn» in 1972, 1992, 1995 there was no water in lysimeters under some kinds of vegetation until the end of the year (what can be explained by the summer water deficit and its interception by vegetation in the forthcoming autumn).

During wet summer seasons of 1973, 1982, 1991 the quantity of water in the lysimeter receivers was three times higher the quantities of water in the dry summer seasons: specifically under spruce there were registered: 391 liters - in 1973, 372 liters - in 1982, 131 liters - in 1991.

According to some forecasts there will be more and more often recurrence of dry summer periods, which will considerably change the nature of moisture regime.

The results of investigations will help to find the right trend in functioning of the analyzed ecosystems.

WATER SUPPLY FORECAST FOR AGROINDUSTRIAL COMPLEX OF RUSSIA BY THE BEGINNING OF XXI CENTURY

Pogodaev A.E., Ismailov G.Kh.
All-Russian Research Institute of Hydraulic Engineering and Land Reclamation, Moscow, Russia
Demin A.P.
Water Problems Institute, Russian Academy of Sciences, Moscow, Russia

The methodical approaches to water supply forecast for the Agroindustrial Complex of Russia at a horizon of 2005 are considered. The procedure of water supply forecast for the Agroindustrial Complex includes a consequent solution of the following problems: forecast of supply of natural water sources and wetness index of the territory; assessment of changes of natural water supply and wetness index under conditions of anthropogenic impacts and possible changes of climate; assessment of condition of agricultural lands and forecast of their alteration in future; forecast of water use by the branches of Agroindustrial Complex; development of prospective water budgets with regard for quality of water resources; development of a complex of measures for stable water supply of Agroindustrial Complex and environmental conservation.

When forecasting water supply of Agroindustrial Complex, its assurance is an important parameter. Design probability of claimed requirements of Agroindustrial Complex to water resources is used as a criterion. Three indices: volume of water supplied to the user (compared with water volume, meeting standard); duration of trouble-free periods and number of trouble-free years are used as quantitative assessment of this criterion.

To assess and forecast water supply of Agroindustrial Complex of Russia there were analyzed time series of such indices as water withdrawal from natural water sources for the branches of Agroindustrial Complex; use of water resources for various purposes at a farm level, including irrigation and watering, agricultural water supply, production needs, pond fisheries, etc. The analysis, carried out for the period of 1980-1996, shows that water withdrawaal volume by 1991 for Agroindustrial Complex was relatively stable and fluctuated within 37-41 km^3/year, but began to reduce sharply during subsequent years, having reached 28 km^3 in 1996. Similar trend was observed in irrigated agriculture. Thus, for example, if the irrigated land area increased up to 6.1 million hectares prior to 1991, beginning from 1992 there was observed its reduction and in 1996 it reached 4.8 million hectares. The area of actually irrigated lands reduced more intensely. The agricultural water supply was most dynamically developed water user, the volume of water use increased there from 2 to 4 km^3/year during the period under consideration.

Forecasting of one of the main elements of water supply for the Agroindustrial Complex suggests that at a horizon of 2005 there should not be expected a sharp increase of the water use volumes, at best it may reach 26.0 km^3/year with water withdrawal of 36.2 km^3/year under irrigated land areas equaling 5.6 million hectares. In this case the volume of water for agricultural water supply (drinking and animal husbandry) will make up 3.6 km^3/year.

In case of maintaining of recently outlined unfavorable trends, total volume of water use will make up 19.4 km^3/year with water withdrawal of 28.3 km^3/year and irrigated land area of 4 million ha.

SMALL RIVERS PROTECTION AGAINST METAL COMPOUNDS OF SURFACE FLOW AND WASTE WATER

Popov A.N.
RosNIIVKh, Yekaterinburg, Russia

Surface water in the areas of mine geotechnical systems is polluted mainly by two ways: acid mine water discharge (permanent pollution) and emission of powdered fractions by air and consequent washing-out into the river (periodical, season pollutions).

As a result of mine-engineering activity the ore dispersion increases sharply, the chemically active surface of labile sulphides increases as well, besides the huge masses of sulphide ores are subjected to acidation under the formation of the depressive crater in the area of mines. All these facts cause the intensive spreading of the sulphide ores elements and the environment pollution.

The dispersion extent of ferrous and non-ferrous metals ions increases under the change of migration forms from mechanical (mineral powder) to geochemical (dump and mine waters, hydrosulphates and other solving salts) and

biogeochemical (peats, lake silts, soil, plants, animals) forms.

So the big mass of ingredients, which are dangerous for every living thing (salts of metals, sulphuric acid, arsenates, etc.), enter surface waters by the diffuse surface flow and through local systems.

The problem of protection against such the ingredients arises, especially if they enter by the surface flow and ground waters and so they cannot be transported to the treatment plants.

We propose the following way of the surface water protection against metal compounds. The basis of it is the creation of the system of various artificial wetlands (in dependence of individual situation) which allow to control only the polluted flow. Hydrobionts play the active role in this way: they regulate pH, precipitate or absorb metal compounds.

The natural experiments organised at the big models of such the systems (up to 1 ha) have revealed that it is possible to reach the extent of purification from metals (copper, iron, zink, lead, cadmium, arsenic, etc.) of waters discharged into the river so that it meets the fishery standards. The secondary pollution was fixed neither in laboratory experiments nor in the natural experiments.

It is necessary to note that the proposed systems promote the reduction of other ingredients (ammonium compounds, nitrates, nitrites, sulphates, phosphorus, organic substances, oil-products) concentration in purifying water both in summer and winter.

In winter the mechanism of the self-putification from ingredients changes, the period required for necessary result achieving increases in evidence.

ASSESSING POLLUTANTS MIGRATION IN THE RIVER BED AREA UNDER SEWER FILTRATION FROM ACCUMULATING POND

Putyrsky V.E.
Water Problems Institute, RAS, Moscow, Russia

Groundwater pollution with anthropogenic wastes is an important theoretical and practical problem. Its solution is closely connected with studying the impact of pollution concentrated sources on the environment. Storing ponds, that accumulate different fluid wastes, refer, in particular, to such sources.

In practice, great attention is paid to preliminary assessment of parameters for natural environment pollution with fluid wastes leakage from storing ponds. In this case, the analysis anthropogenic contaminants is particularly important in the river bed area of flowing reservoirs, where consequences of atmospheric pollution will be the most ecologically dangerous under pollutants penetration into the surface stream.

Peculiarities of fluid filtration from reservoirs, basing analytical methods of investigation, are examined in the works of P. Ya. Polubarinova - Kochina, N. N. Bindeman, S. F. Averyanov, Tsunker, F. M. Bochever, O. V. Golubeva. On the other hand, in the latest time to carry out water protecting measures, calculus means, aimed at geofiltration problems solution, are most actively used. In particular, numerical methods, worked out in the Laboratory for Hydrological Problems of Natural Environment Protection, Water Problems Institute of RAS, make it possible to describe more adequately from a physical point of view, the processes, accruing in the river bed area, and, primarily, those, connected with interaction between water flows in the soil - stream interface.

To solve certain problems, connected with assessing atmospheric impact of storing ponds on the environment, it is reasonable to combine analytical and numerical methods. Thus, using a numerical method, worked out by us, for studying processes of hydrodynamic interaction between flows under groundwater discharge in the open stream, the flow characteristics and aquifer depth in saturated - unsaturated soil in the storing pond area are determined. And using analytical characteristics, correlating water level in the storing pond and spreading of the welting zone under its bottom, the time is determined for polluted waste water to reach groundwater table under different hydrogeological conditions and regimes of water flows interaction in the soil - open stream surface.

Thus, theoretical basis has been created for determining whether polluted waster water reaches groundwater under its filtration from a storing pond in the river bed area of a flowing reservoir and haw much time is needed for it. Further, studied of the problem are supposed to be carried out with the aim of refining the mechanism of contaminants migration by considering the kinetics of physical and chemical sorption.

POLLUTION OF THE OKA RIVER BASIN BY METALS IN MOSCOW REGION

Rainin V.E., Yashin V.M.
All-Russian Research Institute of Hydraulic Engineering and Land Reclamation
Sergeev S.K.
CAC "SPF Analitinvest

Investigation of water quality forming in the Oka River Basin is carried out within the frames of international Russian-German scientific and research cooperation on the "Oka-Elbe" Project. The studies of water pollution by metals are implemented in Moscow region, within the basins of the Oka, Moskva, and Klyazma rivers.

The investigation of water pollution was carried out by sampling of water from above rivers (with regard for location), their tributaries, perennial springs, with subsequent

determination of concentration of pollutants in the laboratory.

To obtain representative data, each sample (1.5-2.0) was obtained by mixing of 3 - 5 samples of water taken from the source with interval of 3 - 5 minutes. Conservation of water samples for determination of metals content was carried out at sampling site.

General indices of water quality (pH, temperature, and electric conductivity) were measured, as a rule, directly in the process of sampling.

Determination of the metal content (Cr^{3+}, Fe^{3+}, Bi^{3+}, Mn^{2+}, Co^{2+}, Ni^{2+}, Cu^{2+}, Zn^{2+}, and Pb^{2+}) was made using X-ray fluoroscopic unit "INLAN RF". The procedure makes possible to determine the content of metals in solution and suspended matter. The results of studies based on the data of determinations of total content of metals in water, found in dissolvedstate and contained in suspended particles, settled on Petryanov filter, are represented below.

In the basin of the Oka River waters of the Oka River, main tributaries and randomly spring water flow along the reach from the Protva River to the Moskva River mouth, are investigated. The range of pollution of the river water by metals is varied widely. Actually metals are found in all samples in concentrations, exceeding maximum allowable concentrations for fishery water bodies. Prevailing contaminants are manganese, the excessive content of which is noted in all watercourses (Protva River - 0.276, Nara River - 0.17, Smedva River - 0.155, Oka River 0.119, Osetr River - 0.09, Kashirka River - 0.08 mg/l). Iron, copper and zinc are revealed most frequently. Maximum concentrations of iron (up to 1.5 - 2.5 mg/l) are observed during flood period.

Waters of the rivers Smedva, Lopasnya, Kireevka and small river, running through Stupino town, are specified by increased values of total index of pollution by matals. Less polluted are the waters of the Tadenka River, flowing through Prioksky Terrace Biospheric Reserve and Osetr and Kashirka Rivers.

Metals (chromium, manganese, iron, copper, zinc, cobalt, nickel, lead) are also found in spring water, but their content is within standards for domestic and drinking waters.

The investigations of water quality in the Moskva River and its tributaries are implemented along the reach from the inflow of the Pakhra River to the Moskva River mouth. Large industrial cities of Moscow Region are located within the basin.

Metals in quantities, exceeding maximum allowable concentrations from 10 to 100 times and more, are found in all analyzed samples within above-mentioned territory. Manganese is characterized by highest concentrations in this basin and in the Oka River basin (Velinka River - 0.44 mg/l, Otra River and tributaries - 0.6-1.0 mg/l, Moskva River - 0.12-0.21 mg/l).

Increaased content of iron is observed in the rivers of Velinka (3.2 mg/l), Moskva (1.2-1.5 mg/l), and Nerskaya (1.2 mg/l). In lower concentrations there can be found zinc (0.024-0.050 mg/l), cobalt ().012-0.026 mg/l), nickel (0.01-0.017 mg/l), and copper (0.005-0.012 mg/l).

The tributaries of the Moskva River - Velinka, Otra, and Nerskaya are distinguished with total pollution by metals. The highest content of metals in the Moskva River is recorded at the river reaches downstream of Voskresensk and Zhukovsky cities.

Increased content of manganese in surface waters is observed as a whole in the interfluve of the Oka and Moskva rivers.

The river waters in the Klyazma River Basin, investigated at the reach from Uchinskoe Reservoir to the city of Sobinka, are specified by highest pollution. It is explained by concentration of large industrial cities in its valley (Pushkino, Ivanteevka, Shchelkovo, Noginsk, Pavlovskii Posad, Orekhovo-Zuevo, etc.). Heavy metals, the concentrations of which exceed maximum allowable concentrations 10-50 times and more, are found practically in all samples of this basin.

Cobalt is characterized by highest concentrations and spreading. Its content in water of the Klyazma River reaches 0.3-0.4 mg/l with maximum concentrations 0.41, 0.42, 0.65, and 0.79 mg/l in the tributaries Bolshaya Dubna, Vol'ga, Vytka, and Fedotovka, respectively. Relatively small content of cobalt (0.01-0.02 mg/l) in the Klyazma River is observed along the reach from the reservoir to the mouth of the Vor' River, and in the tributaries - (Ucha, Sherna, Lavrovka, Chernogolovka, and Khodets.

Concentration of iron, revealed in all watercourses, also exceeds maximum allowable concentrations. Its concentration in water of the Klyazma River is changed from 0/2-0/3 in the place of efflux from the reservoir up to 1.1-1.3 mg/l downstream of the mouth of the Kirzhach River. Increased content of iron in the tributaries is typical for waters of the Bolshaya Dubna (1/71 mg/l), Fedotovka (2/5 mg/l), and Vyrka (5/57 mg/l) rivers.

Chromium, mainly found in suspended particles, is also contained in all samples. Its content in water of the Klyazma River and its tributaries is changed from 0.02 to 0.11 mg/l prevailing values are equal to 0.04-0.06 mg/l.

The content of manganese usually makes up 0.01 - 0.05 mg/l. Copper and zinc are noted in water of the Klyazma River and some tributaries. The concentration of zinc is varied from 0.003 to 0.13 mg/l, and copper - from 0.011 mg/l. Increased content of copper is typical for the Kirzhach River (0.015 mg/l) and Drezna River (0.033 mg/l). The content of lead for water of the Klyazma River is specified by small values (from 0.003-0.01 to 0.016-0.023 mg/l).

The reaches of the Klyazma River in the region of the cities of Shchelkovo, Noginsk, and Pavlovskii Posad are most polluted by metals. Prevailing pollutants are cobalt, iron, and chromium, less commonly - copper, zinc, and manganese. Of the Klyazma tributaries, the highest concentration of metals is observed in the Vyrka, Bolshaya Dubna, Shelovka, and Chernogolovka rivers.

It should be noted in conclusion that practically all investigated watercourses in the Oka River Basin of Moscow Region are polluted by metals. By the extent of pollution three investigated basins in the order of diminishing are arranged as follows: the Klyazma River Basin, Moskva River Basin, and the Oka River Basin. Increased content of manganese and iron is typical for waters of the basins of the Oka and Moskva rivers, and cobalt and iron for the Klyazma River Basin.

WATER AS A GLOBAL BANK OF INFORMATION AND A COMMUNICATION CHANNEL

Revo V.V.
Moscow, Russia

The emergence of water was quite reasonable and essential within the general trend of Nature evolution. This is explicable by the fact that water is probably the natural carrier of the very structural and functional originality inherent in the I type of biological memory, i.e. the memory of living matter, which according to our concept is assigned to the first level of the system-evolutionary organization of information mechanisms of the Nature (LSEO).

Within the structure of a hydrated protein molecule which is the initial universal matrix of life, each protein should be regarded as a specific key to a certain area of information stored in its universal carrier, i.e. in water (Revo, 1990). This is most pronounced in the structure and functioning of enzymes now numbering in more than 2000 of specific proteins which act as a medium of material, energy and information exchange within the living tissues. According to Emil German Fisher (1852-1919), the founder of the chemistry of natural compounds and the Nobel prise winner (1902), molecules of enzyme and substratum relate to one another as the key to the lock (1894). In this case of particular importance for the activity of enzymes is the informative role of their non-protein components, or co-factors. Among the inorganic co-factors are the ions of such metals as potassium, magnesium, calcium, iron, copper, zinc, molybdenum, as well as some anions.

There is good reason to believe that the information potential of water incorporated into the hydrate envelope of each protein macromolecule is to a large extent controlled by its quasi-cristalline spatial structure which provides for the protection of the complex itself, i.e. the protein within the hydrate envelope, and prevents the protein escape to the environment. Physical and chemical properties of water in the layer adjacent to the polar groups of macromolecules are quite different from those of the remaining mass. The same mechanism, rather developed though already transformed, could be present at the gene level, thus representing the universal property of protein and its components, or peptide links, which have been created by the Nature as the principal structure for information "reading" at all levels of the system-evolutionary organization of the living matter.

Anthropogenic impact causes a number of changes at all levels of the system organization of the living matter resulting in a variety of multi-level reactions. While disturbing the system mechanisms of the I LSEO, mainly through the deterioration of water as a component of the hydrated protein molecule, one affects all other LSEO represented by both the diversity of the biosphere and the system complexity of its inhabitants. Humans are characterized by the maximum number of subsystems which include I LSEO of different hierarchy. Therefore the resulting effects are extremely polymorphic in what refers to the transformation of all LSEO from the I to the V rank, the latter being the development of intelligence.

Water plays a vital role in material flows within the life-supporting system through the dissolution and transport of assimilation and dissimilation products. It is also important in terms of energy, for example free energy of the flowing water within living systems, and as both a global information channel and a storage of information.

Anthropogenic transformation of global flow properties of water is objectively requisite though reflected in a subjective way. At present it really brings a threat to the global biosphere.

Is there any alternative to this situation? Certainly, yes! It is first and foremost the extensive alternative, i.e. technologies including medical ones which are environmentally clean in terms of matter, energy and information. It is also the intensive alternative which is based on the high moral principles of mankind. The triumph of these principles is indubitable. V.I.Vernadsky was absolutely right in his statement that life in its biological, as well as geological senses is inexterminable.

SURFACE WATER QUALITY IN LATVIA

Rodinov V.
Institute of Biology, Salaspils, Latvia
Klavina I., Klavins M.
Department of Environmental Sciences, University of Latvia, Riga, Latvia

Surface water pollution is among problems which most directly affects human environment and thus may be regarded as an important environmental problem. Trace elements, organic xenobiotics, nutrients and natural water ingredients are among most common environmental pollutants and their occurrence in waters indicate pollution sources. The main natural sources of major water ingredients in waters are weathering of minerals. In the same time different industrial effluents and non-point pollution sources, as well as atmospheric precipitation can be sources of increased concentrations of heavy metals. So, air masses supplying acidic pollutants to Scandinavia also carry significant amounts of certain metals, which give rise to significant contamination of the terrestrial and aquatic environments in particular. However, concentrations of metals and their actual impact can be greatly modified due to interaction with different natural water ingredients. Therefore to estimate the pollution levels of waters it is essentially to determine the background concentration levels and concentrations of natural water ingredients. Surface water

chemistry have been analyzed worldwide , but there are very few publications about water chemical composition and pollution levels in waters of the Latvia.

Within this study the concentrations of cadmium, cobalt, lead, zinc, nickel, manganese and copper in major rivers and lakes of Latvia using atomic absorption spectroscopy have been determined. The ranges of concentrations of elements analyzed are (μg/l): Cd 0.01- 0.08; Co 0.01 - 0.17; Zn 1.0 - 17.75; Ni 0.09 - 1.76; Pb 0.03 - 0.29; Mn 0.50 - 13.00; Cu 0.10 - 1.50. Metal concentrations in river and lake waters were compared with water chemical composition. The mean concentrations of trace metals in inland waters of Latvia are appreciably lower than the estimated world averages for river waters and close to or lower than background values, unless regional impacts determined by local geochemistry. This may be explained by a comparatively lower level of anthropogenic load. In the same time in several places direct anthropogenic impacts are evident, regarding influences of point sources both transboundary transport impacts.

Also different processes related to pollution of surface waters in Latvia has been analyzed. At first the analysis of changes and composition of pollutant emissions in Latvia has been realized and the obtained results compared with actual composition of atmospheric precipitation and their changes in time. The water chemistry of great number of lakes and rivers has been studied and the possible impact of water chemical composition on water quality has been evaluated.

As most actual object of pollution can be regarded surface waters and their biota. The data about metal content of ~ 100 Latvian lakes are compared with their chemical composition. A survey of organochlorines in lake waters and their concentrations in fish tissues has been done. In the same water bodies the metal concentrations in macrophytes, mussels, crayfishes and fishes were determined and the metal bioaccumulation pattern has been evaluated. Regarding the high concentrations of humic substances both in lake waters, both in sediments, their binding capacity with metal ions were evaluated and the complex forming process between metals and humic substances were investigated. The dominating pathways for different metals has been evaluated stressing the impact of land-use on metal accumulation process. The metal concentrations both in waters, sediments, both in biota were compared with the same in similar objects in other water bodies and the impact of water chemistry, land-use and other natural conditions on metal accumulation pattern and fluxes has been discussed. Water biological quality in Latvia has been evaluated.

As far as a major part in rural Latvia uses water from shallow wells as a source of drinking water, the composition of water quality is of great importance. A total of 2500 water samples from drinking water shallow wells and boreholes in rural areas of Latvia were collected. The samples were analyzed for 20 parameters. Well waters in Latvia can be characterized by a high content of organic (humic) substances. Mean values for analyzed water parameters were: 0.17 mg/l NH_4, 0.016 mg/l NO_2^-, 2.90 mg/l NO_3, 0.028 mg/l PO_4, 25.53 mg/l Cl, 0.12 mg/l Fe, 7.4 pH, 784 μS/cm conductivity, 24 degrees in PtCo scale color, 7.5 mgequiv/l total hardness. Comparison with water quality criteria adopted in the USA and European Community indicate that water quality is often unsatisfactory. For example, nitrate concentrations exceed standards in nearly 20% of the surveyed wells. The main problems of drinking water quality in Latvia are associated with increased concentrations of nitrogen and organic matter, and increased mineralisation. Concentrations of most water substances are dependent on local factors, and some vary substantially between different regions of Latvia. However, concentrations of heavy metals were excessive in less than 1% of wells, indicating a minimal impact of regional industrial and transboundary pollution on well water quality in Latvia.

The conclusions related to environmental policy in Latvia and preventing of surface water pollution are presented.

TOWARDS AN ESTIMATION OF FOREST IMPACT ON VOLUME AND QUALITY OF SURFACE WATER

Roubtsov M.V., Delyugin A.A., Nikitin A.P.

The forest impact on the volume of surface waters is estimated by the discharge gradient, i.e. the changes that occur in the annual river discharge on condition that the river basins forest factor increases by 1% (ΔQ mm*%$^{-1}$). This impact is to be identified for damp zones using the observations made during a number of years on the annual river discharge with varying forest factors for the basins. ΔQ was used to determine the annual increase in the river discharge from a hectare of a forested area (W) as compared with areas void of forest: $W = 1000*\Delta Q$. The value W has been assumed as a criterion to estimate the forest impact on the water resources volumes. In the forest area of the European plain in Russia, the average annual increase in discharge on 1 ha of forest-covered area is 1190 in an excessively moistened zone and 850 m^3 in a moistened zone. In total, this increase may range between 12-33% of the total annual river discharge in the said region. One of the basic sources of water pollution are agricultural areas on which fertiliser and pesticides are used. Some of the chemicals are driven from soil to water objects by a slope (surface) discharge and drift (soil particles). Forest plantations located on the borderlines of agricultural areas and in the hydrographic network (hollows, gullies, river valleys) are in direct contact with the slope discharge, arresting drifts, pesticides and biogenic compounds (nitrates, nitrites, ammonia, phosphates, potassium compounds). We estimate the forest impact on the quality of water in consideration of the drift volume and the mass of pesticides and biogenic compounds which are annually arrested by the forest plantations (calculated on a hectare of forest-covered area of a given region) and thus cannot reach the water. The water-cleansing role of the forest is conditioned by a number of factors: plough intensity, forest factor, soil type and erosion degree, density and forest factor in the hydrographic network, slope discharge volume, doses of fertilisers and pesticides applied,, forest plantations parameters. Various combinations of these factors across the regions account for

a substantial changeability of the water-cleansing role of the forest. In the taiga zone of the European plain in Russia, one hectare of forest-covered area annually arrests the average of 0.15 kg of drifts, 0.4 kg of common nitrogen, 0.15 kg of phosphates, and 0.2 kg of K_2O, including biogenes in solution: 0.15 kg, 0.03 and 0.2 kg respectively. In southern regions with a high plough factor and a low forest factor of the areas, the water-cleansing role of the forest becomes particularly high. Thus, in the lower Volga region, the drifts arrested amount annually to the average of 6,7 m^3/ha, nitrogen 31.7 kg/ha, phosphates 16.6 kg/ha, K_2O 19.7 kg/ha, including biogenes in solution 12.8 kg/ha, 2.8 and 17.7 kg/ha respectively. The annually arrested pesticides on a hectare of forest-covered area range from 0.35 to 59.5 g.

As we move southwards from the north, the forest impart on the volume of water resources decreases whereas its water-cleansing role grows.

For the European plain areas in Russia, there have been elaborated the standards that help to estimate the impact of the forest on the volume and quality of water resources.

COMPLEX ANALYSIS OF ECOLOGICAL PROBLEMS OF VOLGA RIVER

Rozenberg G.S.
Institute of Ecology of the Volga River Basin RAS, Togliatti, Russia

The territory of the Volga River Basin (VRB) - it of 1360 thousands sq.km (8% of all Russia, 62% of a european part of Russia or almost 13% of a territory of all Europe) and includes 40 administrative units and at present sovereign states; two of them - in Kazackstan, other - in Russia).

Are created expert of a system "REGION-VOLGABAS" (for VRB as a whole), "REGION-SAMARA" (for Samara state - 53 thousands sq.km, population - more than 3,3 million the persons) and "REGION-TOGLIATTI" (for a city Тольятти - 30 кв.км, population of 700 thousands the persons), that has allowed to conduct the complex ecolog-economic analysis of these territories. Results of ecological regional of Volga River Basin and forecasts of a condition of various components of ecosystems of a region are analyzed: a condition of water resources, vegetation, dynamics of number of the population, parameters of sick-rate and death-rate, load on air and water environment, agricultural, transport, recreation of a loads and others. The analysis of costs on protection of a nature, including capital and current investments in protection of atmosphere, water and soil is conducted.

Among prime problems of improvement of a condition of a environment in regions - diffusion pollution of territories and VRB in results of a uncontrollable agricultural load.

The second problem - reduction species of variety (biodiversity) and necessity of a increase of a share of protected territories.

The third problem - growth of a level of sick-rate of the population (as children's, as adult) as a result of increased of of effects of pollution on a territory.

In Institute of Ecology of the Volga River Basin RAS (Togliatti) the appropriate recommendations, as within the framework of the Federal Programs "Revival Volga" and "Social-ecological reabilitation of Samara state", as ecological program of a city Togliatti are developed.

A CONSTRUCTIVE SYSTEMS APPROACH TO THE EVALUATION OF ECOLOGICAL STATUS OF THE VOLGA RIVER RESERVOIRS

Rozenberg G.S., Krestin S.V., Morozov V.G.
Institute of Ecology of the Volga River Basin, RAS, Togliatti

Any natural-research theory is aimed at several functions, a most importent of which being the function of accounting for (the establishment of cause-and-effect relationships) as well as of predicting the phenomena under studies in the class of systems involved. The separation of functions with regard to complex systems within the frames of at least two models brings to naught the whole discussion on the primacy of simplicity or complicacy in ecology. Simple models are sufficient for the explanation of phenomena, whereas for the ecological prediction the complexty of models is of paramount importance. Thus the role of a constructive systems approach in the development of an ecological theory mainly implies the finalization of a "whole list" of ecosystems (Multitude I) and their complex characteristics (Multitude II) and the construction of formalized relationships both between these two multitudes, and between the elements of the former for the objectives of explanation and prediction of phenomena.

It was previously shown (Brusilovsky, 1987; Rozenberg, 1988) that all-system principle of plurality of models is displayed in the availability of a large number of mathematical models for the same ecosystems and ecological phenomena. The principle of incompatibility is manifested by the fact that none of the methods performs the explanatory and prognostic functions simultaneously. The aspect of feasibility is implicitly present in all methods of modelling, and in the simulation and self-organized methods - in the possibility of overcoming the "damnation of multi-dimensionness" (a building-block principle of building the simulation models and reduction of surplus in case of self-organization). And finally, the principle of counter-intuitive behaviour of complex systems is taken into account in the self-organizating modelling in case of refusal from a subjective choice of "extrenal addition".

The expert system "REGION" is illustrated by means of the Volga river basin taken as an example.

ECOLOGICAL PROBLEMS OF THE DNESTROVSKOYE RESERVOIR — WAYS OF OVERCOMING OF THE HYDROECOLOGICAL CRISIS OF THE DELTA OF DNIESTER

Rusev N.T., Isakov M.I.
Fund "Prirodnoye Naslediye", ORAN, Ukraine

For centuries the water-swamp territories of the delta of Dniester provided highly-productive spawning-grounds and fodder areas for fishes, including migrating and fresh-water species. The territories of the delta represent the vital link between Northern ocean and Southern Africa, the series of territories, used by thousands hundreds of migrating water fowl, water-swamp territories execute a lot of hydrological and biochemical functions that are of importance for people, occupying the coastal territory of the delta; they play the important role in formation and redistribution of ground waters.

The floats of the Dniester delta perform the function of regulation of the drain and concentration of biogenic elements in the water. Today it is rather difficult to estimate the consumer properties of water-swamp territories and to quantitatively reflect them in economic parameters. But it should be done immediately.

The entering them into the lists of the Ramsar Convention testifies to the importance of water-swamp territories of the Dniester delta only on national, but also on international scale.

The fact is that the ecological condition of the Dniester basin is an emergency. The materials, constantly published in press, the international ecological conferences of 1987, 1993 and 1997 in the city of Odessa testify to it. However, still considerable and special attention is attracted to the ecological condition of the Dniester delta — the water-swamp territories of international significance, the well-being of which is directly stipulated by the regime of operation of Dnestrovsky Hydropower Complex (DHC).

The redistribution of the drain of Dniester and the total water consumption, connected with putting into operation of the DHC, was the determinative factor which has infringed the natural water regime of the delta. The water and level regimes of the delta were changed, and the problem of preservation of natural biodiversity with maintenance of the high-quality potable water supply of Odessa city, on the one hand, and the interests of water-power engineering and water consumers of the middle Dniester, on the other hand, has acquired an alternative meaning.

In the obvious form the manifestation of negative consequences of redistribution of the drain was already reflected in some species of flora and fauna. As to the quality of potable water-supply, this problem is already considered by medical specialists, to be the source and the origin of many latent chronic diseases of a person, including oncological ones. The necessity of prevention of irreversible processes of flood-lands draining, inadmissibility of the penetration of salty marine wedge to the place of potable water intake of Odessa and preservation of usual biodiversity do not require additional arguments. The total factor reflecting the above named problems, is water characteristics of the river and the level regime connected with them. The outcomes of the observations testify that since the beginning of construction of DHC there, in the lower Dniester, have taken place negative changes in the animal and vegetative world, and other occasional and irreversible modifications. The catch of fish reduced more than 2.5 times, 25 species of fish have disappeared or vanished; the birds registered in "The Red Book of Ukraine" are under the threat of vanishing, and their total number reduced 10 times.

All these modifications are connected with the ecologically unreasonable mode of operation of DHC, the design conditions of which allow for the priority of water-power engineering. Moreover, in case of construction of a Hydroaccumulating Station — Dnestrovskaya HAES, the deficit of drain and its redistribution on seasons will be changed again, that will aggravate the ecological situation even more.

The way out of the existed ecological situation is possible only with rigid observance of the optimum ecological hydroregime from the point of view of wild nature of the delta, and taking into account the interests of the nature exploitators, historically connected with the river. That is possible only with conducting systematic ecological measures. The interests of power-producing industry will be certainly infringed upon.

As far as today's Dniester is an international river, it is necessary to conduct joint (Ukraine-Moldova) complex monitoring in the delta of Dniester, including the basin of the river Kuchurgan. This problem can be solved only on the international level.

THE SYSTEM OF UNIFIED METHODS OF DIAGNOSTIC AND PROGNOSTICATION OF WATER RESOURCES AND WATER CONTENT IN ARID REGIONS

Rychko O.C.
Orenburg State University, Orenburg, Russia

The methodical system containing the prognostic and diagnostic methods, algorithms of calculation of water resources and water content of appointed micro- and mesoter-tories through establishment agrophysical, hydrometeorological and biological factors, stipulating their, is offered in the work. These factors are reserves of soil moisture, total evaporation from active surface, indexes of biophysical and phenological vegetation state and the others.

The worked out system is based on the fixed for different intraseasonal periods appropriatenesses of moisture redistribution between soil-ground, vegetation and near--earth air layer both in natural phytocenosises and in agrocenosises.

The use of present system of methods functioning in accordance with adduced block-scheme permits to make values and long-time and done early (till 6 months) prognosises of values and parameters of water balance and hydroresources elements and so agrobiophysical components influencing on them as the beginning of rated period of year-is determined on factual and prognostic facts airfoil-date of stable march of air temperature over 5°C in spring, about, sowing times or revegetation; the length of rated (interface, growing every ten days or every month) period in twenty-four hours - is given or prognosticated over coming times of vegetation phases; water resources (mm, m^3/ha) - are diagnosticated or prognosticated on facts about warm resources, maximum possible evaporation, total evaporation, rainfall, soil water reserves, water inflow from the ground water, phases of vegetation, depth of moistened soil layer, water content. (mm, m^3/ha, %%, part of unity) - is determined by means of comparison of actual or future water resources with their fixed ecologically grounded values.

BLOCK-SCHEME OF DIAGNOSTIC AND PROGNOSTICATION OF WATER RESOURCES AND WATER CONTENT TN ARID REGION

DEFINITION OF THE BEGINNING OF RATED PERIOD

CALCULATION THE LENGTH OF RATED PERIOD

CALCULATION OF WATER RESOURCES

DETERMINATION OF WATER CONTENT

Unification of represented methods consists in the next. The methods contain models for independent diagnostic and prediction use complex relatively simple and reliable rated schemes with enough for practice the accuracy of estimations, high results and considerable done early prognoses. The functioning of methodological system is based on the use of minimally enough volume of standard starting information from working observation post of hydrometeorological service ad doesn't demand an organization of additional complexes of monitoring of the necessary factors.

Introduction of the methodical system in processes of basing and planning of water-safeguard and aquicultural measures and complex of agro-hydro-phytomeliorations does possible the receipt of ecologo-economic effectiveness, that consists in optimization of water regime of arid parts, in economy (till 20%) of volum of irrigating water and in increase (on 20%) in productivity of agricultural lands requiring irrigation.

THE TECHNIQUE OF DIAGNOSTIC STRATIFIED CURRENTS ON SUSPENDED PARTICLES SIZE SPECTRA

Samolyubov B.I., Silaeva L.V.
M.V.Lomonosov Moscow State University, Chair Physics of Sea and Land Waters, Moscow, Russia

Stratified turbidity currents prorogated along slope bottom in the lakes, reservoirs and seas lead often to the development of the underwater storm, internal waves and eddy structures. The main goal of the investigations of such hydrodynamic processes influence on the bottom and surrounding waters is revealing of regularities of the suspended particles transfer by turbulent near-bottom currents taking into account action of other flows and internal waves.

The data about such processes are necessary for hydrosphere pollution prediction and current influence on the bottom relief. However, inspite of increasing interest to the density flow investigations there are still unique the realizations of the programs that includes detailed natural measurements, simulation and applied aspects elaboration.

The results of suspended particle size spectra experimental and theoretical studies are introduced in this report on the database of the turbidity currents expeditionary investigations on the mountainous Nurek reservoir. The suspended particle size spectra were registered simultaneously with measurements of current velocity and water density profiles. The analysis of these materials in complex with mathematical modeling enabled us to obtain the following:

The function of suspended particles size distribution was obtained analytically and presented as the superposition of 4 spectral components, each of them was bounded with the concrete exchange form in the turbulent flow with internal wave. As it follows from the results of measurements the additional nonstationary spectral modes that appeared in the area of rough-grain size-fractions were caused by the internal wave. The spectrum component connecting with such wave influence is described by power function. The index of this function is proportional to the vertical component of the internal wave velocity. Analysis of the particle concentration disturbances field evolution allowed to reveal nepheloid layers fluctuating in the current body under the internal wave influence. Falling down dependence of the turbulent diffusion coefficient on the particles concentration

for a main spectral mode of the particle size distribution was revealed.

The turbulent diffusion coefficient distributions for each particle size-fraction were obtained. Besides the central maximum on the diffusion coefficient profile there were found also additional maxima (in the current shear layers). These additional maxima were sometimes degenerated in the local stabilization intervals at the vertical profiles of the exchange coefficient. The turbulent diffusion coefficient profiles were in compliance with the theoretical distribution of type 'diffusive triplet'. Such theoretical function was obtained from the turbulent energy balance equation in the near-bottom density current.

The solution of the turbulent diffusion equation enabled to find the analytical form of the particle size distribution function as a sum of terms determined by gravitational sedimentation, turbulent exchange, and advective variations of current velocity and internal wave. The revealed semi-empirical expressions of these components enabled to find analytical connections of the suspended particles size spectra parameters with the averaged and turbulent characteristics of the near-bottom density current. The techniques were elaborated and verified for diagnostics of the density currents and internal wave structures on the base of the suspended particle size spectra analysis.

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EXPERIMENTAL AND THEORETICAL RESEARCH OF ADMIXTURE TRANSFER BY STRATIFIED CURRENT IN RESERVOIR

Samolyubov B.I., Silaev A.V., Zamarashkin A.L.
M.V. Lomonosov Moscow State University, Chair Physics of Sea and Land Waters, Moscow, Russia

The subject of this work is results of experimental and theoretical studying of contaminants propagation by near-bottom density flows. The dissemination of such flows in oceans, seas, lakes and reservoirs is accompanied by strong interaction with hydrosphere and lithosphere. The observation and simulation of density currents are necessary for development of forecast techniques of natural reservoirs pollution.

Experimental investigations were carried out at mountain Nurek and flat Mozhaisk reservoirs. The measurements were performed with application of special constructed equipment for structural analysis of near-bottom density flows. The vertical profiles of current velocity, water temperature and electrical conductivity were registered at the longitudinal cross-sections and at the diurnal station.

Energo- and mass-transfer mechanisms were revealing and analytical describing methods were developed on the experimental data-base analysis in density currents. It was found experimental and theoretical distributions of momentum, heat and suspended particles transfer turbulent coefficients. By comparison these distributions the vertical profiles of turbulent Schmidt Sc and Prandtl Pr numbers were obtained. Also the semi-empirical expressions of these parameters were found. It was established that the action of hydrodynamical stability on the Sc and Pr in gravity current is strongly depended on the bottom slope. The increment of the Richardson number can be accompanied with growth of the Sc and Pr or with their decrement depending on the bottom slope value. The variations of exchange coefficients vertical profiles were revealed and analytically described lengthwise and in the time.

The special technique was developed for modeling of the water temperature field evolution in density flow during diurnal cycle. In the elaborated technique the nonstationary boundary conditions and turbulent heat exchange coefficient profile of type 'diffusive triplet' were applied for heat-transfer equation solving. The influence of stratification stability and bottom slope on exchange coefficient value was taken into consideration. The water temperature vertical distributions calculated theoretically were compared with measured ones. The evolution of temperature field in time and along the flow with internal wave was analyzed with taking into account meteorological factors. The perturbations of the flow characteristics were considered for gravity, circulating and induced by drift currents.

The obtained results allow solving the problem of forecast water temperature variations in near-bottom density currents with thermal and suspension stratification.

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INFLUENCE OF DENSITY FLOWS ON WATER ENVIRONMENT AND BOTTOM

Samolyubov B.I., Sluev M.V.
M.V.Lomonosov Moscow State University, Chair Physics of Sea and Inland Waters, Moscow, Russia

Density currents with suspended particles stand out for other types near bottom flows in oceans, seas, lakes and reservoirs on capacity and variety of the forms of influence on bottom and water environment. Such flows erode the bottom and transfer suspended particles on distances up to several thousands kilometers in near bottom layers with thickness up to hundreds meters. In this way the deep-water canyons, many meters bottom depositions, powerful nepheloid layers and turbidity clouds, saturated natural and industrial contaminants including toxic ones are formed. The spe-

cial dangerous of hydrosphere pollution appears in regions of radioactive waste recreation places and in the regions of the ocean bottom entrails development.

The analysis of the materials of the density currents natural investigations including our last expedition data (1996, 1997) are introduced in this report in complex with the results of mathematical modeling. This analysis showed that the flow dynamics is determined by the interaction of the main gravity current with the secondary near-bottom flows and internal waves. The origin of the discovered secondary flows was connected with the bottom erosion that took place in the current autosuspension regimes. This effect was observed not only on the steep bottom slopes but also on the plateau due to the current acceleration under the action of the internal waves. The secondary flows with such origin existed on the short intervals of the main gravity current length. The local increments of the near-bottom current velocity may arrive 100-150% of its undisturbed value due to the action of these ignitive secondary flows.

The evolution of the current velocity field under the action of forced internal wave was revealed. The dispersion relation for this internal wave was obtained. The wave phase-velocities were evaluated in the near-bottom boundary layer and in the mixing layer of stratified current.

The action of the suspended particles transport processes on the stability of the density current was investigated. The longitudinal distributions of Richardson number in the shear layers were obtained and analytically described in the turbidity flows and in the thermally stratified currents. These results were analyzed in complex with distributions of the bottom sediment entrainment function. The flow stability in the bottom boundary layer decreased at the intervals of bottom erosion and increased in the regions of current decay while the current stability variations in the mixing layer had opposite character.

The mathematical model of the density flow was elaborated and verified using the conclusions of experimental data analysis. This model allowed to obtain theoretical distributions of current velocity lengthwise and over the height of the flow in analytical form. The current velocity field is described with taking into account the influence of density stratification, bottom slope, erosion and deposition on the turbulent exchange in the main and secondary flows.

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STRATIFIED CURRENTS AND WATER QUALITY FORMATION IN RESERVOIR

Samolyubov B.I., Kremenetskiy V.V., Moya A.A.
M.V.Lomonosov Moscow State University, Chair Physics of Sea and Land Waters, Moscow, Russia

Introduction.

Density currents at reservoirs belong to the main hydrodynamic processes, which determine a water quality formation. An investigation of such currents is necessary to elaborate optimal methods of biochemical water forecasting and regulation. The results of investigations of stratified flows influence on the physical and chemical water characteristics at the plane reservoir are introduced. Density currents under investigation were formed and evolved under the strong influence of internal waves, meteorological and topographical factors. Discussed results were obtained at the plane Mozhaisk reservoir in 1996, 1997. The vertical profiles of current velocity, water temperature and transparency, electroconductivity and oxygen concentration were measured simultaneously during longitudinal cross-sections and at the term stations.

Goals of the investigations: 1. The revelation of stratified currents formation and evolution mechanisms. 2.The elaboration of such currents modeling methods for the prediction of their action on the water quality parameter distributions.

Results. Three types of near-bottom stratified currents were observed during the investigations: gravity flow, circulating current and flow induced by internal wave. In this work main attention is paid to the mechanics of the flows of second and third types due to the following reasons: A. These currents velocities are unexpectedly high for the plane reservoir (up to 15 cm/s). B. The processes of such flows formation and evolution are weakly investigated. C. The influence of such currents on the water exchange in natural basins is of great importance for the ecological predictions.

The circulating near-bottom density current was formed under the action of the drift one. These flows belong to the circulating system inside the basin with heterogeneous bottom relief. This system provides gas exchange and contaminant transfer between deep and shallow parts of the basin. Semi-empirical expressions were found for time-averaged and turbulent parameters of density flow. A mathematical model of the current was elaborated and tested on the experimental data.

The near-bottom flow, induced by internal wave, appeared simultaneously with the drift current. This flow was generated due to the transport of a drift current energy to the near-bottom layers under the influence of an internal wave. Because the internal wave height reached the water surface this wave transferred energy of the near-surface waters accelerated by wind into the deeper layers (under the seasonal picnocline). This effect led to the formation of the nonstationary near-bottom current.

An analysis of the disturbance fields of the velocity, temperature, transparency and oxygen concentration showed their wave origin. Therefore an evolution of the internal waves can cause such effects as an appearance of the surface contaminants fields, including "spots of flowering" at the aquatory. The techniques were elaborated for prediction of the influence of revealed currents with internal waves on water quality parameter distributions.

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MATHEMATICAL MODELING OF HYDRAULIC OF IRRIGATION FURROW

Sanoyan V.G., Petrosyan N.A., Terteryan B.A.
Association of Water Problems and Hydraulic Engineering Republic of Armenia

Acquaintance with literature sources of C.I.S. and foreign countries related to calculation of irrigation technique elements shows that theoretical solution of this problem today is bringing to solution of balance equation with account of various dependencies for definition of water absorption into the soil. It's necessary to note that even balance equation is solved approximated by averaging lengthwise the furrow. Meanwhile the process of irrigation through furrows from hydraulic point of view is a very complicated phenomenon, as it's the motion of two-phase stream, washout and sedimentation of time of stream motion, motion of variable mass. Therefore the approach to such kind of problems have to be done with known approximations. But first of all is necessary to have equations, which are describing this complicated phenomenon with known accuracy and only after by the way of analysis and assessments to reject values of secondary importance, to solve the equations already approximated (enough accurate from practice point of view).

Equations are derived, which show the process of furrow irrigation, which is considered as two-phased motion of liquid in deformed environment.

As a result the following equations are used:

- equation of quantity of liquid component motion;
- balance equation of liquid component mass;
- balance equation of hard component mass (equation of bed deformation);
- equation of dependencies of water absorption into the soil from the time;
- equation, which is derived by the authors the first: equation of stream transformation ability, which is used for irregular and non-standard motion.

ON THE ECOLOGICAL GROUND OF THE WATER USE NORMS IN THE IRRIGATION AGRICULTURE

Scherbakov G.A., Stackovsky A.V. , Bokun J.I., Romanova V.Ph.
Central Research Institute for Complex Development of Water Resources, Minsk, Belarus

In the process of the elaboration of the water-requirement norms for plants irrigation the calculations basis are the definitions of the probability values of the plants water consumption with respent to their biology, meteorology, soil-hydrogeological and other natural conditions and also with respect to usage technics and technologies of irrigation.

Major part of modern method of irrigation water-requirements norms is built on the principal basis - on the solution of the equation of the root soil layer water balance. Beside the factors mentioned above, filling the root layer with ground waters is also taken into account.

As a rule, values of the biologically optimal norms are calculated according to the possibly maximal agrcultural productivity. In the calculative equations no significant limits are used, that's why there were some cases of soil degradation on the irrigated territories. Even more serious negative fenomena were observed in connection with highly mineralized drainage water flows into the natural watercourses and waters. River saltiness and water pollution especially in Mid. Asia, were widely spead.

For the prognosis and the following prevention of such processes appropriate norms, which were elaborated recently whith institutes of the former USSA should have been used. As a results of the joint researches for all the climate zones water-requirements and water-taking norms were were elaborated. They passed approbation and deserved approval.

Insufficient taking into account quality of the waters, used for irrigation and flowing from meliorational sistems was a weak point of there elaborations. Indicators of irrigational flowing were determined with the help of water-balance equations, which took into account irrigational water losses in all links of the meliorational systems (in fields, in inter-economical network and inside the economic). During the calculations of the total leabing indicators the natural part, wthich is formed with the help of atmosphere precipitations and drainage waters flowing, was taken into account. Evaluation of water quality, depending on many factors, was rather diffiscult. Its solution was also complicated by the practical impossibility of non-organized irrigational flowing measuring .

Today, due to the intensively developing studying of the diffused pollution sources, a real natural water objects caused by all links of agricaltural production, including hydromelioration, appeared. In this case appropriate corrections (also with respect to water-quality) can be made to the water -requirements and water-taking norms.

Subjects, connected with evaluation and forseeing of agriculture's impact on the envirorment are suggested by CRICDWR for the joint elaboration with the institutes of C.I.S. on a IEC programme.

EVALUTION OF THE MAJOR WATER OBJECT CONTAMINATORS AS A RESULT OF THE ANTROPOGENIC ACTIVITIES WITH RESPECT TO CONCENTRATED AND DIFFUSED SOURCES OF POLLUTION.

Shcherbakov G.A, Bokun J.I., Pachomov A.V.
Central Research Institute for Complex Development of Water Resources, Minsk, Belarus

On the rational combination of the balance and statistical calculations basis in the laboratory of the ecological problems of water use CRICDWR a method which provides a possibility of qualitative evaluation of the potential water objects contaminators contribution as a result of the antropogenic activities.

This method provides a possibility of the separate evaluation of the contaminators contribution from point sources (industrial and municipal water- purifying constructions, downpour sewage) and diffused sources (plant-growing, live-stock farming, farm settlements, fertilizers, pesticides, atmosphere fall-outs) with respect to accompanying factors (soil-grounds swamping, plaguing up to of the territory, favouroable meliorative conditions, precipitations, relief, etc).

The results of the calculations allow to range administrative regions and small and long river's watersheds according to the water sources, to contour "hot spots" and ecologically dangerous territories, to determine main water objects contaminators.

The result of the elaborations can be used in preventive hydrological and water-protection activities planing in determination of the priority of the industrial and environmental protection objects construction, reconstruction and enlargement, in the grounding of permissible flows to the water objects from concentrated and diffused sources of pollution.

The elaborate method was approbated during the water-balance calculations fulfillment in the Basins of Neman, Zapadnaya Dvina, Dnieper and Zapadny Bug, on the territory of the Republic of Belarus.

Resulting materials are presented to the customer as ecological maps and computer programs with release geo-informational technology of keeping, processing and reflection of the ecological data.

DYNAMICS OF POLLUTION AZOV SEA BY STABLE CHLORORGANIC PESTICIDES (CHOP)

Semenov A.D., Gribanova S.E.
Azov reseach institute of fishery problems, Rostov, Russia
Sapozhnikova E.V
Rostov State university, Rostov, Russia

Intensive pollution of the Azov sea, especially last decade, was one of the main reasons of considerable reduction in reserve of marketable fish ichtiofauna. Difficults in adequate mark of pollution deal in first with wide variety of pollution's composition.

For identification and quantative determination of contaminative substances including pesticides, gasochromatographic system was worked out. It includes automatized determination of indices at the capillary columns of different polatity in the conditions of temperature program. The system was realized on 5 computerized two-chanals high resolution chromatographs Micromat HRGC-412 "Nordion" (Finland) and GC-9A "Shimadzu" (Japan). For pesticide's composition decoding program "Micman" and worked out in institute library of retention indices was used. In according with change of range applied in the Azov bazin pesticides the library continually increases. In 1997 it was increased to 17 new compounds.

According literature and results of our many years reseach the most danger for marketable fish ichtiofauna, including sturgeon, stable chlororganic pesticides (CHOP) of groups DDT and BHG offer. Accumulating by transmission on food chain from inhabite medium through forage organisms in important fish's organs, CHOP lead to plural breachs of phisiological condition and reproductive system.

The results of our observation show, that in early eighties summary concentration CHOP in the water of Azov sea was, in middle, 20 ng/l (2 limit-admissible concentration). From 1984 pesticide's pollution was rapidly increased. In 1984-1985 concentration CHOP arised in 1,5; in 1986-1987 in twice and achivied maximum in 1988-1989 - 60 ng/l. It was a period of "acceleration" of industrial production and intensification of agriculture, which were accompanied increasing of applied in bazin pesticide's quantity, maximum of which (about 100 thousand ton of pesticide's preparation) was in 1987. Then the sharp slump of industrial and agricultural production was happened. Quantuty of pesticides applied reduced about in order. According sea's pollution reduced too: in 1990-1991 pesticide's concentration was, in middle, 15 ng/l and after some increasing in 1992-1994 it was fixed at the level 13-15 ng/l.

One of the characteristic features of spatial distribution of pesticides (as well as range other pollutants) is often observed local parts with considerable higher concentrations in comparison with averages. For examples, in 1988-1989 for average concentration CHOP 50-70 ng/l in summer at north part of the sea maximum concentration was 870 ng/l, and at west part - 990 ng/l. It about in 100 times more, that ecological-fishery limit-admissible concentration. And, although last years amplitude of vibration concentration CHOP reduced signifficantly, concentration more limit-admissible in 5-6 times, still observe.

Interyear changes of ground sediments pollution had analogical character with temporal lag. The highest pollution's levels were in 1989-1990, in middle, 5 and 7 mkg/kg and last year they change in range 1,5-2,0 mkg/kg.

As well as water medium in ground sediments at some parts of sea pesticide's concentration multiply exceeded averages. In period of maximum pollution it achivied 25-27 mkg/kg and last years - 3-5 mkg/kg.

The results of accumulating and taking out CHOP from fish's organisms give the base to suppose, that observed last years reduction of pesticides concentration in water and ground sediments of Azov sea insufficiently for stopping considerable negative influence of pesticide's pollution of the Azov sea on state it's marketable ichtiofauna.

ON THE ECOLOGY OF CENTRAL RUSSIAN RIVERS

Serebryannaya O.L.
Water Resources Institute RAS, Moscow, Russia

River valleys, especially larger ones, are famous to be more abundant in biodiversity than interfluvial areas. Past migrations of plants and animals proceeded mostly along these natural ecological corridores. The effect of climate changes is also perceived by the biota, first and foremost in river valleys. It will be recalled that Early Man began to occupy land in valleys, and in Central Russia the large valleys of Oka and Moscow rivers served as primary passways for primaeval peoples. Forest clearance was followed by soil erosion, small river shoaling and other disturbances of the hydrological balance. Such changes reduced biodiversity.

Animal life in water bodies was subjected to noticeable transformations. Even in the eighteenth century *Salmo trutta morpha fario* and *Thymallus thymallus* were extermined in Central Russian rivers. In the middle of twenteenth century the development of large power stations on Volga brought to the extinction of marketable passage species: *Stenodus leucichthys leucichthys, Salmo trutta caspius, Alosa kessleri kessleri, Huso huso, Acipenser stellatus, A. nudiventris* and *A. gueldenstaedti.* At present the Oka River receives considerable pollutions, unfavourable conditions arise for vital functions and reproduction of fishes; complaints are forthcoming that fish caught below industrial cities has foreign odours.

Nevertheless there are still rather many fishes in Central Russian rivers. *Perca fluviatilus, Blicca bjoerkna, Gymnocephalus cernua, Carassius carassius, Abramis brama, Rutilus rutilus* and *Cyprinus carpio* are caught at regular intervals. The last five species are not taken into account during competitions of amateur fishermen (ROG, 1997). Such species as *Esox lucius, Leuciscus idus, L. cephalus, Stizostedion lucioperca, S. volgensis, Lota lota, Salmo trutta morpha fario* are less common (ROG, 1998), and even a disappearing species, *Lampetra planeri,* was caught during spawning in the Ranova, Moksha, Pronya rivers and lesser rivulets drained to these rivers (Babushkin, 1991). Although the passage form of *A. gueldenstaedti* cannot exist becuse of dam cascades, sturgeons and also *Anguilla anguilla* and *Stenodus leucichthys leucichthys* are known to occur due to artificial discharges in the Orel Province and Moscow River. There are rare caughts of *Phoxinus percnurus, Leucaspius delineatus, Gobio gobio, Rhodeus serviceus, Alburnoides bipunctatus, Abramis sapa* and *Pungitius pungitius. Hypophthalmichthys molitrix,* discharged to natural water bodies in the middle of seventies, occurs sometimes in Kuzmino dam in the Oka River and in the Rybnoe Region, Ryazan Province.

The summarizing information analysis on fish catches makes possible to represent the biodiversity pattern in river valleys of Central Russia. It is felt that the greatest enrichment of fish species composition was peculiar to the Holocene Thermal Maximum (5,000 - 7,000 yrs BP), when mean temperatures were 2-3°C higher than nowadays. Later on, climate cooling and human impact resulted in the considerable impoverishment of ichthyofauna.

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WATER RESOURCES OF BURYATIA: FORMATION, USE AND PROTECTION

Shaibonov V.V.
Water Managing Committee of the Republic of Buryatia

The Republic of Buryatia is one of Russia regions which holds a unique position by its provision with water resources and is characterized by its ramified system.

Water resources of Buryatia are estimated at 85-100 cubic meters a year, that at recount for one inhabitant is about 95 thousand m3 a year. If compared with European part of Russia water provision of Buryatia is higher but it is much lower than in neighboring regions. It is because of many factors and one of them is a loose occupancy.

There are 55 sources of fresh underground water with operating reserves in volume of 1100 thousand m3/day which have recently been prospected on the territory of Buryatia.

Water resources of the Republic of Buryatia are used for public utilities, in industry and agriculture, irrigation, navigation, fishery and others.

Over 700 million m3 of water annually have been used for production needs. The use of water is 85-90% of the whole volume. The main consumers are industry and agriculture. About 94% of water is used at heat power stations and over 80% is used for irrigation. Nowadays there is a decrease in water consumption which is connected with the general falling-off of production and reduction of watering lands. Insignificant increase in water consumption is connected with changes in electric power output plan of Gusinoozersk hydro electric station and house-building in Ulan-Ude.

Annually over 500 million m3 of sewage is disposed into rivers and lakes, and about 30% of it is cleaned insufficiently or it is polluted because cleaning constructions are old in majority, with single-stage cleaning.

Buryatia is one of few regions of our country where water supply is based on underground sources. There are some difficulties in providing population with fresh water of a good quality. The reason is a natural pollution of underground waters, especially in densely populated central and southern districts.

A big part of the left-bank of Selenga river has rather high content of iron. Underground waters of ore-bearing zones are polluted with cadmium, fluorine and other heavy metals.

Antropogenous pollution of natural water sources has a local character for the present, though sewage of Ulan-Ude industrial plants hardly pollutes low stream of Selenga, the main tributary of the lake Baikal.

TO THE QUESTION OF EVALUATION METHODS OF UNDISTURBED RIVER FLOW

Shakhov I.S.
Ural State Technical University, Yekaterinburg, Russia
Cherniak V.I.
RosNIIVKh, Yekaterinburg, Russia

The problem of man's impact on the environment causes great concern both in this country and abroad. It crossed the borderlines of countries and regions, having become global.

For a long time the attention of scientists and philosophers was drawn on the one hand to the problem of the nature mastering to meet humankind demands, on the other hand to the changes of main environment features under the influence of all types of industrial activities.

The growing nature resources uses followed by increase in hydrosphere and atmosphere pollution, uncontrolled nature transformations mainly resulted in the depletion of many nature resources, and in many regions the mankind has faced a crucial point that might result in ecological crises and threats to the mankind's very existence.

All these resulted in extreme point of view as regards economic activities. It's often said that interference with nature is not to be allowed. To our mind, it's wrong and lacks scientific and practical meaning as is always the case with extremes.

Instead of extreme demands it's necessary to study limits of fluctuations (the dynamic balance) of nature processes and phenomena within which they restore their balance.

Nowadays it's obvious that the mankind can't do without transformations or, to be more exact, intensification of nature processes. But nature will also collapse when thoughtlessly exterminated.

The nature and mankind are an integrated system and their contradictions should not slow down the social progress. It's necessary to change the attitude to nature from purely consuming to constructively creating.

Thus, it's necessary to govern the processes in nature and find in each particular case an optimal correlation between interests of the kind and other environment elements.

It concerns the nature in general and water resources in particular as water is not only the most widely spread substance in nature, but it also guarantees the very life of nature groups.

The main problem of water resources use is to find dynamic balance between the quantities of water taken from a water body and those necessary to be left in a river, lake, etc. To take care of optimal existence of the whole watershed ecological system.

Under the economic activity influence, the water regime in river systems and basins, having been formed for centuries, is changing. Along with this one might expect great transformations in all the watershed elements of ecosystem.

Controlled increase or decrease in river and lake water level will eventually result in changes in flora and fauna, and in some cases may threat water supply due to numerous irregularities or big expenses for water extraction.

Thus, in rivers and lakes it's necessary to reserve some particular part of the flow, the latter being able to guarantee normal water ecosystem functioning under any economic activity conditions.

This flow should be considered undisturbed. It should guarantee water bodies protection from degradation of both components of the animate nature (flora, fauna, fish, waterfowl and near-water birds, etc.), and landscape elements.

THE POLYCICLIC AROMATIC HYDROCARBONS OF THE BOTTOM SEDIMENTS IN THE ZONE OF CONSTRUCTIONS OF DEFENSE OF ST.-PETERSBURG FROM FLOODS

Sheinerman N.A., Cudrjavseva T.P., Slepyan E.J.
International Centre "Bioecological control", St.-Petersburg, Russia

The polyciclic aromatic hydrocarbons (PAH) are bioecolo-gicaly the most dangerous chemical pollutants belonging to the category of the chemical transformers. Many PAH influence on the represents of the different types of organisms coused by mu-tagenic, teratogenic, cancerogenic, ingibitory, stimulatory, toxicogenic and other biological effects.

At the end of the 80th - beginning of 90th the analysis of the quality constituent and the quantity content of the PAH in the bottom sediments near the constructions of defense of St.-Petersburg from floods under the V.P.Astafyev intiative was realized. For this analys lowtemperature spectro-fluorimetric method was used, based on the effect of Shpolsky. The quality content and correlation of the PAH is the evidence of the technogenic origin caused by chemical pollution. In the bottom sediments benzo(a)pyrene, pyrene are identified; its metylsubstitution's gomologs, benzo(g,h,i)perylene, perylene, chryzenic and benzo-fluorenic groups of hydrocarbons.

In the bottom sediments to the north-west from the constructions of defense from floods the concentration of the benzo(a)pyrene is less then high-leveled (admissible), 20 mkg/kg.

To the north from the constructions the concentration is enlarged and exceeds the admissible approximately in 2 times.

To the south from the constructions the concentration of the benzo(a)pyrene is especially considerable and reaches 340 mkg/kg and exceeds admissible in 17 times and more.

THE DNIEPER BASIN SANITATION PROGRAMME (FOR UKRAINIAN TERRITORY)

Shevchuk V.Y.
Ministry of Ukraine, Kiev, Ukraine
Yatsyk A.V.
Ukrainian Research Insitute of Water Management and Ecological Problems (URIWMEP) , Kiev, Ukraine

The ground of the programme working-out is the priority of health of a human being.

Ukraine's transition to stable development requires harmonization of productive forces and stage-by-stage reconstruction of the environmental integrity, creation of possibilities for the balance between its potential and needs of the people of all generations. Thereto, the basis is a parity of relationship on the triad: person - nature - economy.

In Ukraine, and in the Dnieper basin in particular, there are extremely difficult ecological conditions and big difficulties with drinking water supply for the population. The Dnieper gives Ukraine about 80% of water and provides with it 2/3 of the territory. This is nearly 30 million people, 50 big cities and industrial centres, more than 11 thousand enterprises, 2,2 thousand rural and more than 1 thousand communal economies, 50 large irrigative systems, 6 large hydroelectric stations and 4 huge power stations.

The Dnieper water resourses compose 53 km3 in a medium watery year and 43,5 km3 in droughty years. Out of the average volume of the Dnieper water course during the period of many years, 32% are formed on the territory of Russia, about 31% on the territory of Belarus. The drainage, formed in the Dnieper basin on the territory of Ukraine, composes 19,3 km3 in a medium watery year and only 12 km3 in a droughty year.

General irreclaimable water consumption in the Dnieper basin in 1995 accounted for 33,8 km3, comprising irreclaimable water consumption of the branches of national economy of Ukraine - 7,3 km3; irreclaimable water consumption out of the territory of Ukraine - 2,0 km3; losses on evaporation from the square of a mirror of ponds, reservoirs, channels - 4,1 km3; losses on filtration from the Kahovka reservoir - 1.2 km3; sanitary-and-ecological minimum (flow-off from the Kahovka reservoir into the Dnieper firth) - 19.2 km3. Thus, it amounts to 35 km3, considering the volume of the Dnieper drainage in a droughty year of 95%-provision.

In 1995, 7,4 km3 of waste water, 2.1 km3 of which were polluted, were thrown into the water body of the Dnieper basin. Waste water out of only pointed sourses in 1995 irrigated 36 thousand tonnes of multi-oxidated organic substances, 613 thousand tonnes of mineral oil, 439 thousand tonnes of sulphates, 527 thousand tonnes of chlorides, 29 thousand tonnes of nitrates and many other substances, among which there are many heavy metals, poison chemicals, etc.

Intense contamination of ground waters, especially near big industrial centres, inhabited localities and agricultural enterprises is happening.

The exceptional feature of the modern ecological condition of the Dnieper basin is contamination of its large areas by radionuclides together with chemical impurity. There are about 450 thousand curie of Caesium-137 and almost 70 thousand curie of Strontium-90 in the Dnieper basin. Collective impact of toxicological and radioactive contamination on ecosystems has led to their pre-catastrophic condition.

Continuous effect of small doses of radioactive exposure together with constant intoxication by small doses of poison

chemicals and ions of heavy metals in water and articles of food is especially dangerous for people's health.

The provision of the population of Ukraine and branches of its economy with good-quality water is one of the priority tasks of socio economic policy of the state. It is particularly necessary, while considering the fact that three quarters of drinking water supply in Ukraine is realized for the account of surface waters, the majority of which have 4-6 classes of quality, but systems of water preparation are designed for 1-2 classes of quality. The use of bad quality water results in growth of diseases, reduction of duration of life, demographic changes in the community. Under these circumstances, transfering drinking water supply to the more protected from contamination underground waters that are naturally and artificially generated would be radical and actual for water economy policy for the mode period.

The problem of the Dnieper basin sanitation is of a great importance for the formation of a system of stable development of the country. It was considered and approved by the resolution of the Ukrainian Supreme Rada 27th February, 1997. The process of formation of the system of stable development succeeded. But apart from the implementation of the National Programme of the Dnieper basin ecological sanitation and drinking water quality improvement, it is essential to fulfil a complex of activities.

This activities are the following:

- reduction of anthropogenic loading on all the water objects in the basin and increase of self-recovering possibilities and abilities of the rivers in the Dnieper basin and its reservoirs;
- conservation and protection of the reference river basins, free from economic activity;
- improvement of water purification technology;
- implementation of priority financing of the measures, directed on protection and rational use of waters of the Dnieper basin;
- rationalization of the water management systems;
- operation of a water object as a component of the environment for a self-purificatory ability and improvement of the quality of water.

Ecological and economic policy of the state is to be directed on solution of the following urgent problems:

- liquidation of a threat to health of people, connected with contamination of ground, air and especially water;
- surcease of ecosystem degradation and biological diversity decrease;
- reorganization of the national economy should be conducted with allowance for requirements of ecological safety.

Solution of the Dnieper problem is possible only under the condition of development of ecological education for all, without an exception, citizens together with adherence of the following principles in economy and everyday life:

amplification of positive tendencies for water conservation in all branches of economy;

implementation of eco-friendly technologies in production, consumption and utilization;

omnifarious restriction on the scale economic transformations whose outcomes are impossible to forecast in ecological context;

expansion of fundamental and applied research in the field of ecology, particularly water and near-water ecology, and water economy, etc.

Creation of the effective mechanism of management of the ecological condition of the river basin requires a system approach. That is impossible without a system of management, communications, an appropriate legislative and legal basis, conducting necessary research for provision of information banks with authentic qualifications. For their identification and evaluation of informativeness and authenticity as well as linkage with ecological condition of the basin, it is essetial to have knowledge of at volume and deepness, but there is very little expertise or the complete lack of it. The development and research on the implementation of the National Programme of the Dnieper basin ecological sanitation and drinking water quality improvement is divided into four groups. Executive officials, terms of accomplishment of the working-out, volume of financing have been already constituted.

The solution of problems of the Dnieper basin ecological sanitation and drinking water quality improvement in conditions of the budget subsidy deficit and formation of market economy in the country is possible under the following conditions:

- improvement of mechanism of the ecological control, grounded on the principles of rational combination of the market and administrative gears, and mechanism of the Programme activities realization;
- implementation of the stage-by-stage realistic approach to solution of the problems for identification the priority actions and their target set;
- mobilization of the local resourses and initiatives;
- increase of the role of public opinion and decision-making on important ecological issues.

The realization of the strategic purpose is achieved by introduction of a complex of the agreed and interconnected water protectional, legal, economic, logistical and other measures, which are developed in detail at each stage of realization of the Programme with application of the programme-target methods and appropriate information technologies.

The Programme is multi-purposed as it aims at some relative strategic goals. The complexity of the Programme structure, scale of tasks that need to be fulfilled, continuous character of the predicted reinvestment cycles cause a long period of the Programme realization (up to the year of 2010 or so).

While working out the National Programme of the Dnieper basin ecological sanitation and drinking water quality improvement together with the Programme of legislative-and-legal basis and logistics of its realization, the authors realised that it is impossible to improve the quality of water in the Dnieper without conducting the whole complex of the water protectional activities in the basin as well as the problems of the Big Dnieper cannot be solved without undertaking a necessary complex of measures.

The Dnieper basis in the territories of the Russian Federation and the Belarus Republic. It is expected that a stage-by-stage consummation of the straegic goals.

Solvation of the problem of the ecological sanitation of the Dnieper demands a working-out and realization of the

International Programme of the Dnieper basin ecological sanitation, created on the basis of the National Programmes of three states which are situated on the banks of the Dnieper. Each state should make its own contribution in the common business for the water in the Dnieper would be the same quality in all its water-way, and would be up to the standards on water sourses that provide the problems of drinking water supply.

STRATEGY OF SUSTAINABLE WATER USE IN VOLGOGRAD OBLAST

Shubin M.A.
Lower-Volga Affiliate of RosNIIVKh, Volgograd, Russia

The analysis of water resources utilisation and protection in the Volgograd Oblast showed that the water supply to the population and economy does not meet the standards and represents the most important ecological and social-economical problem. In order to solve this problem it is necessary to organise the following measures:

- to equip all water intakes by the instrumental inspection, to introduce the log books of water discharge;
- to carry out calculations of the water requirement for the drinking purposes, technological processes of food industry enterprises, calculations of irrigation rates;
- to formulate a regulation of the quality of water consumed by all objects including industrial enterprises. In irrigated agriculture it is necessary to solve the question of the utilisation of treated domestic sewage;
- in view of the high extent of surface water pollution it is necessary to organise accurate and regular (monthly) monitoring of the water quality of water supply sources drawing attention to the concentration of hexachlorine-cyclohexan. It is required to equip the water intakes by water-metering facilities;
- to design and build the group underground water intakes for the water supply to the rural population and to build the additional water intake and water-treatment plants as well;
- to reconstruct and to build, if necessary, new fish protection structures;
- to design and construct facilities intended for the sludge treatment at the water-treatment plants;
- to replace the chlorination of water by the other more safe methods of water disinfection;
- to replace water conducts and water intake devices;
- to design and construct sewer systems and pumping stations for wastewater pumping-over in order to exclude the discharge of untreated wastewater into the water bodies;
- to carry out works to fix the wastewater composition of industrial enterprises which have not local wastewater treatment plants, to design and construct the local wastewater treatment plants or the circulating water supply system;
- to bring up the wastewater plants to design output and to design, if necessary, and construct the additional blocks of the treatment, put into practice scientific developments concerning the increase of the treatment efficiency;
- to organise researches, design and construct facilities intended for the sewage sludge treatment;
- to design and construct storm flow treatment plants;
- to ensure the disposal and treatment of drainage water by means of step-by-step implementation of rational methods of drainage flow utilisation;
- to organise researches, design and construct the wastewater advanced treatment plants;
- to work out efficient and safe modes of wastewater disinfection;
- to work out and realise the legal basis of the juridical and economical responsibilities of the operating personnel for the keeping of maintenance regulations concerning water conducts and sewerage, for the discharge of insufficiently treated wastewater into the municipal sewerage and for the pollution of environment by the municipal and industrial wastewater sludge.

FORECASTING OF THE INFLUENCE OF RADIONUCLIDES POLLUTION ON THE WATER QUALITY BY THE BOX MODEL OF INCREASED ACCURACY

Sizonenko V.P.
Institute of Mathematical Machines and System Problems, Cybernetics Center Ukrainian Academy of Sciences, Kiev, Ukraine

Increase of accuracy of forecasting of the transport radionuclides in the Dniper reservoirs keeps significance in connection with proceeding washing Sr-90 in time of spring floods of contaminated territories, contiguous of the Chernobul nuclear station and from surrounding watersheds. There is the opportunity to compare mathematical models with data of field measurements.

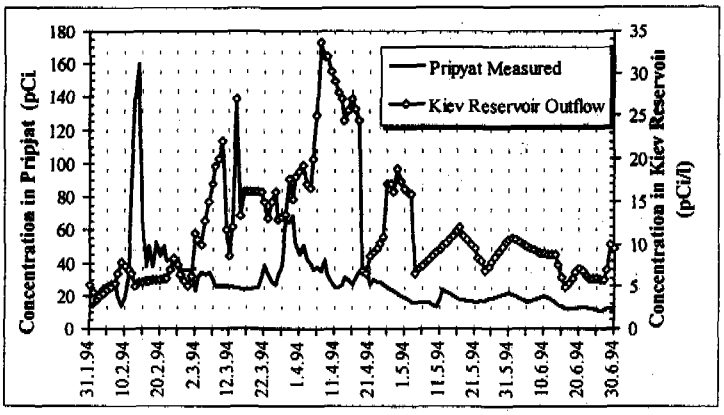
The elementary of models used for description of the transport of pollution - the box models of complete mixing, where variables averaged over the compartment area usually representing all reservoir or its significant part. Similar models are less sensitive to quality of initial data in comparison with existing more complex 1-, 2-, 3-dimensional models, by use of

which the opportunity to have exact forecast is limited of necessity to have plenty of exact initial data and boundary data, but the time of calculation is long. It makes inconvenient the decision of problem of identification of parameters.

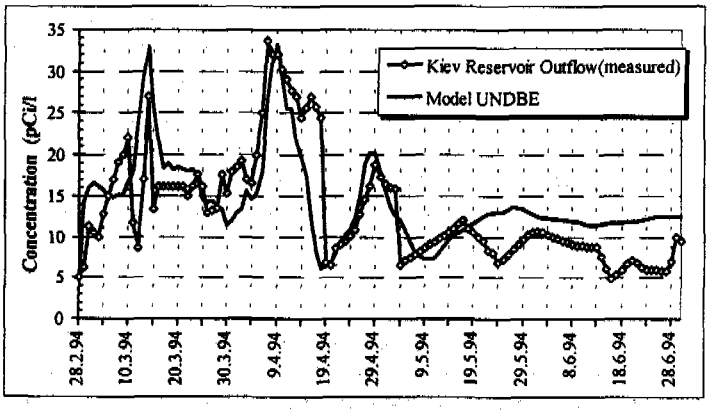
In the article analyze opportunities of the box model of complete mixing(WATOX) on examples of distribution Sr -90 in Kiev reservoir after the Chernobyl accident and define factors that have main influence for transport of pollution.

There is description of a non-full mixed box model(UNDBE) with a retarded parameter in this paper. The model takes into account the transport time of water and contamination through the reservoir. It is give the opportunity to describe the process more exactly. As a result, the model UNDBE increases the accuracy of prediction of a pollutant concentration in the outflow of reservoir particularly in the case for a short time forecast. This approach not requires more detailed field measures than the full mixed camera model. The mathematician and soft complexity of the model have been increased not so strongly. The block of parameters identification has been included in the model's soft. It is make the possibility to choose the best parameters of the model and therefore to increase model's accuracy and to calibrate the model for a concrete reservoir and pollutant. The calculations and identification of parameters were made for the hard situation of the spring flood 1994. An ice jam took place in the Pripyat river(the main source of Sr-90), before the usual spring flood that year.

Though simplicity, short time of calculation and presence of the block of parameters identification give the possibility to use the model for various prognostic tasks and for solving of optimization problems of water usage while working in on-line regime.



Inflow and outflow concentration Sr-90 for the Kiev reservoir.



Dynamics of Sr-90 concentration in outflow of the Kiev Reservoir.

THE INFLUENCE OF FAINT OIL POLLUTION ON THE ZOOPERIFITON OF THE RIVER MEDVEDITSA

Soloviova E.
The Water Problems Institute Russian Academy of Sciences, Moscow

The influence of accidental throwings out of great amount of oil on hydrobionts of sea ecosystems is investigated more detailed. Fresh waters are examined so good, especially it concerns the prolonged faint influence on reservoirs' inhabitants. In 1997 the influence of flowing gutters of a steam, polluted by petroleum products, on zooperifiton of water plants of the river Medveditsa (Russia, Saratov region) was under research.

The samples were taken from coastal and submersion vegetation according to the generally accepted methods and from plants with swimming leaves on the water surface. The samples were selected from the area that is higher than the polluted stream's mouth near the village Uritskoe (1);

immediately lower its flowing gutters (2); in a distance downstream near the village Alexeevka where the river is used as a watering place for animals (3); and on a district practically devoid of the anthropogenic influence near the village Barsuchie (4).

On the area of the river under research 13 species of macrophytes were found; Scirpus lacustris L., Typha angustifolia L, Nuphar luteum (L), Potamogeton natans L., Sagittaria sagitt: folia L. and Ceratop hyllum demersum L. were found more frequently.

Among the perifiton of the water plants 26 groups of invertebrates of different systematic rank were met. The composition of the species of some groups was defined. Chironomidae (30 species) are the most numerous; Rotoctoria (8 species), Gastropoda molluscs (7 species), Trichoptera's and Ephemeroptera's larvas (each of 6 species) and Odonata's grubs (5 species).

The reaction of perifiton on oil pollution was different. We can distinguish several strategies of changes in the structure of assosiations: 1. Negative indication - the abrapt lowering of the number and biomass in the place of polution and the rising of these indexes in the "clean" district. Chironomidae, lowest crayfish (Cladocera, Copepoda, Ostracoda) and Gastropoda molluscs reacted in this way; for example, Chironomidae's number in the samples taken from the district a) was reduced 3 times.

We also observed some changes in the composition of the species of mosquitos' larvas: in the flowing gutters the representatives of subfamilies of Tanypodinae, benthos grubs of the genus of Chironomus appeared; Glyptotendipes gripekoveni which are usually met in the rest samples disappeared; Polypedilum's nubeculosum and Rheotanytarsus's exiguus number were greatly reduced. Rather steady were Cricotopus's gr. silvestris, Cr. gr. algarum's and Paratanytarsus's lauterborni grubs.

Gastropoda molluscs in the undergrowth of macrophytes were represented mainly by the juvenil and at the same time the bottom was strewed with the shells of the died adultus. It may be either a consequence of adaptation to the faint chemical influence or a result of reduction of the volume of petroleum products' sewage. It may be also proved by the significant lowering (2-5 times) of eggs of the water invertebrates taken from the samples near the village Uritskoe in comparison with those taken from the rest districts of the river.

2. Positive indication - the increasing of the organisms' number and biomass on a polluted district of the river. We can regard Rotatoria, Simuliidae's grubs, Trichoptera's grubs, Ephemeroptera's grubs and Acariformes's grubs to this group. These groups live in the water saturated with organic substances. The biomass of Simuliidae's grubs in the samples of zooperifiton, taken lower the watering places (district 3) reached 9,6 g/sq.m, at the same time they were practically not found on the 1st and 4th districts of the river.

Ephemeroptera's and Tricoptera's grubs were found almost in all samples. Tricoptera prefers a part of reservoirs with clean water, saturated with oxigen, they are used as indexes of the water's cleanness. But the oil pollution on the district of the river Medveditsa under research has not influenced on the content of oxigen in the water, perhaps due to the intensive flowing. The increasing of the number of Trichoptera's grubs is connected with the mass appearing of the species of Neureclipsis bimaculata, Cheumatopsyche lepida, Ithytrichia lamellaris and Hydroptila tineoides, prefered clean water (Kachalova, 1977).

The number and the biomass of Ephemeroptera on the district 2 increased 2-4 times at the expense of Procloeon ornatum and Heptagenia sulfurea. 3. The steady organisms which have not reacted on the pollution are Hydra, Oligochaeta, leeches, bugs and Odonata. Probably, the oil pollution occured not constantly and it was insignificant due to the small volumes of drains and to the intensive flowing of the river. That is why the general breaches in the structure of the perifiton's associations are considered to be insignificant. The social and economical drains near the village Alekseevka influenced on it not less or may be even more.

The zooperifiton has a great potential for restoration: the considerable number of the animals-perifiton with different sensitiveness allows not only to determine the quality of the water but also to appraise the duration of the influence, and to assist to the reservoir's self-cleansing.

ANALYTICAL SOLUTION OF THREE-DIMENSIONAL NON-STATION DIFFUSION IN CALCULATING THE DISPERSION OF CONTAMINANTS DISCHARGED FROM POINT SOURCES TO WATER RESERVATIONS WITHOUT DISCHARGE CHANNEL

Sosorbaram Ts., Basandorj D., Chuiuunhuyag S.

The processes of distribution of pollutants to water reservoirs are of decisive importance in tha formation of fields of both. natural and artificially brought into the water substances. Without knowing appropriately the regularities of the pollution diffusion in reservoirs it is impossible to make an optimal choice of methods for calculating the distribution of pollutants. The process of diffusion :m the water area is very complicated process owing to the impact of a multitude of factors affecting the distribution of substances.

Applying a three-dimensional differential equation of convective diffusion (1), which takes into account the limiting and starting conditions, could solve the distribution of pollutants thrown off into the water reservoirs from point sources of pollution.

The purpose of the study is to determine the spatial and temporal alterations of the distribution of pollutants in the reservoirs with the application of non-stationary three-dimensional differential equation which is solved by methods of transformation suggested by Four.

Limiting and initial conditions for solving the equation

Taking as coordination of point sources x=0, y=y0, Z =Zs, it can be simulated in the following way

$C(o,y,z,t) = C\,\delta\,(y-yo)\,\delta\,(z-Zs)$;

Where: δ - delta of Dirak function; M-amount of pollut-

ants discharged per unit of time ($M = C Q_0 / U_0$), Co -starting concentration of pollution. Q0 - flow rate of discharged water; Zs distance between the outlet edge of the discharge pipes and water surface level,

The simulation calculations show that the concentration of pollution reaches its maximum in 1/4 an hour after their discharge and is characterized futher by a sharp drop reaching after 13-14 hours its minimum value and creating the background concentration and that the model calculated provides correctly the regularities of the concentration

The fact that the concentration pollutions has not been found at a distance of 300 meters from the source of pollution two hours later is connected with that in the solutions of the equation taken for the speed uf distribution of the concentration was the velocity of the oscillatory movements of the water.

The dispersion of the concentration of pollution in depth is to become stable in 6-8 hours providing the background concentration and becoming rather homogeneous. The decrease of the concentration of pollution transverse to the axis of the pipe goes on pursuant to the law by Gauss and in 11 hours becomes by far lower than the highest permissible limits.

The results obtained basing upon the solutions of the equation of mathematical simulation are of high correlation in comparison with the results of experimental studies and provide opportunities for their application in carrying out the prominanery evaluation of the quality of water.

Such analytical solution of differential equations is of great interest taking into consideration the difficulties existing in the applied mathematics and hydrodynamics in connection with their solution.

SCALE FOR EVALUATION OF THE STEPPE PROCESS IN THE MEADOW VEGETATION OF THE FLOODPLAINS UNDER REGULATION OF THE RIVER FLOW

Stefankov L.I., Zaletaev V.S.
Water problems Institute Russian Academy of Sciences, Moscow, Russia

Regulation of the river flow by dams on the rivers of subhumid and semiarid zones of Europe lead to aridisation of floodplains in the tail-water of hydroplants and caused development of steppe process in the meadow vegetation. This process appeared to be universal.

We revealed the typical phasic characted in the development of steppe process in the meadow vegetation of floodplains in the floodplains of the Low Volga and its tributaries (Bolshoy Irgiz, Maliy Irgiz, Eruslan), in the floodplain of the South Bug, in its middle and low flow, in the floodplain of the Upper Rhone and on Bavarian part of the Danube. For the floodplain of the Low Volga in the tail-water of Balakovo hydroplant it is typical the intorduction into the meadow vegetation of middle and even low floodplain of communities composed by *Artemisia austriaca* and *Koeleria glauca*, while on the high pathces including riparian levees - microcommunities formed by *Artemisia austriaca, Festuca valesiaca* and *Koeleria glauca*. It is also typical for the left bank of the Low Volga close to the mouth of the Bolshoy Irgiz river (region of Volsk town) growing of mesoxerophyle weeds on disturbed meadows (common dominants are - *Tanacetum vulgare, Achillea millifolium, Aechium vulgare)* and overgrowing of the floodplain by bushes is observed.

For the floodplain of middle flow of the South Bug in the tail-waters of Sabarovskiy, Ladizginskiy, Glubochekskiy, Sutisskiy and Tivrovskiy hydroplants the steppe process is indicated by formation of microgroups with *Festuca pseudoovina* and *Verbascum densiflorum, V.Lychnitis*, as well as associations with *Festuca pseudoovina, Artemisisa austriaca* and *Koeleria glauca*, sometimes with *Anisantha tectorum* and *Bromus japonicus*. But degree of participation of these microgroups and assocuiations with steppe appearance consisting of mesoxerophyle and xerophyle species, in vegetation of Middle and Low Bug on its various patches differs. This fact enabled us to select 6 stages in the steppe process of meadow vegetation that is provoked by water-management construction.

On the basis of multiple nature observations in the floodplains of the South Bug, Low Volga and its tributaries we worked out the scale of evaluation by marks of the steppe process degree in the meadow vegetation. Each mark is characterized by specific parameters (table 1).

Table 1. Stages of steppe process in the meadow vegetation of the floodplains.

Stages of steppe process	Character of successions	Number of steppe species in association, %	Territory, occupied by steppe species, %	Evaluation of steppe process by marks
Initial	Incidental introduction of steppe species into meadow vegetation	1-10	1-10	1
Steppe process of weakly expressed	Regular participation of steppe species in meadow vegetation of the floodplain, mainly in specific microecotopes	10-15	10-20	2
Steppe process averagely expressed	Forming of microgroups of steppe species	15-30	20-35	3
Steppe process expressed strongly	Formation of steppe associations	30-45	35-50	4
Steppe process expressed very strongly	Expansion of steppe associations (spreading of steppe species)	30-45	50-75	5
Transformation of meadow into steppe	Replacement of meadow vegetation by steppe associations	45-50>	75>	6

Our experience of using this scale on the floodplains of various rivers under disturbance of the floodplain regime supported its applicability for evaluation of the steppe process degree, for evaluation of ecological state of meadows and for revealing of transformation tendencies of floodplain ecosystems under definite conditions under anthropogenic impact on the flow and on hydrological regime of the river valleys.

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USING THE COMPLEX MODEL EXPERIMENT FOR ESTIMATION BAIKAL WATER QUALITY

Stom D.I., Zilov E.A., Barhatova O.A.
Scientific-research Institute of Biology Irkutsk state University, Siberian ecology company

For estimation and prediction Baikal water quality, results of laboratory and field experiments with mathematical modeling, were joint. The experiments allowing to determine quantitative characteristics of interaction of main pollutants of the lake Baikal with some pelagic components.

Optimum time for experiments with mesocosms on lake Baikal is 7 days in summer and 14 days during the under-ice period. Established that mesocosms reflect the conditions of plankton community components much better than microcosms. Advantage of under-ice mesocosms over open-water is showed.

The concentrations of nutrients (nitrate nitrogene, phosphate phosphorus) and some other contaminants (diphenols, oil products, sulphateanion, ions of heavy metals) causing reversible and irreversible changes in systems imitating baikalian plankton (mesocosms and microcosms) are estimated.

Under toxicity of phyrocatehin in model ecosystem zooplankton (with 0,1 mg/l) and phitoplankton (with 0,1 mg/l) were compressed. Concentrations less than 1,0 mg/l lead to increasing biomass of summer phytoplankton. The cosmopolitan forms of phytoplankton (such as, Nitchia acicularis) are showed much toxically resistance than endemic forms. Growing of saprophyte and fenoloxidation microorganisms was stimulated by the presence of pirocatihin (0,01 mg/l). The rapidity of elimination of pirocatehin in model ecosystems were highest in summer than under-ice period. Decreasing of concentration of pirocatehin was faster in mesocosms than in microcosms.

The adding of mineral forms of nitrogen and phosphor (0,003-0,5 mcP/l and 0,017-2,2 mcN/l) didn't affect to zooplankton and microorganisms, but stimulated summer phytoplankton. In mesocosms with addition of nutrients, the cosmopolitan forms (Nitzchia acicularis and others) dominated, which one more time showed the especial sensitivity of vulnerable endemic species from lake Baikal.

Using of mathematics modeling for analyzing the possible results of toxification and eutrophication of lake Baikal showed qualitative similarity of reaction to both influences.

The materials necessary for information provision of mathematical model of lake Baikal ecosystem are obtained. The coefficients reflecting interaction of main components of pelagic ecosystem (phyto-, bacterio-, zooplankton), hydrochemical parameters and contaminants are calculated. The constants of destruction of pollutants and concentration changes of hydrochemical characteristics in the presence of biotic components are found and dynamics of planktonts under the influence of contaminants and under the change of abiotic (water mineralization, nutrients and autochtonous organic matter content) is observed for different biological seasons.

Plankton is shown to react on nutrients addition as oligotrophic one during ice-cover period and as eutrophic one in summer. Winter-spring planktonic complex was more sensitive to pollution than summer one.

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IMPACTS OF FOOD TO TOXICALLY RESISTANT OF EPISCHURA AND DAPHNIA

Stom D.I., Gill T.A., Barhatova O.A.
Scientific-research Institute of Biology Irkutsk state University, Siberian ecology company, Irkutsk , Russia

The endemic crustacean Epischura baicalensis Sars. at some years takes up to 80 % of common biomass in lake Baikal (Kozhov, 1962). It plays very important role in trophic relations between Baikal gidrobionts and in the self-purification processes in lake. In connection to that, the toxically resistance of Epischura to some pollutants was studied. In comparing to Epischura impacts of same pollutants to Daphnia я8(я0as a one of the usually used biotest) were estimated.

Experiments showed that for Epischura with adding algae sells (euglena, scenodesmus) and yeast, toxicity of solutions of resorcyn, mannit and cadmium salts was highest than with presence of food's objects.

For Daphnia, toxicity of chemicals mentioned above, was less with presence of food. Algae and yeast decreased toxicity of mercury salts for both Epischura and Daphnia. In closely same conditions, the abilities of Epischura and Daphnia to devour lipid-soluble xenobiotic - sudan were compared, and rapidity of filtration for both crustaceans was

estimated. The intensification of devouring of toxicants with presence of food was determined.

Highest toxicoresistance of Epischura to some chemicals, might be preliminary explained by the differences in rapidity of filtration. If we get, that Daphnia's rapidity of filtration is faster than Epischura's, so accordingly during the same time Daphnia take more toxicants than Epischura. The filtration activity was calculated by the using dates of decreasing numbers of yeast's cells which were marked by C0 glucose. Established that maximum rapidity of filtration for Daphnia was ml/sp., for Epischura -3,3 ml/sp. (in calculation to night-day). With calculation to mg. of dry weight filtration activity of Daphnia when 18 °C was 302,7 ml/mg of dry weight per day-night, for Epischura when 88 °C 330,0 ml/mg. But we have to remember, that determination the filtration activity of Daphnia and Epischura in our experiments was made by counting numbers of yeast's cells, and not by estimation of filtered water amount.

The food selection by Copepoda much elaborate than by Cladocera. That is why Copepoda increase it filtration activity with presence of food (Gutelmacher and others, 1988). So we can suppose that it's one of the reasons of little sensitivity of Epischura to toxicants. It means that high toxicoresistance of Epischura relates with low rapidity of devouring and collecting of toxicants , in conditions when crustacean doesn't eat.

If it true, it means that presence of food for Epischura have to increase the rapidity of devouring and collecting xenobiotics. The results from experiments with sudan had confirmed it. The addition of algae increased up to 2-3 times the amount of sudan devoured by Epischura. As difference with alive crustaceans, in preliminary killed crustaceans the level of sudan didn't change.

The difference which was established in impacts by microorganisms on toxically resistance, linked with food selection by Epischura. So, it means it relates with much more entering of pollutants into Epischura because of increasing rapidity of filtration with presence of food.

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MERCURY-CONTAMINATED SEDIMENTS OF THE RIVER NURA: OPTIONS FOR CONTROL AND CONTAINMENT

Tanton T.W.
Department of Civil and Environmental Engineering, University of Southampton, Southampton, Britain
Yanin E.P.
Institute of Mineralogy, Geochemistry and Crystal Chemistry of Rare Elements, Moscow, Russia
Ilyushchenko M.A.
Chemistry Department, Kazakh State National University of Al-Farabi, Almaty, Kazakstan
Heaven S., Usenaliev T.A.
Chair of Environmental Technology, Kazakh State Academy of Architecture and Construction, Almaty, Kazakstan

This paper presents details of mercury pollution of the River Nura in central Kazakstan. Until recently the problem was not widely known in its full extent, but the overall scale and intensity of contamination in the area classify it as a major hydroecological disaster. Preliminary investigations suggest there are at least 130 tonnes of mercury in the sediments of the river bed near the city of Temirtau, and a further 30 tonnes in the 80 km downstream. Detailed research has been carried out on the location of the technogenic silts in the bed of the Nura. Most of them (several million tonnes) are found within the 25 km immediately below Temirtau. However a significant quantity is also found in backwaters and old river beds, frequently dried out, buried under later sediments and covered by plant growth. The soil of the floodplain is also highly polluted by mercury for a distance of not less than 80 km, due to transport of the silts during floods. About 10 km2 of the floodplain has surface pollution of soils to above sanitary norms.

Because of its high toxicity and bio-accumulation, the maximum permitted level for mercury in the aquatic environment is 0.5 :g/l. The content of soluble mercury in the Nura can be traced in excess of sanitary norms for 100 km downstream of Temirtau. Mercury in excess of sanitary norms can also be found in groundwater in that part of the floodplain. This has immediate implications for the health of the people of the region. In the long term it also poses a threat to the unique ecology of the lakes of Kurgaldzhinskiy nature reserve.

The main source of mercury is AO Karbide, which produces acetaldehyde using a mercury catalyst. From 1951 to 1976 effluent from the acetaldehyde workshop was not treated specially to remove mercury, and concentrations reached 50 mg/l. The most polluted effluents were discharged into the Swamp Zhaur, situated 15 km from the river. After dilution of the mercury-containing effluent it was also discharged into the river Nura 2.5 km below Samarkand reservoir. It is likely that most of the pollution occurred in this period. The quantity of mercury discharged has now been reduced, by the introduction of local treatment for mercury containing effluents and the almost complete halt in acetaldehyde production due to the economic crisis.

During spring floods, sediments are transported down the river and dispersed over the floodplain: in subsequent years they may re-enter the river. Downstream thousands of hectares of agricultural land are irrigated with river water. Secondary pollution of the river water also occurs from the contaminated silts. Mercury is thus migrating downstream by a number of mechanisms, moving between the water and sediment phases.

The best technical option is removal and treatment of the contaminated soils and sediments. The difficulty with this

solution is the high cost. In the case of removal and containment of the silts the cost would also be high, and additional problems would arise in placing the extracted material. In both cases there are problems of transporting a large quantity of environmentally dangerous material. An alternative approach would be containment of the mercury-containing soils and silts in situ. 80% of the silt is thought to be in the 25 km of the river immediately below Temirtau. Much of this could be moved into meanders in the river, then isolated by realignment of the river bed. The remaining contaminated silts could be moved to reservoirs or ponds close to the river. The fundamental problem is choice of the safest method of moving the silts. It is also necessary to choose the most reliable method of isolating the contained material and preventing the possibility of erosion of the containment area.

TERRITORIAL-GEOGRAPHICAL PERCULIARITIES OF WATER CONSUMPTION

Tchernyaev A.M., Loginova N.N., Belova L.P.
RosNIIVKh, Yekaterinburg, Russia

Geography of the water consumption in Russia is formed under the influence of social-economical factors when the territory and extent of the surface water pollution are differentiated extremely in time and space of the water sufficiency.

Inspite of water consumption variety there are the districts in the country where some branch types of water consumption prevail. The water situation in every district is characterised by the complex of quantitative and qualitative parameters (water sufficiency, volume of water consumption, quality of water consumed, etc.).

The type of the water consumption of some district is determined by the coefficient of the industrial specialisation used under the economical division into districts.

The criterion of the quantitative evaluation of water sufficiency is the ratio of water intake to the minimum river liquid water content in limited winter period taking into account the fact that the possible (ecologically safe) water intake from the rivers in natural conditions is 25-40%.

The criterion of qualitative evaluation of surface water is the percentage of polluted wastewater discharge to the minimum winter average monthly river discharge of 95% frequency. The extent of water bodies pollution is evaluated using the Index of Water Pollution.

The water situation assessment on the base of principles mentioned above enables to fix the districts in the Russian Federation of industrial, agricultural, fishery and other types of the water use. The borders of such the districts usually coincide with the administrative borders or the borders of the river basins.

Calculations show that the territorial organising of the water consumption as regards the quantitative aspect is quite co-ordinated with the natural water sufficiency excluding some districts. The majority of the districts is characterised by the low and middle extents of quantitative use of water resources. The possibilities of permissible water intake in the districts coincided with the basins of the Ural and Don rivers regarding the territory have already been used in fact. At present the value of the quantitative use in these districts is over 70%, although the water intake has been reduced in recent time. The value of the water resources use is near the maximum limit in water complexes of the Volga, Kuban and Terek rivers basins.

Almost the all exploited surface water resources are polluted to some extent. The correlation between the portion of wastewater discharged and river water discharge shows that the impact level of the most part of water sources in the Ob, Irtysh, Angara, Volga, Ural and Neva rivers basins is very high, and that the impact level of the most part of water sources in the Terek, Kuban and Don rivers basins is extreme high. These facts are among the important limiting factors of water consumption.

The conclusions acquired enable to assess impartially the present water situation in the country and in the regions on the whole.

THE DETERMINATION OF TRANSPIRATION AS IMPORTANT PREMISE FOR ECONOMY OF FRESH WATER

Terteryan B. Petrosyan N.
Association of water problems and hydraulic engineering

It's a well-known fact that the main consumer of fresh water is the plant. In the drained regions the scarcity of water fills up by irrigation. The contemporary demands to the irrigation are:

- to guarantees the optimal crop capacity of sewage-farms,
- to improve or at least to mountain the natural meliorate condition of sewage farms,
- to guaranties maximum economical usage of water.

To solve these tasks it's necessary to do the processes of watering maximally operative and to do the performance about irrigation more adequate to the point of the water, which will make possible to use the fresh water, more economy.

The land between crop and irrigation expressed by coefficients of transpiration. Although they haven't the correct performance about transpiration values.

They use the "biological curve of evaporation" not

enough correct during determination of the transpiration. Often in the departments of irrigation systems the biological curve of evaporation is identifying with summary evaporation. Although the summary evaporation consists from evaporation from bare soil. Physical evaporation and transpiration biological evaporation.

It's very important to define these components separately. It becomes possible to do this by Budagovsky's method. We have definite the transpiration and evaporation from bare soil for all main agricultural plants in dependence from vegetative period for different altitudes. It does possible to infer that about 45% of fresh water in Armenia the whole is gone to the evaporation from bare soil; which is not productive. So, we have considerable quality of potential reserves of water resources, which must be regulated.

URENGOI PRODUCTION COMPLEX AND WATER ENVIRONMENT. OPERATIONAL IMPACT ASSESSMENT

Tsatsulnikov V.T., Kamenev A.P., Fomina S.T.
TyumenNIIgiprogas

The results of assessment of operational impact upon water environment performed by TyumenNIIgiprogas within Urengoi Production Complex throughout its existence led to the conclusions below.

The water environment within Urengoi gas field is being affected *In a dual way, i.e.* chemical pollution of water ways and bodies through waste disposal and use of mechanisms, including water extraction for industrial and drinking purposes.

Mechanical influence upon water bodies prevails at construction stage and generally results in changes in discharge pattern, bog formation, channel damage and river bank erosions, turbidity increase, downgrade and water level changes following pipeline and road construction. In addition, spawning and feeding sites are lost to river crossings, and surface and subsurface waters are extensively used for drilling operations.

In the course or Urengoi industrial development surface and ground water resources have not been depleted due to the fact that actual consumption at most facilities remains at 1/2 to 1/5 of the design rate. Therefore, existing water supplies can be used for installations under construction and projected facilities.

Hydrochemical analysis revealed mostly local contamination of water bodies *within Urengoi Production* Complex, mainly in gas plant sites, well pads, pipeline routes ..and other heavy duty industrial works. Besides, dispersion range of hazardous substances is not uniform and in some cases unaffected water bodies were registered even at close proximity to operational facilities. Water pollution close to the field boundary is considerably lower than that of the central section. In general, the degree of surface water contamination remains stable while spatially expanding.

Normally, concentration of base ions and microcomponents including those of heavy metals (excl. iron and manganese) in surface and ground waters is well within permissible limits. Petroleum products, diethylene glycol, *methanol*, phenols, synthetic surfactants, and NOX are among regular contaminants in the area. Although singular concentration values of these agents sometimes exceed permissible limits, their average concentrations are relatively low and vary slightly. Concentration of most contaminants in subsurface waters is much lower than on the surface due to more robust natural protection of underground aquifers, and this is the evidence of downward pollutant migration. However, existing contamination types can be observed for a long time since the natural self- purification processes in Arctic waters proceed at in extremely slow pace.

Thus completed studies revealed that Urengoi Production Complex seriously affects water environment, mainly by contamination. Nevertheless, the overall condition of water bodies in the area can be deemed more or less satisfactory. Any reliable projections of status changes will be achievable only with establishment and practical application of water environment monitoring and dedicated research, Implementation of the proposed sustainable development and preservation procedures will help to prevent future pollution of water ways and bodies within Urengoi Production Complex and to improve its present environmental standing.

USAGE AND PROTECTION OF WATER RESOURCES IN THE REPUBLIC OF BASHKORTOSTAN. PROBLEMS AND HOW THEY ARE SOLVED

The Republic of Bashkortostan is one of the regions of Russia where industry is developed very highly.

Concentration of industrial enterprises is much higher than in other regions of Russia, including oil-processing, petrochemical and chemical branches of industry, which are ecological more dangerous.

5 % of the total Russian oil is extracted, 16 % is processed and 30 % transported in the Republic of Bashkortostan.

Bashkortostan takes the fifth place in Russia in the total volume of industrial output and the third place per capita.

Every citizen of Bashkortostan is provided with 6.6 thousands m^3 of water per year.

The usage of fresh water in Bashkortostan was reduced *from 1980 y. to 1996 y. from* 1049 millions m^3 (25%), including 605 millions m^3 (53%) for industrial needs, but for public

utilities and agricultural needs it increased from 257 to 335 millions m^3 and from 13 to 153 millions m^3 accordingly.

Industrial water- circulation reached its maximum in 1988 8.6 billions m^3, then it gradually reduced reaching 6.3 billions m^3 in 1996 y..

The volume of sewage water reduced within the above mentioned period from 956 millions m^3 to 646 millions m^3 (33 %).

The increase of polluted sewage water was 65 % and in 1996 it was 95.5 millions m^3, including not properly purified water - 416 millions m^3 which make 75 % increase in volume, and non purified water was reduced to 32 % and included 80 millions m^3.

water which didn't need purification increased in volume to 148 millions m^3, which made 69 % and properly purified water was reduced to I % and comprised 0.56 millions m^3.

Only 38 (20 %) out of 176 sewage purification constructions function effectively in the republic.

According to the resolution № 61 passed by the government of the republic in 1997, economic sanctions will be used to those who neglect nature protection measures and not to fulfill them within the appointed time.

Work is begun to introduce industrial norms for polluting substances for enterprises - subscribers of municipal water - supplying and sewerage systems, Russia lacks such an experience.

Economic mechanism are being worked out in the sphere of subscriber - owner of purification structures - water reservoir.

A mighty analytical systems with unique technology is built in the republic. The method of utilization of silt of biological purification system at the Ufa state industrial enterprise "Chimprom" is worked out.

The institute of problems of applied ecology is making researches concerning the presence of benzopiren.

Measures are taken to exclude pollution of the river Shugurovka. Projects are worked out to prevent pollution of surface and underground waters from the Ufa plant of the synthetic spirit and the Ufa oil - processing Plant (for the river Belaya).

The republic still faces some problems in oil - processing and other branches of industry that require solution.

ON THE WATER RESOURCE MANAGEMENT IN THE COASTAL CITIES

Vasiliev A.S.
State Oceanographic Institute

A dramatic development of technologies in the twentieth century has lead to a water budget shortages and changes in the inner water ecosystems in many regions of the world. This problem is essential for Russia, especially for its southern regions. There is an increasing demand of freshwater for developing industry, irrigated agriculture, restoration of the inner water ecosystems, protection of water environment from pollution. The shortage of freshwater is most detrimental to the coastal cities. This problem is presently dealt with by purification of the sewage waters which is important but not sufficient for preservation of water ecosystems. The existing projects for transport of freshwater from the nearby regions require significant investments, with the consequences for the ecosystems of inner waters and seas being unpredictable. The achievements in simulations of the complex marine ecosystems, development of instruments, meteorology, surface and groundwater hydrology, management systems have given an opportunity to solve problems of ecosystem management as well as protection of water environment as a source of the Earth's life. This problem can be solved by a development of the regional (within the water catchment of a given coastal region) automated systems of the natural process management. The latter covers monitoring, mathematical simulations of the water and substance cycles within the coastal region water catchments, including biochemical processes of transitions in the living and nonliving nature. This serves as a basis for working out technical management decisions which modify the elements of the environmental substance cycle.

For instance, in the last 20-25 years, the shelf areas of the Azov and Black Seas have been experiencing large anthropogenic pressure. The most important of them is a disruption of the freshwater budget in the water catchments of the southern seas

due to water irrevocable consumption for the agricultural and industrial development of the southern regions of Russia and Ukraine. The disruption of freshwater balance of the water bodies, both the entire sea (the Black, the Azov) and its individual regions (bays, lagoons, etc.), leads to an increase in the water and salt exchange via the strait and, consequently, in a larger salinity of the fresher sea and less vertical gas exchange there.

All these changes eventually result in a sharp drop in biological productivity of the water body both in lowest and highest elements of the trophic chain and larger deficit of freshwater which is necessary for marine ecosystem sustention.

Thus, the water and salt exchange via the strait is an important factor of the sea ecosystem formation under anthropogenic effects. If an efficient way can be found to control the water and salt exchange in the strait without its entire closure (to preserve the transit biota), one will be able both to control the ecosystem development in the sea as a whole and to solve a number of problems related to deficit of the freshwater budget in the southern Russia and Ukraine.

These problems are proposed to be solved by an installation of a one-directed valve mechanism in the strait. This is a lock of a wing-like shape designed to control the salt, water and gas composition of the water body. The mechanism controls these parameters automatically responding to the current structure in the strait. Also developed is a mathematical model of the sea region which allows an intended

modification of the automatic operation of the valve mechanism when controlling the marine processes.

The numerical simulations have shown that, for instance, an installation of the wing-like valve mechanism in the Kerch Strait aiming at sustention of the sea water characteristics as they used to be in 70-ties can save up to 10 km* of freshwater per year.

The outlined problems can be also effectively solved for the river mouths with a tidal regime where the freshwater (including drinking one) in the vicinity of the coastal cities is becoming more salty.

WATER RESOURCES CONSERVATION UNDER OPERATION OF IRRIGATED AGRICULTURAL LANDSCAPES

Yurchenko J.F.
All-Russia Research Institute of Hydraulic Engineering and Land Reclamation

The analysis of operation of the systems of irrigated agriculture and its subsystems has demonstrated the necessity to reform their operation, aimed at restoration of the strategy of land reclamation activity to solve the problems of environmental conservation.

The developed [2] recommendations on operation of irrigated agricultural landscapes include the following principal requirements:

- priority of social and ecological conditions in comparison with economic efficiency of reclamations:
- landscape approach when organizing lands of agricultural use;
- co-organization of land improvement and agricultural activity;
- enhancement of information support for the procedures of decision making.

The requirement of priority for social and ecological conditions is dictated by the law of irreversibility of interaction between man and biosphere [1]. Land reclamation activity is dealing with most scarce resources — water and land.

The achievement of social and ecological balance during operation of irrigation systems is envisaged both by way ofecologization of land reclamation activity (Fig., 2.1 ...2.4; 5.1 ...5.4) and by conservation of natural ecosystems (Fig., 4.1 ...4.4)

Landscape approach when organizing lands of agricultural use is naturally connected with the orientation of land reclamation activity towards achievement of harmonious conformity between society and natural environment (Fig., 2.5, 3.1, 4.2, 4.3).

The necessity ofco^frganization of land improvement and agricultural activity is caused by

the availability of a rule of integral resource, according to which the damage of competing branches of the economy under joint operation of ecological component or ecosystem is increased with the growth of changes of the latter.

Co-organization of land improvement and agricultural activity in "Recommendations..." is offered first of all through the measures of the system of irrigated agriculture, including technologies of cultivation of agricultural crops based on artificial water supply (Fig., 3.2).

The importance of information support for the procedures of decision making is increased essentially due to growth of integration in the process of evolution of both biological and social systems. Of special importance is the knowledge of information-managerial networks of biosphere, but not only the information about its state.

To improve information support for the decision makers, a ctructure of determining land reclamation and ecological situation of irrigated and adjacent lands is presented in "Recommendations" and the elements of subsystems of agricultural landscape, subjected to control in the process of its exploitation, are distinguished.

Layout of developed "Recommendations" for operation of irrigated agricultural landscapes, specifying a structure of the document and its basic content, is presented in Fig. Later on it is supposed to establish computer-based information decision-support system, the methodical support of which will be based on the results of present investigations.

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Layout of methodical instructions for operation of irrigated agricultural landscapes recommendations on operation of irrigated agricultural landscapes.

1. General provisions.

2. Measures for operation of irrigation systems, securing ecological safety and saving of natural resources. 3. System of operation of irrigated lands and technologies of cultivation of agricultural crops.

4. Conservancy measures at irrigated agricultural landscapes.

5. Improvement of technological decisions on irrigation regime, operation of irrigation network and technologies of cultivation of agricultural crops at reclaimed agricultural landscapes.

I.I Structure of agricultural landscape and factors of influence of land reclamation systems.

1.2 Criteria ofecologically sound influence of irrigation on agricultural landscape.

1.3. Assessment of the state of irrigated agricultural landscape.

2.1. Provision of required hydrological conditions.

2.2. Alteration of hydrogeological and chemical conditions of irrigated and adjacent lands. Q

2.3. Improvement of soil fertility.

2.4. Prevention of damage of agricultural landscapes by engineering and geological processes.

2.5. Preservation of medium-forming functions of agricultural landscapes.

3.1. Recommendations for arrangement of crop rotation areas in conformity with elementary morphological structure of agricultural landscape.

3.2 Technologies of cultivation of agricultural crops on irrigated lands, securing safety of agriculture and ecologically sound production.

4.1. Methods of provision of special conditions for monunents of nature.

4.2. Optimization of structure of agricultural landscape.

4.3 Protection of water bodies and water courses.

4.4. Protection of wildlife habitat.

5.1. Improvement of irrigation technology.

5.2. Improvement of sprinkling technique.

5.3. Improvement of subsurface irrigation network.

5.4. Technology of cultivation of agricultural crops on the lands of periodically pulsed irrigation.

5.5. Computer-based management of water distribution.

ESTIMATION OF THE ECOLOGICAL SITUATION OF STURGEON SPAWNING SITES

Zaitsev V.F., Fiodorova N.N., Kazantseva S.Z., Gorden U.V., Shipulin S.V.
The Astrakhan State Technical Universiti, Astrakhan, Russia

Monitoring of heavy metals content in the Volga river waters on sturgeon spawning sites as well as in their internal organs and tissues is being implemented at present.

Recently field research works have been carried out on sturgeon spawning sites and in the regions of fry migration during spring of 1997.

Table. Average levels of heavy metals content in the Volga river waters.

Region of sampling	Elements (mg\.)							
	Pb	Mn	Cu	Fe	Cd	Co	Ni	Zn
50 km. From the city Astrakhan	0.0010	0.0008	0.0016	0.0021	0.0003	0.0004	0.0015	0.0023
102 km. From the city Astrakhan	0.0015	0.0004	0.0007	0.0022	0.0004	0.0006	0.0025	0.0022
150 km. From the city Astrakhan	0.0006	0.0010	0.0015	0.0022	0.0003	0.0002	0.0016	0.0023
200 km. From the city Astrakhan	0.0027	0.0007	0.0017	0.0027	0.0005	0.0008	0.0027	0.0008
Average(m)	0.0015	0.0007	0.0014	0.0023	0.0004	0.0005	0.0021	0.0019

The order of average levels of heavy metals content in the Volga river was the following: Fe > Ni > Zn > Pb > Mn >Co > Cd that does not completely correspond with the analogous levels of these elements content in sturgeon organism : Fe > Zn > Cu > Mn > Ni > Pb > Cd > Co.

Water in the region of Tsagan - Aman (200 km. from the city Astrakhan) turned out to be the most polluted one, but water near Gusiny island was the purist (150 km. from the city Astrakhan).

As a result of research study the highest level of heavy metals content was determined in the central blood - producing organ - spleen but it was a little bit lower in the intestine and much lower in in the liver and in the trunk kidney, gill, etc...

The lowest level was being observed in the gonads that indicates tissue - hematic barrier withholding accumulation of these metals in the gonads.

Thus we can conclude that constant control of qualitative state of hydrobionts as well as of sturgeon species is being carried out with the help of bioindexing methods.

MEGA-ECOSYSTEM OF THE RIVER BASIN AND RESEARCHES OF INTERBASIN LAND-WATER ECOTONES AS THE BASIS FOR ANALYSIS OF ITS FUNCTIONAL UNITY

Zaletaev V.S., Dikareva T.V., Podolskiy S.A.
Water Problems Institute RAS, Moscow, Russia

Functioning of mega-ecosystem of the river basin as unite natural system is provided by interaction of its structural blocks - watershed area, interbasin water objects, including small rivers, floodplain waterbodies, temporary streams, bogs, depressions occupied by marshes or collecting precipitation and reservoirs. In this system of interactions one can select the most active zones (belts) of biotic interactions that have hydrogenic conditioning. These zones are land-water ecotones that are contact patches between water objects and terrestrial ecosystems of riparian belt. They have barrier and membrane functions and serve as canals for flows of matter and organisms settling as well as zones of life concentration, biodiversity and more than that, sometimes as places of pollution accumulation that comes from watershed area and water surface.

Land-water ecotones form in every river basin large and very complicated, typologically various net that resembles capillaries. It is ecotone system that formed in the contact zones provide active interaction of biotic complexes of various spheres that gives ecotones the role of zones with high activity of biotic processes in the biosphere and high biodiversity.

Development of water-management construction and diverse activity (industrial, agricultural, recreational) that impact the river flow, surface and ground waters flow on the watershed areas complicate significantly the functioning of mega-ecosystem of the Volga basin. But the whole system of agrotechnonatural interactions must be considered and analyzed as united dynamic, ecologically active complex of specific basin bearing in mind all actual and distant in time impacts on its separate patches and natural complexes and on the whole river basin. Such approach can provide possibility to prognoze ecological processes development and the destiny of mega-ecosystem of the river basin.

One of the most priority task is creating of new natural-agricultural dividing into regions of the Volga basin on the basis of analysis of the new changes in the state of natural complexes of watersheds and floodplains as well as changes in distribution of agro- and cattle-breeding complexes, industrial centers (considering specificity of their impact on terrestrial and water ecosystems, on volume and quality of water flow) and population agglomerations. For example, territory of the Volga basin include 40 administrative units (regions and republics) - 38 in Russia and 2 in Kazakhstan. Variety of forms of agricultural activity in the river basins makes it complicated to select regions in the basin. But it is necessary for organisation of the net of ecological monitoring and prognosis of the state of terrestrial natural complexes, water ecosystems, state, stability and development of the whole mega-ecosystem of the basin.

NATURAL ENVIRONMENT ECOLOGY IN THE KALININ NUCLEAR POWER STATION AREA

Zhuzhneva E.V.
Post-graduate student, Water Problems Institute, RAS, Moscow, Russia

Lithological-chemical soil sampling, sampling of surface and ground water, vegetation cover and bottom sediments, estimation of radionuclides and microcomponents content have been made by Kalinin Geological Exploration Group (Yu.G. Osipov, Z.M. Bolshakova, V.M. Gladkov, and et.al., Geological-ecological study in the Kalinin Nuclear Power Station). Basing these data the analysis of ecological state for some natural environment components such as soil cover, surface water, bottom sediments, has been made.

It should be noted, that Kalinin NPS ha been built at a distance of 3 km from town Udomlya, Tver region, on the Udomlya lake coast. When constructing the station, the problem of its impact on the environment, complex engineering geological conditions, lack of reliable water supply sources have not been considered, therefore, the Udomlya and Pesvo lakes, connected by a channel, are both cooling reservoirs for Kalinin NPS and sources for domestic and potable water supply. The Siezha river is the only river, outflowing from the Udomlya lake, and flowing into the Msta river, Ilmen lake, then Volkhov, Ladoga, Neva. The main attention is concentrated in this work on radiative, microcomponent and heat conditions of soils and water system.

According to the main results of the Chernobyl accident aftereffects liquidation (Collection of Theses, Minatomenergo, Chernobyl, 1988), the territory of Kalinin region has not been subjected to Chernobyl contamination. Thus, radiation background changes within 30 km zone of Kalinin NPS are supposed to be caused by its own functioning. But studies, carried out in the latest years in the Radiology Faculty of Pittsburg University (USA), have proved, that short-time intensive irradiation can appear less destructive, than low background one of more time (Low irradiation paradoxes. Nature and Man. N9, 1989). The existence of a safe radiative level, amounting to 35 rem/year, below that penetrating radiation does not affect human health, was rejected by experiments (Maximov M.T., Adzhagov G.O. Radioactive contamination and its meaning. M. Energoatomizdat, 1989; Ecological aftereffects of natural environment pollution in the Chernobyl NPS accident area. Izrael Yu.A. Atomic energy.1988.V.64.iss.1).

Soil layer is primarily subject to contamination in the area of large industrial complexes functioning. All the environment

studies, made from August 1988 to September 1989, are characterized with 9-13 rem/hour in 1988 and 11-14 rem/hour in 1989, here the highest values have been observed in a 5-km zone, where there are cooling reservoirs, between that gamma-field values amount to 26 rem/hours in 1988, and 23 rem/hours in 1989. During a year, there appeared a tendency gamma-values increase by 2-4 rem/hours. comparison of results obtained in 1989 by different services, using different equipment, demonstrates the increase of this value, measured in 1982, before stating the NPS operation in 1,2-1,8 times for 70% of events, and for 30% they are close to gamma-field characteristics in 1982. The increase of the values points to the fact NPS and Chernobyl accident impact on its formation. Cesium 137 and 134 are most widely spread among radionuclides. Their ratio is used for singling out cesium contamination of Chernobyl, station or global types (Yegorov Yu.A. Predicting radionuclides accumulation in the main components of NPS cooling reservoir ecosystems and assessing possible radionuclides runoff into water reservoirs. M.Energoatomizdat.1987, iss.12). Cesium 137 maximum values amount to 20,25-32,86E-10 Cu/kg, here there are point with radionuclides ratio less than 1, that indicates their station origin. Considerable number of samples with increased radionuclides content (135%) is spatially confined to 20-km zone.

Analysis of a relation between radionuclides and landscapes indicates, that maximum radiative conditions are characteristic for forests and landscapes with slowed water exchange. The most "pure", considering radioactive conditions, are floodplains, swamps and peat bogs.

An anomalous concentration of such elements as vanadium, strontium, lanthanum, cerium is observed in the 5-th soil layer in the vicinity of NPS. Natural landscapes accumulate manganese, zirconium, barium, yttrium, ytterbium, lithium, vanadium. Titanium, copper, molybdenum, lead, zinc prevail in anthropogenic landscapes. On the whole, there are four geochemical fields of anomalous elements, coinciding in space with the increased radiation zones in the Kalinin NPS territory. The largest one is to the East of KNPS, its area is 210 sq.km, and there is cobalt in its composition-an element of the second class of risk (8,3%). To the West of KNPS there is a polyelement field of lead, vanadium and cobalt, along the Mazhitsa river valley, Magi and Svyatoye lakes. Anomalous field to the North of the station contains zinc (7%). During a year the area of fields and number of anomalous points have increased, in addition boron, silver, and other elements have been found, and saturation of the former elements has also increased. Anomalies density is growing when approaching KNPS.

Taking into account subacid soil reaction (6,5-7), processes of cobalt, manganese and tin leaching and their transfer into readily soluble compounds are assumed to occur.

Radiative background has increased from 26 to 31 rem/hour in surface water for 1988-1989 years; in 1988 there are five anomalies of summarized cesium (more than 5E-11 Cu/l) singled out, two of them being confined to a 10-km zone, that makes it possible to relate it to the Kalinin NPS functioning. By 1989, areas of increased surface water gamma-activity have been confirmed, areas of anomalous cesium content have been revealed in the northern part of the Udomlya lake, new anomalies with a low cesium isotopes ratio have appeared. In some rivers, including the Siezha one, maximum for this territory strontium-90 content has been observed.

Bottom sediments sampling indicates there lakes attachment to agricultural and anthropogenic impact. The content of strontium-90 in he lakes is 0,18-0,45E-12 Cu/l, while value is not exceeding 0,19E-12 Cu/l in the nearest points. The excess of "zero" background for cesium is more than in 20-61 times. For the present, the nucroelement content in the dry residue and bottom sediments is below maximum permissible concentration for wastes.

CHANGES IN THE CHAPAYEVKA RIVER ECOSYSTEM EXPERIENCING AN INTENSIVE TECHNOGENIC LOAD

Zinchenko T., Vikhristyuk L.
Institute of Ecology of the Volga River Basin of the Russian Academy of Sciences, Togliatti, Russia

Complex studies of an ecological state of the Chapayevka river were conducted during 1990-1996. Particular attention has been given to abiotic and biotic aspects when assessing the impact of eutrophication and pollution on the water quality at the background of a general degradation of the ecosystem.

The Chapayevka, a left-side tributary of the Saratovskoye reservoir is a typical lowland highly-polluted river. Having a catchment area of more than 4,000 km, the river runs for 290 km and is characterized by a low flow velocity and shallow water.

The human-induced load from the catchment area along the whole length of the river is non-uniform. Its upper section experiences a diffusion pollution resulting from agricultural inputs of most of biogenic substances. The lower reaches of the river are under the load of point sources of pollution originating from the towns of Chapayevsk and Novokuibyshevsk (large centers of chemical and oil-chemical industries). During 1990-1994 the average annual amount of industrial effluents was about 38.5 mln.m3. These are mainly responsible for contaminating the river with toxic elements of organic and inorganic genesis.

Such a heterogenous anthropogenic influence upon separate sections of the Chapayevka river has determined a differing hydrochemical state of the riverine water masses. The most hazardous section is in the vicinity of the town of Chapayevsk where concentrations of cadmium, phenol, oil products in the water are dozens of times higher than permissible.

As to the combination of hydrochemical parameters, the Chapayevka water is referred to IV-V classes of purity.

Bottom sediments reflecting the nature of biological, chemical and physical processes in the water, as well as a direct impact of industrial wastewaters, contain substantial amounts of toxic pollutants. In terms of the build-up of heavy metals, the Chapayevka river is ranked among hazardous and extremely hazardous streams; their concentrations are 3 to 5 times, and that of cadmium 38 times (11.23 mg/kg) exceed the background indices. The contamination with oil products and phenols is within 1527-9487 mg/kg and 0.32-1.29 mg/kg, respectively (at the norm of 1,000 and 0.05 mg/kg). The accumulation of chlor-organic compounds is hundreds and even thousands of times higher than allowable limits (Volga: Independent Investigations, 1994).

When carrying out any complex field studies bottom communities remain as a most reliable indicator for the assessment of an ecosystem's state because they reflect the cumulative processes occurring in the water masses. Areas with an intensive pollution are characterized by an abrupt reduction in the numbers and diversity of species in the benthic fauna. The stenobiontic species disappear from the faunal composition. There are occurrences of larval chironomids with evident morphological deformities.

The quantitative assessment of the zoobenthos share in the uptake of organic matter testifies to a low capability of benthos for self-purification that, in turn, indicates to the change in the natural typology of the Chapayevka river at an intensive anthropogenic load.

Non-traditional objects of studies, such as hydrocarines, micromycetes and nematodes can be highly indicative of an aquatic ecosystem's state under the conditions of eutrophication and contamination. The abundance of nematodes within the meiofauna decreases, whereas that of cyclopes increases. Hydrocarines disappear from the faunal composition. At the decrease of a total amount of micromycetes, the share of melanized fungi resistant to contamination increases.

The Chapayevka river is taken as a model object for carrying out complex studies aimed at obtaining generalized data on the state of a riverine ecosystem in the presence of a high anthropogenic load. The intensity and duration of the influence upon the riverine ecosystem determines the extent of biotic changes therein.

SECTION I
WATER RESOURCES RATIONAL USE AND PROTECTION

SUBSECTION
GROUND WATER

ECWATECH

COMPUTER SIMULATION OF THE HYDROGEOLOGICAL SITUATION UNDER A PROPOSED DRAINAGE SCHEME IN KUWAIT USING MODFLOW SOFTWARE PACKAGE

Akbar, A.S., Al-Murad, M.A., and Ghoneim, H.F.
Kuwait Institute for Scientific Research, Water Resources Division, Hydrology Department, P. O. Box 24885, 13109, Safat, Kuwait

Ground water level rise in Kuwait City and Suburbs is a major problem that Kuwait has been suffering from for the past two decades. Manifestations of such a problem are flooding of basements, formation of water ponds in low lands and damage to road pavements. The implementation of controlled dewatering schemes that would lead to lowering the ground water level safely to a predetermined depth has, therefore, gained urgency. A 3 Km2 area was selected to undertake the proposed dewatering scheme. The study area is located south east of Kuwait City. The water table in this area is present, in some parts, above the ground surface (forming water ponds), while in other parts it occurs at approximately 3 meters below the ground surface. The ground surface generally slopes towards the sea in the east. An earlier investigation was carried out in the study area using one production well, a short section of horizontal drains and 11 observation wells. To lower the ground water level to a depth of 1.5 m below the existing ground level over the whole of the study area, a number of vertical deep wells and horizontal drains were proposed. Based on the lithological description of the cores and cuttings of the drilled boreholes and the conducted pumping tests, the subsurface of the study area was divided into four distinct aquifers. To assess the hydrogeological situation under the proposed drainage scheme, a computer simulation package (MODFLOW) was used. Eight drainage scenarios were investigated by the simulation model. The scenarios included combinations of deep wells and/or horizontal drains. The pumping rates were manipulated in the different scenarios under the prevailing hydraulic and lithological characteristics of each of the four aquifers.

The results of the simulation model suggest that horizontal drains can lower the ground water level more efficiently than deep wells in the area of study. These results also indicate that the effect of the drainage process is more pronounced in aquifers 1 and 2 (upper aquifers) than in aquifers 3 and 4 (lower aquifers). In fact, aquifer 4 hardly shows any response to the drainage process. The simulation results were used as a basis for a comprehensive dewatering system in this area.

GROUNDWATER QUALITY UNDER DIFFERENT NATURAL COMPLEXES

Akhmet'eva N. P., Lantsova I. V.
Institute of Water Problems RAS, Moscow, Russia

The quality of surface and ground waters of the Ivan'kovskoe Reservoir drainage area depends on the landscape specific features and on anthropogenic loads. Three principle types of natural complexes are remarkable for the drainage area of the reservoir: forests, meadows, and swamps.

1. Forests occupy about 50% of the drainage area and they are fir, pine, and small-leaved birch and asp. On the Ivan'kovskoe Reservoir beach, introduced pine-and-fir forests occur. Under forests, groundwater has poor mineralization, hydrocarbonic calcium-magnesium compounds with $N\text{-}NO_3$ concentration equal about 1 mg/l, $N\text{-}NH_4$ concentration 0.4--1.0; $P\text{-}PO_4$ 0.04--0.1; K 0.6--3.0; SO_4 10--60; Cl 1--5 mg/l; pH of water 4.5--7.8 depending on forest type. Total mineralization of groundwater is 150--400 mg/l.

The type of forest influences on the quality of groundwater. Under fir forest, where the depth of groundwater is 1--1.5 m, it has the most acid reaction (pH is 3.5--6.0), and the high concentration of SO_4 (up to 50--60 mg/l). The concentration of HCO_3 is 120--300 mg/l, $N\text{-}NO_3$ 1.0--1.5 mg/l. Here, the content of metals is slightly increased.

Under pine forest, groundwater lies at a depth of more than 3 m and has weak acid reaction (pH is 5.5--6.8). Total mineralization here is lower than under fir forest (150--200 mg/l). The concentration of $N\text{-}NO_3$ and $N\text{-}NH_4$ are lower too (0.6--1.0 and 0.3--0.5 mg/l, respectively).

Forest is the buffer zone that protects groundwater from the pollutants because forest soils have high sorption capacity and plants consume biogenous substances. Forest soils are rich with humus (2--5%), and they sorb well chemical elements. The soil of loamy composition play an important protection role. According to the experiments, the monolite of loamy podzolic soil retains 50--60% of biogenous pollutants. If the thickness of falled leaved or moss layer is significant, this value increases up to 70--80%. A good protection against the pollutants of groundwater is the asp forest that accumulates nitrogene in root tubers.

2. Meadows occupy about 20% of the drainage area. Dry valley meadows are very vulnerable to anthropogenic load. These meadows are sandy and sandy loam, and they have a low sorption capacity that contributes to pollutant fast reaching the groundwater level. The lowland meadows, on the contrary, are very good natural filters. The great part of pollutants (60--70%) are retained in the upper layer of the loamy soil. The lowland meadows are intensively used like hay-making and pasture lands. Bacteriological pollution of this soil is observed only in the upper part (up to 20 cm) of the soil layer. On the agricultural fields (about 12% of the drainage area), mineral and organic fertilizers are used in the dozes: 20--30 kg/ha of NPK and 8--10 t/ha of manure. In the kitchen-gardens, they use up to 1000 kg/ha of NPK and 15--20 t/ha of manure; the fields of poultry farms are provided with the most high dozes of organic fertilizers, up to 50--60 t/ha. Our observations on the quality of groundwater show

that in the 30% of cases, the water in wells contains $N\text{-}NO_3$ more than 10 mg/l, $N\text{-}NH_4$ more than 1 mg/l; high concentrations of total phosphorus (>0.3 mg/l) are sometimes observed; the concentrations of potassium and chlorine (up to 30 and 200 mg/l, respectively) are higher than their background concentrations.

The springs of this area, situated on the board of the reservoir, have the reputation of the best potable water. However, our investigations show that during the last 15 years, the quality of this water has been getting worse and worse. For example, the spring near the camping "Razdolie" has the high concentration of phosphorum (up to 0.6 mg/l), permanganate oxidizability is high (7.0 mg O_2/l). The spring near the village of "Teshilovo" contains large amounts of P and Cl. The springs in the villages of "Gorodnya" and "Selikhovo" contain much of $N\text{-}NO_3$.

3. Swamps are largerly spreaded on the drainage area of the Ivan'kovskoe Reservoir. The groundwater level is 0.5--1.5 m. The concentration of nitrogen (nitrate and ammonium) is not high (0.1--0.2 l and 0.8--1.2 mg/l, respectively). The concentration of phosphorus is 0.04--0.5 mg/l, color index of water is up to 500°, permanganate oxidizability is about 10 mg O_2/l.

Swampy lands and swamps are good filters that protect natural waters against pollution. As water passes through waterlogged soil, the process of pollutant sorption occurs.

Thus, under high anthropogenic load, forests and swamps play the important role of filters.

Presently, the problem of the surface water purification with the help of swamps is carried out. Taking this into consideration, we recommend the localization of pollutant sources (garbage dump, stocks of fertilizers and fuel-and-lubricant depot, poultry farms, etc) by way of their enclosing with tree-planting. We do not recommend to dry out swampy lands.

PECULIARITIES OF EXPLOITATION OF GROUNDWATER ON BUILT-UP TERRITORY

Alekperov A.B.
State Committee on Geology and Mineral Resources of Azerbaijan Republic, Baku, Azerbaijan

Conditions of an exploitation of groundwater on a built-up territory depend on the natural, geological, hydrogeological conditions, as well as a city planning development, character and kinds of industry, state of communication lines and other factors of the economic activities of mankind, influencing on those conditions. With an opening up territory the hydrogeological conditions are changed. In the first place consequences of these changes are told on the groundwater qualitative composition and they are became apparent in two ways. If the territory before building is characterized by the fresh groundwater spreading, fit for national economy , after one take place an increase of groundwater mineralisation and its pollution. Due to one its significance gradually loses. If the territory before building is characterized by the spreading of mineralized groundwater and after one take place its freshing and as well pollution.

With the opening up territory a rise of groundwater level of the first from the surface aquifer is the result of a leakage from water-supply, sewerage and formal system, infiltration of irrigating water, in parka and gardens. A problem of level rise is aggravated because groundwater the first from the surface aquifer are produced in a small quantity for technical needs. As a rule a pressure aquifers are exploited. By water supply of the city because of a pressure water of the own areas occurs a wear of pressure and a surface subsidence. With the pressure wear the hydrodynamic conditions of groundwater the first of the surface aquifers are changed, acquiring dominating position. It's become a recharge source of exploited horizon and become worse the water qualitative structure. A pumping back of the residual quality of recycling water into exploited lay is used in the world practice, as to avoid of a groundwater supply exhaustion and the surface subsidence protection then for the sewer water removal-But this replenishment of supply can't changes the natural recharge and lead to changing groundwater qualitative structure.

In the first place the intensive groundwater exploitation promotes to the changing of the hydrogeological conditions: from one side the intensive extraction increases a pulling up incondensative water steam, from other side as well a rate of subsurface drainage is increased, as a result the time of a contact with the aquiferous rocks, the possibility of a concentration structure by chemical elements and combination are decreased.

The groundwater exploitation on the built-up territory should make by small water intakes. The working productivity of the water intake should be defined not only in depending on hydrogeological parameters of the aquiferous horizon. It is necessary to take into account a spatial spreading, a dynamicance in quantitative and qualitative relations of a main source the groundwater recharge. A sparseness of an artificial source of the recharge on the city's area. Its fickleness in time make for a different degree of flooding deposits, a big diversity of colors of the mineralization size, chemical structure of groundwater and a big dynamicance those indexes in time and in space.

By arrangement of a question of the groundwater exploitation should be used the system approach in an estimate of hydrogeological conditions and should be defined the possibility of groundwater using for the different needs of the city's economy. It should be forecasted the negative hydrogeological appearance, the negatively influencing to ecology and development of the city's economy.

In connection with this it is effectively the creating of constant-working hydrodynamical model, integrating all alterations connecting with a man's impact to environment. A data bank of the geo model should be mathematically replenished by information about geological, ecological and industrial situation that will give the possibility to regulate and to forecast either processes.

PROBLEMS OF GROUNDWATER PROTECTION AGAINST POLLUTION BY OIL PRODUCTS

Allyev F.Sh.
State committee on geology of Azerbaljan Republik, Baku, Azerbaijan
Gadjiyev B.A.
Azerbaijan State Oil Academy, Baku, Azerbaijan

Oil products as energetic resources are vitally-important raw material for all the countries, independently of presence oil and gaz deposits in its area.

With every year oil products are more transported from one place of the earth to another by difference ways: pipelines-through seas and lands, tankers, railways, avtocisterns and etc. In all those cases a risk of the negative influence on environment takes place. The environment both in the region of the oil product spreading and on a route of the transportation has the difference natural conditions, with more vulnerable places. In this case, on example of Azerbaijan Republic we consider the problem of preservation a quality of fresh groundwater against the oil product negative influence.

The Azerbaijan Republic is rich in oil and gaz deposits, spreaded on the land and the Caspian sea. In present case we won't be described the ecological problems, connected with prospecting and exploitation of the sea oil deposits and its transportation to the reworking terminals, situated in the Apsheron peninsula Of course even very modern technology can't completely except a flood of the oil product in either volumes. Every flood has a bad influence on flora and fauna of the water medium. The economic damages from these consequences have the difference scales.

In Azerbaijan the problems of the preservation quality of the fresh groundwater are connected with the transportation. The biggest oil and gaz deposits are discovered on the territory of the Apsheron peninsula, the Lower Kura depression, the Near Caspian zone and etc. Everywhere in the area of their situation, the groundwater in natural conditions has a high mineralization (more 10-25 g/l).By chemical composition ones are cloridic sodium nonstandardal. However, with their transportation it is arise a difficult situations-the leakages out of the oil lines. In the last years the cases of groundwater pollution by the oil products become more frequent in the city's territory. In 1987 y. because of the oil products leakages from the pipelines in the area of the Baku metro station "Neftchyllar" and "Azizbekov" on the groundwater level forms a layer by thickness 0,7-1,8 m., occupying the area accordingly 90000 and 300 m^2 . The groundwater lies on the depth 2-4 m. and the oil products coming with groundwater to the metro lines created and Great a dangerously situation as well as a threat for a dwelling houses, a decorative and olives trees. The oil product maintenance in a water sample, forms from 12 to 216 g/l.

A big dangerous arises with a building of the export pipeline. The priority directions are: 1) the oil production from the Azeri, Chlrag and the depth parts of the Gunashly deposit situated of approximately 120 km from Baku on Caspian; 2) the transportation one to the world market.

The oil product transportation will be made from the Sangachal terminal for the Northern and the Western routes. Together with another components the groundwater, the environment being one of the main source of the inhabitants water supply, are exposed to negative Influence In the process of the oil line building and In period of one exploitation.

From Sangachal terminal oil will be pumped over for the Northern route to the Russian port on the Black sea-Novorossiysk. A route length in Azerbaijan make 233 km. and for the Northern way, coming by difference hydrogeological conditions creates the risk of the menace groundwater deposits with exploitation supplies 3888,4 thousand m^3/day, being the source of the water supply, local inhabitants of Baku and etc.

The general extent of the Western route Is 960 km., but In Azerbaijan-481 km. With respect to the groundwater a small sections of the Shirwan and the Garabah plains with exploitation supplies 517,7 and 1939,9 and the Gandja plain-4218,6 thousand m^3/day are the most vulnerable. By considering the materials of the oil lines building we were shown the most dangerous sections with respect to groundwater (apace between rows Tovuzchay and Akatafachay, and the Karayazl section).

RESEARCHES AND STARTING-UP AND ADJUSTMENT WORKS ON INSTALLATIONS DEFFERIZATION AND DEMANGANESE OF UNDERGROUND WATERS IN AQUIFER

Arkhipov 6.5., Kozlov S.A., Kulakov V.V.
NTC Dalgeocenter

In Priamurie since 1989 the installations defferization and demanganese of underground waters in aquifer take root. Is skilled - technological researches and starting-up and adjustment works on installations defferization and demanganese of underground waters in aquifer were carried out in area of cities Blagoveshchensk, Komsomolskk-na-Amure and Khabarovsk.

The introduction of this technology treatment in Russia restrains because of a wide circulation filtrate of superficial structures (quite often with chemical by processing). However, in connection with a low capital investment on a structure of installations defferization and demanganese of underground waters in aquifer (onehole and manyholes) and insignificant in comparison with traditional superficial structures treatment by the operational charges, this technology should borrow a worthy place on working and projected watersupply of underground waters.

APPROACH TO THE PROBLEM OF DEVELOPING OF HYDROMINERAL RESOURCES OF AZERBAIJANI COAST OF THE CASPIAN SEA AND THEIR PROTECTION FROM POLLUTION

Babaev A.M., Aukuliev R.I., Ibraguimova I.Sh., Ismayilova M.M. and Atakishieva N.A.
Institute of Geology of the Academy of Sciences of Azerbaijan and Azerbaijan State Oil Academy, Azerbaijan

The Caspian Coast of Azerbaijan with length of around 800 km covers the territory from the mouth of Samur river at the north up to the mouth of Astara river at the south. Is considered economically developed and densely populated area.

The area possesses considerable and various hydromineral resources, unique nature-climatic factors, which create great possibilities for the establishment of a number of resort zones with complex broad of treatment (sea, climatic and curative) as well as health mass zones of intergovermental importance.

As a result of carried out researches of the mineral waters' fields of the region, we have discovered the regularities of their spreading, saline and gas composition, content of rare elements, resources. As for the main fields (Alasha, Kalaalty, Meshasu, Nabran, Shihovo) we have characterized the peculiarities of dynamics, regime and stocks and implemented resort zoning of the coast.

Mineral waters of the coast are subdivided on the following curative groups:

1) waters without specific components and qualities – nitric, chloride calcium-sodium, thermal waters with mineralization from 2 to 5 g/l. They spread within eastern and south-eastern peripheral parts of Talish pleated area. The outlet of waters refers to fault vilolations, which complicate bridge parts of anticlinal structures, which consist of paleogen tuffogen-sediment formations. The mentioned waters are brought out by wells on Meshasu field from the depth 312-500 m from tuff-sandstone, tuff-alevrolit and argillites of oligocene-miocene. Mineralization of the water 4,7 g/l, content of silicon acid 30-40 g/l, temperature 40°C/Waters are forceful, self-poured out. Discharge of a well 5 l/s.

2) Sulfide (hydrogen sulfide) – methane, hydrocarbonate-chloride sodium waters with mineralization from 15 to 35 g/l, spread within Apsheron artesian basin. Brought out by Shihov well in arch-by part of anticlinal crease, consisted of sandstone-clay formations of productive width of middle Pliocene from depth 2319 m. Content of sulfide 0,3-0,4 g/l, Iodine 25 mg/l, bromide 40 mg/l, silicon acid - 65 mg/l. Waters are forceful. Discharge of a well at saw-pouring out - 3,0-4,0 l/s. Temperature of water at mouth of a well 70°C.

3) Bromide, iodine, bromide-iodine waters – nitrate-methane and methane, chloride and hydrocarbonate-chloride sodium waters with mineralization from 5 to 15 g/l, spread in Yalama-Khachmas and Apsheron basin, belong to sandstome-clay sedimentations of upper Ur and Mela. Lied on depth from 500 to 2000 m. Content of iodine till 50 mg/l, bromide till 60 mg/l. In number of cases waters are iodine-bromide.

4) Waters with high concentration of organic substances spread in the regions of eastern immersion of Big Caucasian pleated area. The most typical are waters of Kalaalty and Tenglalty sources. These waters are similar to naftusinski. Circulation of waters is of cracking-carst character, their unloading happens on cracked zones of tectonic violations and contact with Ur and chalk sedimentations. Content of hydrogen sulfide 0,002- 0,003, bitumen- 0,00175-0,0002, alcohol soluble substances 0,0035- 0,0098 g/i. Temperature of water 9,5-14,2°C.

With purpose of warning the pollution, spoiling and before time exhaustion of the mineral resources, the steps on strict control over the Implementation of work on protection, registration, extraction and lose of the mineral waters are lightened in the work. During the last years the natural factors of the coastal area of the Republic are under complex researches in Azerbaijan. This done with purpose of their usage for resort treatment and rest, developing of ecological ground, sanitary- hygienic and other conditions of regional scheme of resort zoning of the coast, as well as for revealing the perspectives of resort-restoration mastering.

A CONCEPT FOR ASSESSING RISKS AND HAZARD OF CHANGING GROUNDWATER ECOLOGICAL STATE UNDER NATURAL AND TECHNOGENOUS FACTORS

Belousova A.P.
Water Problems Institute of RAS, Moscow, Russia

Environment conservation is one of the most important problems in global sustainable development. The main postulates of this problem has been first mentioned in the highest rank meeting in Rio - de - Janeiro in 1992. One of the most significant aspects discussed there was protection and rational use of fresh groundwater resources. Deficit, gradual depletion and increasing pollution of fresh water sources, as has been noted in the Meeting, is caused by ecologically destroying model of development, and also lack of adequate information and knowledge among pollution on the necessity and ways of protecting fresh water sources. The problem of global climate change and in particular, its impact on fresh water sources was of special concern among the participants. Some approaches have been recommended for supplying people with water for drinking and sanitary purposes, including those, concerning water quality and water resources protection.

In the top level Meeting of the "Eight" in Denver on June 20 - 22, 1997, the fresh water problem has also been paid special attention to and a call to UN has sounded for working out practical measures to solve the problems, concerning fresh water including a support of effective water use, water quality improvement and its purification, technologies development, informing the population and perfecting the institutional base.

Fresh water volume in the water ecosystems is about 2.6 % of the total water on the Earth. A portion of fresh groundwater is less than one percent, but it is the only water supply source in many regions, that is why, when assessing region sustainable development, a role of groundwater should be

considered alongside with surface one. In the Volga basin fresh groundwater role as a water supply source increases from the North to the South, from oversaturated regions to arid ones. In this connection, the problem of assessing hazard and risk of changing groundwater ecological state, and , particularly, its vulnerability to pollution in this industrially developed region is especially urgent due to proving the perspectives of its use and planning sustainable development for certain regions in the Volga basin.

For estimating groundwater ecological state, aimed at proving perspectives of its use and compiling perspective plans of sustainable development for certain regions of the Volga basin, it is necessary to work out a multi - stage system for assessing its state and quality, formed under the impact of natural and human - induced factors, and perspectives for its further change under the influence of predicted climate changes. Multi - stage system for assessing groundwater ecological state, based on different - scale investigations of large and super large regions and also local places, can be united by a single approach, that is assessing hazard and risks.

Under small - scale zoning (1 : 2, 500, 000), characteristic of groundwater state should base on assessing super - regional hazards and risks. Hazard from point of view of influence on groundwater state are both natural processes (karst, permafrost, landslides, and etc.) and some peculiarities of protective zone structure -soils and rocks in the unsaturated zone (small thickness and sand - sandy - loam structure), shallow groundwater and groundwater (absence of confining layers and sandy - loam - clayey structure of water - bearing rocks), unfavorable climatic condition and character of groundwater recharge, and mainly, human impact. Hazard and risk, caused by the effect of protective zone and aquifers structure, are permanent, according to the time of influence.

Hazard is determined by HC (hazard coefficient) and HI (hazard index). For instance, to characterize the influence of the first protective zone level (soils) on the possibility of pollutants to penetrate into the groundwater, HC can be used, determined as a ratio between sand - sandy - loam sediment area of spreading and a common protective zone area; another HC is a ratio between thickness of the first protective zone level and its optimum value, HC for the second protective zone level (aeration zone) is determined in a similar way; to describe the intensity of pollutants movement through a protective zone, HC are composed by relation between either atmospheric precipitation, or infiltration recharge, or rock saturation level and some their characteristic, or optimal values. HI is the sum of all HC, determining the hazard or the level of protective zone penetration relative. Hazard caused by hazard natural geological processes (HNGP) on the groundwater can be determined in a similar way, HC will give relations between aquifer areas, subjected to negative influence of HNGP, and a common area of aquifer spreading by considering probable characteristics of HNGP development in time, the risk can be determined of a certain HNGP impact on the groundwater. A hazard of human induced effects on the groundwater, chemical ones, in particular, can also be determined, using HC. HC values are determined by relations between pollutants concentrations and its maximum permissible concentrations. When determining HI, it is necessary to consider degree of toxicity for pollutants and to determine HI using separate categories of pollutants.

Risk assessment will characterize possibility or repeatedness of pollution process by a given pollutants or group of pollutants. A total risk of groundwater pollution will be determined by a permanent risk of possible polluting object effect and its composition, and a real risk, characterizing the available groundwater pollution. Total superregional risk, characterizing groundwater ecological state changes caused by natural and anthropogenic factors, will be a sum of risk, caused by the structure of protective zone and groundwater, by the impact of HGNP, anthropogenic effect and actual groundwater pollution and depletion and will be material. In future, this risk can be used for assessing economical and social risks, caused by ecological changes in the groundwater under the effect of natural and anthropogenic factors. Besides, it is necessary to assess superregional predictive risk of groundwater ecological state changes caused by predicted climate changes in the XXI century, using a sequence discussed. Regional risk can be assessed during average - scale (second stage in a multi - stage system) investigations, for estimation of groundwater state changes in certain regions in a similar way (like superregional) but with a greater degree of detail and validity. For assessing regional pollution risks by individual pollutants, it is possible to use, the assessments of groundwater protection and vulnerability, transforming them in a simple way. Local risks (the last stage of a multi - stage system) can be assessed under large - scale investigations, as risks, caused by local pollution sources or processes acting within local sites, these estimates must be most reliable. For assessing local risk of groundwater pollution under melioration due to the process of saline - soil and aeration zone rocks desalinization, the results of special hydrogeochemical zoning (Saratov Transvolga area) at a scale of 1 : 50, 000 can be used.

STUDYING THE PROCESSES OF HIGHLY MINERALIZED BRINE MIGRATION IN THE UNSATURATED ZONE, AIMED AT PREVENTING GROUNDWATER POLLUTION

Belousova A.P.
Water Problems Institute of RAS, Moscow, Russia
Dudukalov A.P.
Water Problems Institute of RAS, Moscow, Russia

In the Cis Urals oil fields, one of the main ecological is groundwater pollution with highly mineralized chloride - sodium brines, additionally got when exploiting the oil field, and flowing over the land surface under damaged water lines. From the surface, brines penetrate into soils and rocks in the aeration zone, making them saline (often making soils unsuitable for the land - use) and then reach the

groundwater, where Cl^- concentrations begin to exceed maximum permissible concentrations.

Observations for dynamics of unsaturated zone salinizations were made in some test points, where water - line damages have been observed before. Rocks in the unsaturated zone were constituted by interlaying of loam, sandy loam and sands. Rocks and soils are salinized, salinization is different from medium to very high one of a chloride type. Maximum salinization is confined to the less permeable rocks in the unsaturated zone profile. Maximum moisture content in rocks is observed in the some interval (1 -1.5, 2 - 2.5 m), that produces the impression on the availability of an aquifer (pseudo - aquifer). Process of pseudo - aquifer formation can be characterized as falling or pressing the brines through to these depths. A large portion of exchange-sodium in absorption complex is in the soil layer and the upper part of the unsaturated zone rocks, though toxic salts content here is minimal or close to it. It cab explained by the fact, that actually not - absorbed Cl^- is inflowed and fallen through into more deep layers due to gravitational gradient (brines density is more than a unit). Na^+ behaviour is a bit different, a part of it is similar to Cl^- behaviour, and a part penetrates into absorption complex due to ion exchange and is retained in the upper layers of unsaturated zone. Inflowing of maximum salinization to 1 - 2m depth does not guarantee a further improvement of the soil layer state. In a vegetation period and in the seasons with minimum atmospheric precipitation, salts from this horizon will be entrapped by the root zone, thus making soil layer worse.

For studying the mechanism of brines migration in unsaturated zone, field investigations have been carried out, that were of a preliminary character. Field investigations were aimed at modelling the processes of soil salinization with brines and weakly mineralized artificial solutions to determine transporting and migration parameters and also modelling the process of soil gypsum application for neutralizing brines effect on them.

Experimental studies were carried out in two sites with an area of 1m2 on the surface to the left and to the right from a pit 1.5 m deep, 1.5 m wide and 3.0 m long. Margins of the sites have been thoroughly banked up to prevent overflowing of solutions over the site limits. One site was for industrial brines of chloride - sodium composition (mineralization being 137917 mg/l, density - 1.176 g/cm^3), the other was for an tracer solution of chloride - sodium composition (mineralization being 1893 mg/l, density 1.0 g/cm^3. The volume of solutions being introduced was equal to three volumes of pore space in the filtration body. Soil sampling for water extraction have been taken from pit walls. The experiment lasts for two days.

Preliminary data processing of brine and trace solution introducing has shown that brine filtration intensity is twice as large as trace solution. Here, it should be considered, that the brine used in the experiment has a minimal mineralization and density, if compared with the most widely spread types of industrial brines, characteristic for this oil field. Thus, more mineralized and dense brines will filtrate through unsaturated zone even more intensively.

Under brine migration in the upper profile (0 - 0.2 m) maximum salinization began to be formed at the end of the first day, and during the first day soils were not saline, but by the end of experiment maximum salinization has been formed in this layers. In the second profile (0.2 - 0.4 m) soils were not saline for 10 hours, maximum salinization has been formed by the end of the first day, similar process was observed in the lower profiles, but maximum salinization began to be formed in them after 14, 19 hours.

Under migration of trace solutions, quite a different picture was observed: all the soil layers gradually became saline during the experiment and maximum salinization has been formed at a depth from 0.2 to 0.4 m.

Experimental data have confirmed our assumption on pressing falling the brines through the upper part of the saturated zone. The next stage of investigations is to determine parameters of brines and trace solution migration.

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GROUNDWATER ECOLOGY IN YAMALO-NENETSKY AREA

Beshentsev V.A.
Committee of a nature protection of a Yamalo-Nenetsky Area, Salekhard, Russia
Kovaltchuk A. I.
Institute of geology and geochemistry, Urals Branch of Russian Academy of Science, Ekaterinburg, Russia

This presentation include the results of long-term hydrogeological researches and the regional works having being auditing character.

It was carried out by Ural branch of Russian Academy of Science jointly with "Yamalecology" and "Yamalgeology".

We were assembled the materials on hydrogeology and hydrochemistry underground and partly of surface waters in territory of administrative areas.

During field work have been selected more than 200 samples of ground-water which were analyzed in the legalized hydrochemical laboratories of Ekaterinburg for macrocomponents, microcomponents, organic substances, natural and antropogene in origin.

A study are correspond to the territory of northern part of West-Siberian artesian basin.

It representing extensive tectonic depression with limb flat in western and abrupt in the east. The basin consist of (thickness 5-10 km) horizontally bedding sediments Mesozoic-Cenozoic in age. Crystalline basement compose of Paleozoic rock.

The basin was divided into two hydrogeological units, separated by water-resisting of Oligocene - Turonian horizon . The upper unit (Oligocene-Quaternary) contains mainly

fresh waters infiltration in origin which are distributed in cryogenic zone. Regime of groundwater is an artesian or free-surface. They are a important and unique fresh waters source in the region of investigation.

The top zone of the upper unit is covered by permafrost reaching thickness of 300-500 m. The spreading of underground waters their inflow and protection against surface pollution depends on litiology and cryogenic conditions.

The underground waters are characterized by a lot of features in their natural state. It have low salt percentage (50-150 mg/l), high contents of silicon (exceeding MCL in 1,5 times), iron (exceeding MCL in six times) and manganese (in 6 times). It characterized also by low calcium (19,9 mg/l), magnesium (9,1 mg/l), iodine and fluorine (0,1 mg/l) contents. Such composition of waters could be have bad influence to health of the local population.

The big contents of iron and manganese in water require perfection of water preparation system. The salt percentage scarcity and low concentration of components that are biologically necessary can be compensated by balanced mineral waters.

Pollution of fresh water by petroleum exceed of allowable concentration up to 60 times, by phenol to 10 times, by dihetilenglicol and methanol to 4 MCL etc. This contamination have "mosaic" character and located in area of oil extraction zones. Such zones have the tendency to increasing "spots" of contamination in time.

There are a lot of a designly imperfect petroleum production wells, that have high pressure. After waste of oil deposits this can create risk of fresh water pollution by toxic brine from depth.

Therefore, the creation of complex groundwater monitoring system is urgent necessity.

FLUORIDE IN GROUNIMMATER OF KUTCH, BHAVNAGAR AND MEHSANA REGIONS IN GUJARAT STATE AND SOME HOME REMEDIAL MEASURES

Bhatt K.D., Dave A.M., Mehta M.H.
GSFC Science Foundation, Dist. Baroda, India
Thfakore P.V.
G. S. F. C. Ltd., Dist Baroda, India
Dave V.K.S.
Department of Earth Sciences, University of Roorkee, **Roorkee**, India

The present study report highlights a scenario on groundwater contamination by fiuoride in some of the defected regions of (3uJarat State. The area; of investigation were *selected as* Kutch, Bhavnagar and Mehsana districts. As per the WHO standards the fluoride level above 1.0 - 1.5 ppm is dangerous to human health and hence the data obtained were subjected to a statistical analysis with respect to this limit

In Kutch region as low as 34% groundwater samples were found having fluoride levels below I pprn and as high as 45% samples abow 3 ppm Similarity, In Mehsana, low and high distributions were found to be 18% and 72% respectively. In Bhavnagar region a few samples showed fluoride level above 3 ppm-

The prominent causes of the fluoride contamination may be attributed to the alkalinity, presence of clay minerals and mixing of groundwaters with connate waters. Advanced assessment of fluoride may help in diagnosis of fluorosis in early stage which could further assist *in* differentiation of *effect* of fluorosis from that of ageing for suitable medical treatment.

Remedial measures for defluoridation of water have indicated lowering of fluoride concentration successfully by adopting a proposed technique in Bhavnagar district.

The study thus helps in preparing and/or updating fluoride map of Gujarat as a model date. Public awareness programmes alongwith proposed defluoridation technique are strongly recommended for abatement of fluorosis.

STRATEGY OF THE STUDY AND DEVELOPMENT OF GROUND WATER FOR PUBLIC WATER SUPPLY IN RUSSIA AT THE TURN OF THE CENTURY

Borevsky B.V., Yazvin L.S.
Hydrogeoecological Research and Design Co. (HYDEC), Moscow, Russia
Kochetkov M.V.
Russian Federation Ministry of Natural Resources, Moscow, Russia
Klyukvin A.N.
Central Regional Geological Department, Moscow, Russia
Alekseev V.S.
Research and Engineering Institute for Water Supply, Sewage Systems, Hydraulic Structures and Engineering Hydrogeology (VODGEO), Moscow, Russia

1. Russia possesses huge predicted and explored drinking ground water resources. However, the present-day use of ground water in the communal water supply system accounts for 40-45% of the total use of water and equals

about 30% in large cities. Many large and medium cities the water supply of which is entirely based on surface water almost do not have ground water resources protected from contamination. Russia's average of the explored ground water resources, which may be developed economically, accounts for 30-35%. At the same time, the contribution of ground water to the total drinking water supply of the communities should be increased immediately. To provide the water users with water of good quality at the present hazardous state of surface water contamination, the contribution of protected ground water to the total public water supply should be no less than 20-30%. For this reason, the strategy of water development in Russia in the coming years should be aimed at the increase in ground water use.

2. Increasing the contribution of ground water use requires restructuring in drinking water supply system. This will necessitate the gradual replacement of surface water supply sources by ground water sources or creation in settlements two water supply sources based on surface and ground water.

In turn, the realization of the strategy of the dominant use of ground water will require numerous geological, environmental, and technological investigations, as well as application of new technologies to well construction, installation of well equipment, construction of pipelines, and monitoring of the ground water and environment in the area of operated well fields and those to be developed.

3. The strategy of increasing the contribution of ground water to water supply under the present conditions is suggested to be based on the following principles:

a) Maximum possible development of ground water in the operated well fields located within the municipalities and outside of them;

b) Prospecting, exploration, and development of new ground water reservoirs located as close to the water user as possible, instead of earlier prospected water reservoirs situated at considerable distances from the water user due to the impossibility of its development;

c) Creation of major interregional water supply systems on the basis of individual large ground water reservoirs for water supply of a great number of cities, towns, and settlements. These systems may be independent and parts of the integrated systems of water supply using both surface and ground water;

d) When Hydrogeological conditions do not permit introduction of water supply systems based on safely protected ground water, it is advisable to create enterprises for water withdrawal and bottling of ecologically pure drinking water. These enterprises should meet the requirements of the communities for drinking water in emergency periods, which must be mentioned in the license to use the earth's interior for ground water development;

e) Reconstruction of existing systems of water supply for increasing their productivity, maintaining the quality of water delivered to water users through existing pipelines, providing the ground water over the entire area of cities and towns, and enhancing the economic and technological efficiency of ground water development;

f) To attract and effect investments in projects involving development of major ground water reservoirs and creation of centralized water supply systems.

4. To realize the suggested strategy, it is advisable to solve the following problems of high priority:

4.1. Carrying out hydrogeological studies and assessments:

- completion of the current assessment of providing people with ground water of good quality, highly protected against contamination, over the entire territory of Russia and individual constituents of the Russia Federation, administrative regions, and major water users;
- reassessment of the safe yield in the operated well fields with allowance for preserving good water quality for the prediction period and protecting ground water from contamination in urbanized areas;
- study of the causes and trends of ground water quality variation in contaminated areas and ground water depletion, assessment of artificial ground water recharge;
- hydrogeological substantiation of zones of sanitary protection and technology of the protection of well fields from contamination;
- geoecological substantiation of ground water development projects;
- organization of monitoring systems of ground water and environment in the course of ground water development and hydrogeoecological substantiation of compensative measures in the case of the negative effect of ground water withdrawal on the environment.

4.2. Carrying out technological studies and assessments:

- inspection of well fields for finding the technological possibility of ground water withdrawal of required quantity with its predicted quality using the existing system of wells, pumping equipment, and water conduits; determining possible causes of water quality deterioration on the way from the point of withdrawal to the treatment plant; determining the possibility of contamination of the withdrawn water in the casing-well annular space, casing string, and conduits (the assessment of ground water quality stability and ground water corrosion action);
- making suggestions concerning the reconstruction of well fields and ground water conditioning;
- development of complex optimization models for hydraulic design of ground water intake structures.

5. The efficient development of ground water reservoirs requires creation of complex optimization models making possible the purposeful management of ground water development by realization of the needed pattern of the flow, minimization of development costs, and prevention of negative environmental aftereffects.

ASSESSMENT OF ECONOMIC DAMAGE AGAINST GROUND WATER CONTAMINATION

Borevsky B.V., Lubensky L.A., Yazvin L.S.
Hydrogeoecological Research & Design Company HYDEC, Moscow, Russia
Babiev A.V., Lesnikov B.N.
State Institute of Applied Ecology, Goskomecologia, Moscow, Russia

1. According to the laws of Russian Federation "On the subsurface", "On the environmental protection ", and RF "Water code", citizens and juridical persons are charged in full, voluntarily, by award or arbitration court to recompense the damage due to the human activity which led to the contamination of ground water and as result, its use was hampered or excluded at given purposes, and (or) it occurred the change in other natural components of the environment over established regulations.

2. The methods of assessment of economic damage from ground water contamination were not elaborated earlier. The undertaken efforts to use for these purposes the methods of the assessment of damage for surface water with allowance of the extent of contaminants coming to surface water bodies led to absolutely improbable results because the features of geological structure ,ground water dynamics, and migration of contaminant elements were not taken into account.

3. The methods of assessment of economic damage against ground water contamination developed by HYDEC are based on the following main positions:

a) When estimating the extent of ground water contamination, the comparison of its quality with background state and requirements to water quality is performed taking into account the purposes of water use;

b) In general case, the damage (D) is the total value term of all expenses and losses caused by ground water contamination. It is calculated by formula:

$D = E_{gr} + D_{dir} + L_{dir} + D_{ind} + L_{ind}$,

where E_{gr} are expenses for studying the contaminated ground water site ,its forecast of further development , and solving the problem of the elimination of contamination, or reimbursement for all the damages suffered;

D_{dir} is direct damage to ground water as minerals and its use should be reduced or excluded in connection with the contamination;

L_{dir} are direct losses which should cover subsurface users exploiting ground water due to its contamination including the lost profit;

D_{ind} is indirect damage to other components of the natural environment (soils, surface water, vegetation) in connection with ground water contamination;

L_{ind} are losses of nature users connected with restrictions in use of other components of the natural environment as a result of ground water contamination.

In specific cases, one or another constituent of the right part of the equation may be equal to zero.

c) Expenses for studying ground water contamination site are calculated in conformity with the project of necessary hydrogeological investigations and are coordinated with respective protection authorities of nature and natural resources;

d) The value of direct damage is obtained by the damage which will cover the owner of resources (the State) in connection with payment reduction *(suspension) for subsurface* use and expenses connected with measures related to the sanitation of contaminated site (if it is necessary). The damage which will cover the resources owner is defined on the basis of the change in ground water safe yield (yields of well fields) that could be at the contaminated site;

d) Direct losses of subsurface users are estimated by values of capital costs and production ones connected with reorganization of the water supply system due to ground water contamination;

e) Indirect damage and indirect losses are evaluated according to the rules and methods acceptable for estimating the damage and losses in the process of the contamination of other natural components and sites.

4. The procedure of the assessment of damage from ground water contamination should be established on the basis of special standard normative document.

UNDERGROUND WATERS RESERVES AND THEIR USE IN THE REPUBLIC OF KAZAKHSTAN

Daukeyev S., Uzhkenov B., Kalmykova N., Kasymbekov D., Murtazin E., Podolny V., Satpayev A., Smoliar V.
Ministry for Ecology and Natural Resources of the Republic of Kazakhstan, Alma-Ata, Kazakhstan
Kim R., Mustafayev S.
Almatyhydrogeology JSC, Alma-Ata, Kazakhstan

Underground waters play a significant role in the watereconomy balance, being the only source of water supply in the conditions of arid climate and surface water deficite. Estimate of all hypothetical reserves of the underground waters in the Republic have been implemented for the period of 50 years with 100-250 m lower than ground surface depending on both natural resources and natural reserves. Over the last decade the estimate of regional hypothetical resources of underound waters in the artesian basins have been fulfilled on the mathematics model. This method helped to estimate the reserves far precisely in the entire Kazakhstan.

Hypothetical operated reserves of the underground waters with mineralization up to 10g/l in the Republic make 1800 m3/sec. The fresh underground waters with mineralization up to 1g/l make part of 1100 m3/sec. South

Kazakhstan concentrates more than 50% of hypotetical reserves.

On the Republic's territory over 600 deposits have been developed with summarized reserves of 502,1 m3/sec, it equals to 27% of the hypothetical reserves. The 55 largest deposits (236,4 m3/sec) have been developed at the debris cones on the foothill trains. In the river valley 210 deposits have been developed, in the artesian basins - 190, in the hydrogeological massifs - 157, in the sandy massifs - 11 underground water deposits have been developed. Despite the provision of the Republic by underground waters in the total, certain regions (North, West and Central Kazakhstan) experience a sharp deficite of water, especislly of potable water, because of irregular underground waters distribution.

Use of immense reserves of underground waters in the Republic of Kazakhstan is very slight. Now the underground water intake makes only 11% from the proved reserves.

For irrigation in Kazakhstan 66 underground water deposits with reserves of 277 m3/sec have been developed, which can irrigate 350,000 ha of the land. Before the water intake for irrigation made up to 5% from the proved reserves, but in 1996 it equaled to 1,73 m3/sec. or 0,8%.

On the Kazakhstan's territory medical-mineral waters of the 6 basic balneological groups are widespread. Over 250 prospective areas have been discovered and 45 deposits have been developed, which reserves of 344 l/sec, 35 deposits are under operations.

In the Republic large resources of geothermal waters with temperature 20-1000 C have been found, which natural resources are more than 600 bln. Gcal. Nowdays thermal waters almost are not used for the heating system.

Thus, in Kazakhstan there are significant reserves of underground waters which may be used for different purposes. The estimate of hypothetical resources of underground waters requires a quite new responsible approach, as potable water and water for other purposes in the economy to be used a long, almost unlimited period.The estimate of hypothetical operated resources on the new methodical base needed, only natural resources and resources under exploitation can form them.

HYDROGEOECOLOGICAL MONITORING OF WASTE WATER INJECTION SITES OF RAO GAZPROM'S ENTERPRISES

Dedikov E.V.
RAO Gazprom
Ilchenko V.P., Goncharov V.S., Levshenko T.V.
VNIIGAZ
Sevastjanov O.M.
VolgoUralNIPIGaz
Akulinchev B.P., Petukhova N.M.
SevaKavNIPIGaz
Serebruakov O.I.
AstrakhanNIPIGaz

Burial of waste water which is widely spread in the gas industry eliminates contamination of soil and surface and underground waters. Usually this method is used for those waste waters that cannot be treated biologically due to an increased salt, petroleum and chemical reagents content.

In order to choose a site for injecting waste water hydrogeological methods are widely used. These methods allow to locate absorbing horizons, to predict the dynamics of reservoir pressure and waste water distribution in horizons, to study physical and chemical compatibility of waste water with absorbing horizon rocks, to provide necessary measures for protecting upper water-bearing strata against contamination, and to monitor ecological safety of buried waste waters.

Monitoring buried waste waters is of particular concern since their utilization is possible only in exceptional cases when methods of treatment and purification are not applicable due to a series of special requirements and conditions.

When choosing waste water injection sites, the following requirements are considered: geological and environment conditions and information about atmospheric air, soil, flora and fauna, surface and underground waters, and injection, buffer and control horizons.

The evaluation of environment conditions and possible negative impact of buried waste waters and the development of monitoring system including methods and means are being carried out based on this information. The main monitoring parameters are: injection pressure and consumption which should not exceed allowable limits and ion-salt composition and physical properties of waste waters.

Of chemical parameters, pH, alkilinity, Ca, Mg, sulfate content, mineralization, unstable components or components reacting with reservoir waters are usually limited. An ultimate value of these parameters are defined by the compatibility of waste waters with reservoir waters and rocks and are limited by the requirements of waste water preparation for injection.

Field environment monitoring includes the following types:

- hydrodynamic, i.e. estimation of head fields state in absorbing strata and controlled horizons;
- hydrogeochemical, i.e. estimation of reservoir water composition change, waste water components and physical and chemical properties of reservoirs;
- geophysical, i.e. estimation of rock physical fields change including thermal field, liquid resistance and seismic effects.

In order to perform hydrogeological monitoring of sites of burial waste waters and zones of their influence observation wells and stations are provided. On depleted fields with low reservoir presure injection of waste water is useful since it enables to restore partially disturbed natural hydrodynamic equilibrium. However, direct distribution of waste water in bed and the results of their interaction with reservoir waters and rocks can be determined only by hydrogeochemical monitoring.

The main features of hydrogeological monitoring are illustrated on the basis of the experience the authors have gained at the waste water injection sites of North Tyumen, Pre-Caspian and Ciscaucasia gas-producing provinces.

ASSESSMENT OF THE GROUNDWATER RESPONSE TO ATMOSPHERIC POLLUTION

Dzhamalov R.G., Zlobina V.L.
Water Problems Institute, Russian Academy of Sciences, Moscow, Russia

Ecosystems are affected by various (both point and non-point) sources of pollution. The most important of them is atmospheric pollution since its effect persists in all seasons and because in recent decades its macro- and microelement composition markedly changed.

Interaction between the polluted acid precipitation and components of the subsurface environment in the precipitation–groundwater system can results in disturbance of the groundwater stability. The humid areas located in the Central Russia are quite susceptible to the anthropogenic impact because of poor buffer properties of local ecological systems, i.e., low carbonate content of soils and water-bearing rocks and low water salinity.

In this context, determination of the groundwater vulnerability under the effect of precipitation, which spatially is polluted quite irregularly and which represents the main component of the groundwater budget, is of great topicality.

The processes deteriorating the groundwater quality were investigated using the observations performed on the drainage areas with different human-induced loads. In order to assess the future development of processes of acidification and pollution, the systems under investigation were simulated using computer programs for selected pollutants studied under various scenarios of anthropogenic load. Variations in the saturation deficit of major rock-forming minerals caused by changes in hydrogeochemical regime of groundwater were studied. The results of calculations were correlated with the values of the criteria that were developed for assessment of acidification for drainage areas with different landscape, geological, and hydrogeological conditions.

It was shown that in areas exposed to considerable human-induced load ecosystems can become unstable notwithstanding the degree of their vulnerability under the polluted precipitation.

METHODOLOGICAL, HYDROECOLOGICAL AND MEDICOECOLOGICAL APPROACHES TO THE GROUND WATERS USE UNDER THE CONDITIONS OF INTENSIVE TECHNOGENESIS

Elpiner L.I., Shapovalov A.E.
Institute of Water Problems, Moscow, Russia
Zeegofer Y.O.
"Geocenter - Moscow", Russia

Hydroecological and ecologomedical foundations for forecasting the ground waters use under the conditions of intensive technogenesis are of current interest because of the powerful anthropological impact on the environment.

The qualitative and quantitative depletion of continental water resources, drinking waters sources pollution, changes of territorial water capacity and the deterioration of human living related with the previous factors are observed in Russia. They incline the authors to pay special attention on the possibilities of wide use of more protected ground water sources.

The evidence of natural hydrogeochemical anomalies in chemical composition of the ground waters (Sr, Ba, B, F, Fe) drinking in Moscow region, as well as the information on their technogenic pollution has been analyzed and generalized. Review of the data base provides information that approximately 80 percent of ground waters used by the population does not correspond with the established standards for drinking water. The preliminary assessments of the influence exerted on population health showed an obvious lack of official medical statistical data and regulated control over ground water quality carried out by sanitary and hydrogeological services.

The analysis of water quality formation on the way to consumers shows that the plausible assessments made by traditional statistical methods can be possible provided detailed medicoecological researches of local objects will be carried out. Only the objects for which the salient factors of ground water formation were defined and estimated should be taken into account

As a primary result of this scientific work the authors consider foundations for the necessity to change contemporary approaches to the assessment of the quality of drinking ground waters if these have natural anomalies

and are under the conditions of intensive technogenesis. The structure of hydrogeochemical investigations on ground water quality was justified. This structure is necessary to judge the complex medicoecological situation in Moscow region. The theoretical approaches to the methodology of complex hydrogeochemical and medicoecological assessment of ground water quality were justified. The authors take this methodology as the basis to forecast all possible influences of chemical composition of ground water on population health.

The authors put forward the approach that requires methods of hydrogeodynamics, hydrogeochemestry and geoecology. These methods should be oriented to the purposeful information for conducting medicoecological investigations. The newness of this approach consists in the composition of these methods to assess the influence of ground water quality on population health. This influence is also based on the methods of preventive and clinical medicine.

In this report the authors describe new methodological approaches to assess the suitability of drinking ground waters that are used or are outlined to be used. Newest data about their native admixtures and anthropological pollution as well as new information of toxicological epidemiology are taken into concideration.

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WATER QUALITY MANAGEMENT WITH SPECIAL REFERENCE TO THE WELL FIELD OF PRILUKSKI AREA WITHIN PRIOKSKI RESERVOIR IN CASE OF HAZARDOUS SURFACE WATER CONTAMINATION

Ershov G.E., Zakutin V.P.
Hydrogeoecological Research and Design Company (HYDEC), Moscow, Russia

The ground water safe yield of Priokski reservoir was proved by the State Commission of mineral resources of Russian Federation Ministry of Natural Resources, dated of December 27, 1995, accounts for 1286,5 thousand m^3/day where 502 m^3/day are for Prilukski area (the first stage of this well field area).

Drinking ground water occur within Mikhailovsko-Tarusskoe horizon of the Lower Carboniferous. On the territory of watersheds and overflood plain terraces of the Oka river, the aquifer is overlied by the strata of water-bearing and semipermeable deposits of the Median and Lower Carboniferous, their total thickness amounts to 120 m. At the area of flood plain of the Oka river the aquifer is overlied by only alluvial deposits composed of sands and overlying loams, their total thickness ranges from 5 to 25 m, and in some places overlying loams are not observed. The main source of the formation of ground water safe yield in this area is induced surface water of the Oka river amounting to 93% in the total balance of projected water withdrawal.

According to the state standards GOST R 22.6.01-95 introduced into force in 1995 "The safety in emergency conditions. Protection of systems for drinking and domestic water supply", by Hydrogeoecological Research and Design Company HYDEC on request of the Institute Mosoblinjproekt in the feasibility report of the Southern water system for public water supply of Moscow and the towns of Moscovskaya oblast were considered different hazardous cases which can lead to the ground water quality deterioration of the well field.

In accordance with the rules of the State standards (GOST) the hazardous cases include the working regime of centralized systems for public water supply when the water is delivered with disturbance of sanitary requirements on water quality or the water delivering to settlements is suspended due to the reach of contamination level of surface source exceeding the technological and sanitary safety of the system. In connection with this, when studying the cases threatening to water quality of well field under project, it was advisable to determine the levels of surface water contamination, surpassing the technological reliability of water supply system, and to develop the working schedule of well field in such cases.

For solving these problems was carried out the collection and analysis of materials concerning the enterprises, which potentially contribute to surface water contamination in given region, examined with details the quality of ground water within Prilukski area and well fields-analogues, developed a comprehensive migration model of well fields area and completed the modeling of different variants of the possible contamination of ground water through surface one in the course of different protected working regimes of the well field.

On the basis of implemented investigations were made the following conclusions:

1) The application of fertilizers and pesticides to agricultural fields, inflowing of domestic wastewater to the areas of settlements within the water reservoir with allowance for present-day anthropogenic conditions cannot negatively effect on the ground water quality in the course of its operation. The contamination of surface water of the Oka river is the more hazardous for the ground water quality;

2) The coming of hazardous chemical components to the Oka river with storm wastewater is accompanied by their important dilution. The least dilution occurs at low water period when the water yield of the Oka river does not exceed 60 m^3/sec, and as result the emergency for ground water occurs during this period.

3) The analysis of flow rate of hazardous chemical components used for industrials purposes in the region of the town of Serpukhov showed that the concentration of these compounds over maximum permissible concentration is not formed in the water of the Oka river even in the case of monthly run-off of industrial waste during one day. A great hazard for the quality of surface water, from the standpoint of

its using for domestic and drinking water supply, is emerged from oil products, such as gasoline and kerosene as well as hazardous farm waste as nitrate.

4) In the majority of emergency cases, the inflowing to rivers of the considerable amount of waste does not exceed 1-2 days. When continuing important emergency during a long period in sewer systems or live-stock farmings, this term is about no more than 5 days, and this one is taken as estimated value term of the hazardous contamination of surface water.

5) On the basis of performed predicated calculations on can see that:

- when full load rating of well fields, the hydrogeological conditions and regime of well fields provide 8-10 times reduction of ground water contamination in comparison with surface water. In the cases when the surface water contamination is less than 5 days, the ground water contamination is also reduced (for example, surface water contamination during 1 day, ground water contamination is reduced - 40 times);
- a full stopping of wells contributes to the preservation of contamination inflowing into the water-bearing layers. After putting off well fields the time of contamination inflowing into ground water amounts to 1-1,5 days;
- the more reliable and efficient method of environmental remediation after hazardous contamination of surface water is the exploitation of well fields in the area by return of water from the group of wells more closely situated to the river, back to surface water. A number of well field areas of water run-off may be changed depending on the extent of hazardous contamination with allowance for data monitoring of the ground water quality;
- the possible actual contamination of surface water by industrial waste of enterprises does not exceed the reliability of water supply system. When carrying out the developed protective measures, the hazardous contamination by oil products, phenols or nitrates may be eliminated.

ON DISTRIBUTION AND QUALITY OF THE URAL UNDERGROUND WATER OF ECONOMICAL PURPOSES

Gayev A.Ya.
Perm State University, Perm, Russia

Fresh underground water of economical purposes is distributed in the zone of the intensive water-exchange and it is of the infiltration origin. Its formation and distribution obey the laws of the structure-hydrogeological control, height zonality and latitudinal zonality. The quantity of underground water reduces from the zone of the northern taiga till dry steppes directly proportional to the reduction of precipitation value and inversely proportional to the evaporation parameters. The quality of underground water also deteriorates from the north till the south, its salination and hardness increase. Underground water resources at the western slope of the Urals exceed resources of the eastern slope in 2-3 times because the mountain-folded works play the role of climate divide. The scarcity of water resources at the Ural is accompanied by the famine of iodine, fluorine, selenium and some metals in it.

Anion structure of underground water changes zonally from hydrocarbonate-silicious at the north of the region till hydrocarbonate-chloride, hydrocarbonate-sulphate-chloride and chloride-hydrocarbonate at the south. Kation structure of water is formed under the influence of peculiarities of holding rocks lithology. Calcium predominates in the kation structure of water, but natrium dominates in granitoids, magnesium dominates in dolomites, magnesites.

The regions of the inversion zonality have been fixed. There is a place of chloride and sulphate waters formation under the influence of hydrohalogenesis and secondary salinization processes in the aeration area and run-off microbasins. These waters change into hydrocarbonate water.

The influence of technogenesis on fresh underground water had been increasing in the second half of the 20th century. It consists in the metamorphization and pollution of the region water. The intensive agricultural developing of the southern forest-steppe and steppe regions, population urbanisation and location of the basic industrial potential in the big rivers valleys have affected the growth of the technogenic metamorphization of waters and their pollution from watersheds till the river valleys and from the northern landscape-climatic zones till the southern zones. The physical-chemical changes in water composition are supplemented by the microbiological changes. There is a wide range of microorganisms in water including pathogenic micro-organisms.

Technogenic processes are found especially in the regions of the industrial-urban agglomerations and mining enterprises. There are the following kinds of technogenesis in the hydrosphere: 1) metamorphization of the chemical composition and pollution of water; 2) exhaustion of underground water resources; 3) underflooding of building territories; 4) increase of the intensity of underground geological work at the expense of natural processes of rocks suffosion, dissolving and lixiviation under the artificial increase of aeration zone capacity in conditions of water lowering at the water intakes and mining enterprises where the cones of influence develop with the area of up to 20-30 km^2 and more; 5) intensification of the processes of water self-purification at the natural and natural-technogenic geochemical barriers; 6) increase of the scale and intensity of the anthropogenic impact on the hydrosphere; 7) emission into underground water of the increasing volume of the new substances synthesised by people.

With a view to protect fresh underground water and use it rationally it is recommended: 1) to use the underground building wider, in particular, in order for the disposal of ecologically adverse technologies; 2) to introduce into water management technics of fresh underground water storage and practice of geochemical barriers use; 3) to formulate the

reserve variants of water supply to the industrial-urban agglomerations in case of emergency at the expense of local underground water resources implementing the projects of recultivation and forest amelioration of lands; 4) to carry out the nature use on the base of modern ecological-cartographical concepts: a) schemes of the typification by the pollution resistance of geological milieu; b) schemes of zoning by the reliability of the underground building; c) schemes of the typification by the national economic value of natural resources; d) schemes of the ecologically reasonable perspective disposal of the productive forces; 5) to realise the lithohydromonitoring systems in fact.

PREVENTION OF UNDERGROUND WATERS FROM POLLUTION SINCE RESTRUCTURIZATION IN COAL INDUSTRY

Gorshkov V.A.
IEGM UB RAS

Pit waters at mine wet elimination appear to be a severe source for underground water pollution. Aquifers tapped by mining may be imposed by particularly hazardous pollution. A large number of iron, aluminum and other elements including carcinogenic, such as beryllium and lead are dissolved in mine water, and acid water in particular. Even insignificant water exchange may cause pollution transfer to great distances. Mine waters are the product of technogenesis. In the course of mine construction and exploitation, an intensive water exchange is formed artificially at the sacrifice of water pumped out to the surface, and caused by the necessity of draining the underground mining. Biochemical processes of sulphide mineral oxidation with the formation of sulphates,sulfuric acid and other elements take place in the course of intensive water exchange. On elimination of mine activities the worked out area, and also the depression cone are filled in with water. Natural discharge of underground waters starts, and thus the volume of water thrown down to drainage is lowered to tens of times. Water exchange intensity is drastically lowered. Air supply created earlier by vent streams is cut off. Alteration in conditions for microorganisms' occurrence in this case of water exchange, followed by the change in gas, organics and salt concentrations causes replacement in geomicroflora. Aerobic geomicroflora is substituted for an anaerobic one. The presence of organics and sulphates in sufficient number in submerged mines forms the conditions for an intensive development of sulphate-reducing bacteria. Hydrogen sulphide and OH- hydroxy group are the metabolites for cited bacteria. OH- hydroxy group interacting with acid water shifts pH to alkaline state. Thus neutralization of acid water takes place. Hydrogen sulphide

interacting with iron sulphate reduces the latter to sulphide, which precipitates. On further habitat alteration the methane-producing group of microorganisms starts to develop. Disclosed process of geomicroflora replacement (succession) may occur at mine submerging with subsequent formation of anaerobic conditions. Lowering of water exchange intensity and creation of anaerobic conditions at mine elimination may be approached by technical means: construction of arches, exclusion of technogenous disruptions within mine diversion, soil surface recovery, etc. It is advisable to place biogenic additives in the form of wood or other plant wastes into mining with the aim of acceleration of succession process at mine submerging.

INCREASE OF USE AND PROTECTION EFFICIENCY OF NATURAL RESOURCES OF SOIL WATERS IN AGRICULTURE ON THE BASIS OF THE ACCOUNT OF THEIR STOCHASTIC CHARACTER

Ismaiylov G.Kh., Golubash T.Yu.
Water Problem Institute, RAS, , Moscow, Russia

1. Formation, use and protection of natural waters depend on natural and economic conditions of a territory. The main changes of these conditions are connected with natural waters use in agriculture. The most important agricultural regions in Russia are located in steppe and forest-steppe zones with frequent and intensive droughts, and in some years (seasons) water supply of a territory is similar to the conditions of sufficient humidifying, therefore water consumption is characterized by significant temporal and spatial variability.

2. Compensation of a moisture deficit can be achieved or by the attraction of additional water resources, or by the increase of efficiency of use of natural resources of soil waters on the basis of application of dry agriculture methods. The measures, directed on the improvement of soil water regime in regions of insufficient humidifying, should be established in view of natural stocks of soil moisture, as well as probable changes of humidity during the vegetative period, which forecast with necessary terms is rather difficult. In this connection the problem of evaluation of a territory water supply is formulated as stochastic.

3. On the basis of our earlier researches for irrigated agriculture [Golubash, Ismaiylov, 1981] we developed the probability model of evaluation of the territory water supply in conditions of natural humidifying, enabling to obtain the functions of distribution (frequency) for productive water storages in a soil and deficit of water consumption of

agricultural crops for various time intervals within a year and vegetative period.

4. The problem is solved by the composition method (construction of cumulative frequency curves of sums of random distributed variables) for the water balance components of soil root zone.

5. Cumulative frequency curve, obtained by the composition method for water storages on the beginning of warm period for meteostations, located in a steppe zone of Volga river basin, shows that the sufficient soil humidifying on the beginning of a warm period is observed for frequency of productive water storages in a meter layer of a soil less than 30 %. At large values of frequency moisture deficit is observed. Thus in the years of different frequency from 30 up to 99 % the deficit of water consumption varies from 0 up to 100 mm. During the years of moderate humidifying (P = 50 %) it makes 20 mm, and at P = 75 % - 50 mm. To the end of the warm period almost complete depletion of productive water storages occurs. During the years of moderate humidifying they drop practically up to zero, and the frequency of critical water storages makes less than 5 %.

6. For the verification of obtained results we put data of observed water storages under spring wheat on the cumulative frequency curve of productive water storages, obtained by the composition method. These data are well enough approximated by the obtained modeling curve.

7. The obtained cumulative frequency curves for various agricultural crops enable to evaluate probable territory water supply for various time intervals depending on casually varied hydrometeorological conditions, that finally should promote the development of decision-making strategy for the improvement of water supply with the help of some complex of measures depending on the value of water consumption deficit and the desired reliability of agricultural production, as well as the soil condition as a result of its water regime changes.

WATER PROTECTION IN GERMANY. SITUATION, PROBLEMS, REMEDIAL MEASURES

Jedlitschka J.
Bavarian State Ministry for State Development and Environmental Affairs

The conservation of clean groundwater as part of the natural water cycle and as important natural element is vital. In Germany, clean groundwater is essential for the supply of its people with this most important foodstuff, drinking water. Therefore, in Germany, the overall protection of groundwater has priority. Accordingly, we have set the following objectives which are also part of the groundwater action programme of the European Union:

- conservation of the properties of clean groundwater,
- prevention of further damages to polluted groundwater,
- rehabilitation of polluted groundwater as far as possible.

As additional protective measures drinking water processing plants must be furnished with extra water protection areas .

In Germany hazards to groundwater mainly derive from the following areas:

- application of fertilisers and pesticides by agriculture,
- handling and transport of water-hazardous substances,
- contaminated sites in areas with former deposits and abandoned land,
- waste deposits,
- pollution through the atmosphere (acid rain),
- leaking sewers,
- recycling of waste (residual substances).

Some of these areas are specially being dealt with in this paper.

In Germany the activities of agriculture with an increasing application of fertilisers, with large livestock and therefore the production of more liquid manure on one hand, and the intensified use of pesticides on the other hand, have led to more groundwater pollution.

According to the latest investigations carried out by the German „Länder" Water Working Group (LAWA 1995) 11% of the groundwater observation points show nitrate concentrations of more than 50 mg/l (limit value for drinking water). The same critical situation exists with the contents of pesticides.

At the example of Bavaria it is shown which remedial measures have been taken concerning agriculture: counselling of farmers, appropriate handling of fertilisers originating from farms, prevention of soil erosion, strips of river banks, non-admission and prohibition of the application of certain crop protection products. Security requirements for the handling of water-hazardous substances are also being explained, as well as the detection, assessment and rehabilitation of groundwater damages in Germany.

In Bavaria, about 3300 underground pollution point sources leading to groundwater pollution have been discovered and assessed up to now. In about 600 cases rehabilitation is either on its way or already carried out. The following value criteria has been published by the German "Länder" Water Working Group (LAWA) as recommendation for the whole of Germany :

- reference values show the geogenic background including ubiquitous pollution,
- test values are values which, as a rule, do not entail further measures when they are not reached,
- measure values are values which, as a rule, will trigger further measures ,
- once they are exceeded.

The different values are listed in this paper.

Finally the importance of systematic groundwater monitoring is stressed, showing the different tasks according to which monitoring is carried out in Germany:

- documentation of the actual state and changes in groundwater quality,
- early identification of groundwater pollution for the just-in-time introduction of counter measures,
- long term control over the efficiency of rehabilitation measures (e.g. of abandoned contaminated sites) and of governmental regulations with respect to groundwater protection.

TECHNOGENIC CHANGES IN HYDROGEOLOGICAL CONDITIONS OF MINERAL FIELDS UNDER DEVELOPMENT

Kasymbekov D.A.
Ministry for Ecology and Natural Resources of the Republic of Kazakhstan, Alma-Ata, Kazakhstan

The Karatau folded structure is the most important mineral base of Kazakhstan. A range of large mining plants (Achpolimetal Joint Stock Company, Karatau Company and other) and settlements (Kentau, Zhanatas) were set up on a basis of existing and explored phosphorite and complex fields.

Development of these fields resulted in considerable technogenic changes in hydrogeological conditions over the region. Limit of the technogenic influence on geological environment equals 800-1000 m. Thus, the techogenesis has actively appeared in the Great Karatau when developing the Mirgalimsai complex field and in Small Karatau when exploiting Zhanatas, Kokzhon and other phosphorite fields.

Geographic and geological&hydrogeological conditions of the folded structure promote this process. Fracture-karst and fracture waters prevail. Availability of open karst cavern, intensive jointing of water-enclosing carbonate rocks determine the prevailing role of the surface inflow from numerous rivers of Karatau in forming underground waters.

Development of the fields is complicated with rocks of a high water encroachment and total annual water inflows in underground workings average 13.000 m3/hour, maximum daily water inflow averages 25.5 m3/hour. Over 90% of water inflow is supplied by Bayaldyr river, Biresek river and Kantagi river.

A comprehensive cone of depression (1500 km.2) was formed by mine drainage while the level of underground waters has lowered till 800 m. These processes caused changes in forming the underground waters, sensitive redistribution of underground and surface waters, in structure of water and economic balance, development of geodynamic processes (karst, shift of rocks) appeared in the surface as mining damage and subsidences.

Forthcoming conservation of Kentau and Mirguilimsai pits in respect with their non-profitability may seriously change the hydrogelogical conditions, inversions spring flow as well as may lead to appearance and activisation of geodynamical processes and to sinking of some constructed plot of Kentau city.

Draining of the underground working has been implemented simultaneously with exploitation of fracture-karst water deposits (Berkutinsky, Tamdinsky and others) which supply the large mining area with economic and technical water. As a result of mutual influence of mine drainage and concentrated water intake cones of depression have been formed, being both regional and local. It depends on geo-hydrologeological properties as well as on scales and schemes of deposits working. The experience in the water intaking shows that such mutuality exhausts the exploitable reserves of the sole source of the centralized potable water supply.

Due to the underground working and water intaking constructions, impact of natural and technogenic pollutants (concentrators waste tailings, drainage basins, collectors and fields of filtration) worsen the quality of potable water.

The negative impact of mining enterprises on hydrogeological situation of adjacent territories requires a scientific approach to the underground waters management, to protect and rationally use, to develop and establish of operating control over the underground waters reserves and their quality (within underground resources monitoring), which provide with analysis, estimate and forecast of technogenic hydrogeological processes development on mathematics model during development of hard minerals and underground waters deposits.

CHANGE OF HYDRO-GEOLOGICAL CONDITIONS ON THE TERRITORY OF ALMATY AGLOMERATION UNDER INFLUENCE OF INTENSIVE MAINTENANCE OF UNDERGROUND WATERS

Kasymbekov D., Nekrasov B., Podolny V.
Ministry for Ecology and Natural Resources of the Republic of Kazakhstan, Alma-Ata, Kazakhstan
Vatlina E., Kim R., Mustafayev S.
Almatyhydrogeology JSC, Alma-Ata, Kazakhstan

Industrial - urban territories in the southern arid areas of Kazakhstan, including Almaty, historically developed in favorable climatic conditions on foothill plains. In the same areas in debris cones the main industrial stores of good-quality drinking waters are focused which often are the unique source of the urban water-supply. Operating deposits in such conditions has a number of aspects which can be both positive and negative.

The Almaty deposit of underground waters with reserves of 8m3/sec began to be operated from the end of 1950-s. On a debris cone was created a large water intake with expenditure in 1974 of 4,35 m3/sec. Since 1969 as a result of intensive maintenance of deposit a common regional depression funnel has been formed. Some reduction in water intake took place in 1975 at the expense of commissioning of the Talgar underground waters deposit, and from now on boundaries of a funnel are concerning stabilized. Currently, water intake makes 3,7 m3/sec, and depression funnel has square about 200 km2. The level of underground waters has decreased on 17-28 m. This led to the underground waters relief in Karasu river and moved the boundaries of the pinching out zone to the north, which reduced the square of naturally sunk territoties. In addition, the ground waters level lower than surface on 10 m and more improved the technical-geological properties of the ground, as well as potencially decreased the earthquakes probability approximately by 1 time.

Water-bearing horizones of debris cones are not protected from the surface pollution. The urbanization impacts the quality of underground waters as well, because a sanitary protection can not be reached. They have been polluted for a long time. Areal pollution by nitrartes __have been identified both on debris cones (about 100 mg/l) and on foothill plain. On the urban territory in the zone of underground waters pinching out and lower the areas polluted by oilproducts, phenols (up to 20 limit concentration (LC)), mercury (up to 2 LC), cadmium (up to 10 LC), lead, selenium, manganese (7-10 LC), synthetic surface active substances, bromine are found.

Phenoles in the underground waters found almost everywhere. Besides these compounds the underground waters content within the limit concentration copper, zink, molybdenum, vanadium, beryllium, arsenic. Maximum concentration of such components are found in the different places and in the differnt periods, what is appropriate to anthropogenic pollution, the places polluted by manganese and oilproducts confined mainly to the areas of industrial enterprises.

Over the past decade phenols, nitrates, manganese, oil products as well as bacterial pollution have been found in the productive water-bearing horizons with depth of 150 m. In the water intake areas of the debris cone's central part a manifistation of high quality of kolifags can be seen. The depression funnel foundation led to localization of pollutions within funnel, and to their approach to the water intakes. The process of underground water pollution was studied on the mathematics model using a programming complex TOPAS - 9 (VSEGINGEO), that allowed to operate the Almaty deposit differently.

ASSESSMENT OF IMPACT OF URBANIZATION ON GROUNDWATER QUALITY IN LITHUANIA

Klimas A.
Vilnius Hydrogeology Ltd, Vilnius, Lithuania

The influence of urbanization on the quality of shallow groundwater is important in two aspects: (1) well owners drink this water in city areas, where there are no centralized water supply systems; (2) this water recharges and pollutes deeper aquifers, especially those which are intensively exploited. During the last four to five years, we have carried out detailed studies of shallow and deep groundwater quality in four Lithuanian cities.

In order to investigate and map all these and other hydrogeological changes in the upper part of the geological section of Lithuania, we have proposed an original methodology. The basic steps for the assessment of the effect of urbanization on urban hydrogeological conditions are as follows: (i) formation of computerized data bases (CDB); (ii) control investigations; (iii) mapping of the area; (iv) modelling of pollution processes; (v) monitoring optimization; (vi) recommendations for groundwater protection. These studies do not require large financial means, since data of former investigations are usually used for assessment of the state of shallow groundwater in the cities. Three basic information sources are used in characterising of the quality of groundwater: 1 - data from Public Health Care Centres concerning dug well investigations; 2 - data from geotechnical borings; 3 - data from monitoring and water supply boreholes. Control investigations revealed the fact that anomalies in shallow groundwater pollution in the cities are stable in time and space. Therefore, in order to detect them, water analyses from different times could be used.

The principle of the hydrogeological mapping of urban areas is similar to that of GIS. Usually three maps are compiled: urbanization, groundwater dynamics and hydrochemistry. Groundwater dynamics map shows lithology of water-bearing rocks, and groundwater flow structure, i.e., head contours and water flow lines. Industrial, residential and green areas are distinguished in the urbanization map. Industrial and residential areas are further zoned with more details according to potential effect on shallow groundwater. Hydrochemical maps contain isocones of various groundwater quality criteria drawn from CDB data by the kriging method. After all three maps are superimposed one on the another, the position of isocones is adjusted, and all the CDB data about groundwater quality are grouped according to their position in the above-mentioned urbanization and groundwater dynamics maps. After statistical treatment, the groundwater quality characteristics are obtained for certain urban areas reflecting different urban and hydrogeological conditions in a city. In order to get an integrated picture of the urban effect on shallow groundwater, the summarized anomaly coefficients are determined from groundwater quality indices, then after treatment by factorial analysis, the zones of greatest groundwater pollution and those of pollutant migration are defined.

The effect of urbanization on shallow groundwater quality is expressed in three ways:

1. Groundwater is polluted by substances which do not occur naturally in the aquifer;

2. Pollution increases the concentration of already existing components;

3. Pollutants are transformed in the aquifer by means of interaction with water-bearing rocks, thus supplementing the groundwater chemistry with new compounds.

Long-term data show that the composition of fresh groundwater under the impact of pollution is developing in a well ordered manner. The neutral oxygen-rich environment that prevailed in a clean hydrogeological medium is gradually being replaced by a slightly alkaline or alkaline anoxic environment under the conditions of intensive pollution.

The influence of urbanization on deeper semi-confined aquifers is revealed at the time when these aquifers are insufficiently isolated from polluted shallow groundwater or when they are being heavily pumped.

Our investigation in the cities mentioned shows that from the ground surface to a depth of about 30 m the confined water chemistry is similar to that of the shallow groundwater, except for the fact that the confined groundwater always contains less nitrate, but more ammonia and bicarbonate. Such changes in confined groundwater chemistry are observed to the depth of 70-100 m. Below these depths, the groundwater practically never contains nitrate and is enriched with iron and manganese, and sometimes with hydrogen sulphide. This indicates a change in redox environment in the polluted deeper aquifers compared with unpolluted ones. Especially typical is the increase in alkalinity that is the result of redox reactions. Such phenomena are observed in Siauliai and Panevezys water intakes to the depths of 180-250 m.

FRESH UNDERGROUND WATERS IN A YAMALO-NENETSKY AREA

Kovalchuk A. I, Ivanov Y.K.
Institute of geology and geochemistry, Urals Branch Russian Academy of Science, Ekaterinburg, Russia

The fresh underground waters being practically a unique source for users are distributed in sediments of Oligocene-Quaternary in age with thickness up to 300 meters.

They composed by interbedded clay and sandy formations, in a various degree covered by permafrost. Combination of changeable litiology and the development of a permafrost responsible for complicated character of groundwater distribution in section , and their hydrodynamics and hydrochemistry.

Some horizons of underground waters are distinguished in the section:

1. Sediments covered cryogenic zone with thickness about 1.2 - 3.0 meters correspond to active layer.
2. Series "inter cryogenic" horizons located in various levels.
3. "Under cryogenic" horizon are disposed in lower part of permafrost.

"Inter cryogenic" horizons are connected with a surface water by system melted ground of various size. They are associated with lakes and river valleys. Through this melted areas occuring inflow and discharge of groundwater.

In the "inter cryogenic" horizons the most practical importance have Oligocene-Quaternary sediments. The aquifer thickness increased from 6 to up 100 meters in a southern direction. Waters have hydrostatic pressure. The depth of water level is situated on depths from 1 to up 20 м with precisely expressed gradient from watersheds to river valleys. Yields of wells is 100 -2000 м3/day with level fall 1.5 - 50 m. Waters are belong to ultra fresh type with salt percentage about 30 -160 mg/l. The Oligocene horizon, represented by melted sandy deposits. The specific yields lower than in Oligocene-Quaternary horizon with salt percentage about 40-200 mg/l.

The "under cryogenic" horizon was investigated very poorly and its practical importance is limited by the large salt percentage (2 - 5 g/l).

The "inter cryogenic" horizons were the main objects, Oligocene-Quaternary in age. The main problem was the study of chemical composition (natural background), and an estimation of pollution by results the oil extraction wells.

With respect to hydrochemistry the underground waters of a natural background are rather monotonous. All investigated objects by composition correspond to ultra fresh and characterized by salt percentage (not more than 160 mg/l). They have a critical (exceeding MCL) concentration of iron, manganese and SiO2. The heavy metals concentration, excess MCL have not been established.

It is possible along with to note individual features of waters distribution in Urengoisky, Noyabrsky (Noyabrsk, Muravlenko, Gubkinsk) and Nadimsky areas.

The Urengoisky area waters characterized by the minimum salt percentage (34.0 - 74.0 mg/l). In Noyabrsky area the salt percentage raise from 52.0 to 158.0 mg/l and in Nadimsky area it raised to 72.0 - 162.0 mg/l. Its increase occurred in the case of calcium and magnesium raise. The following are the chemical composition of groundwater in Noyabrsky (1), Nadimsky (2), N.Urengoi (3). "Purneftegas" (4), "Noyabrskneftegas" (5) area and Noyabrsk city (6):

$$M_{77,18}\frac{HCO_3'94,87}{Ca''33,77\,Mg''36,35\,Na'14,29\,Fe'''11,69}SiO_2\,28,05(36,34)\ (1)$$

$$M_{104,25}\frac{HCO_3'94,03}{Ca''40,58\,Mg''36,23Na'10,14}SiO_2\,23,34(22,39) \quad (2)$$

$$M_{51,0}\frac{HCO_3'46,15SO_4\,28,85Cl'19,23}{Mg''34,36Ca'25,00Na'15,63Fe'''15,63}SiO_2\,17,40(34,12) \quad (3)$$

$$M_{65,25}\frac{HCO_3'95,38}{Ca''34,79\,Mg''30,43Na'15,94Fe'''14,49}SiO_2\,25,53(41,01) \quad (4)$$

$$M_{87,78}\frac{HCO_3'95,51}{Mg\,42,68Ca''29,27Na'13,41}SiO_2\,27,58(31,42) \quad (5)$$

$$M_{96,86}\frac{HCO_3'90,84}{Ca''45,45\,Mg''27,28Na'11,57Fe'''10,74}SiO_2\,28,14 \quad (6)$$

Underground waters pollution occurs by of organic compounds such as petroleum, phenol, and used in technology dihetilenglicol and methanol. The same type pollution is common for Noyabrsky area and for the some production wells of Urengoisky area. The pollution of underground waters absent in the Nadimsky area.

CLIMATE AND GROUNDWATER RESOURCES IN THE MOSCOW REGION

Kovalevsky V.S., Yakimova S. V.
Water Problems Institute, Russian Academy of Sciences, Moscow, Russia

Climate transformations, caused by human impact, and expected to manifest themselves in changing the temperature of air, atmospheric precipitation and evaporation, cannot but effect groundwater regime and resources. Assessment of these changes for Moscow region is particularly important, as due to its high urbanization and water balance stress, any disturbances of hygrogeological and interrelated with them engineering-geological conditions can be significant from a practical point of view, that obliges to know and, hence, to predict such changes.

Worked out by State Hydrogeological Institute (GGI) scenarios for climate changes serve a basis for such predictions, and also adapted by us methods for predicting groundwater regimes and resources, as applied to solution of this problem. Low winter groundwater discharge has been considerd as groundwater resources, registered, using actual hydrological measurements and characterizing minimal annual groundwater recharge (minus evaporation, transpiration and irreversible losses, caused by exploitational water pumping out within a watershed).

It is known, that global climate warming up, judging by paleoclimatic reconstructions, results in increasing the difference between atmospheric precipitation and evaporation in northern and humid areas of the Earth, and, vice versa, to predominance of evaporation over atmospheric precipitation in arid zones of the globe, thus increasing a degree of climate humidification in the former and climate aridification in the latter case. Moscow region is near the interface between these two zones. Therefore, any siguificant, and particularly catastrofic changes should not be awaited here. Nevertheless, predicted for this region increase of atmospheric precipitation by approximately 100 mm/y or 100-150 mm/y (under a global climate warming up by 2 or 3-4 C°) will be 15-25 % of the water balance income in the region. Similar changes are predicted for the third decade of the coming century.

Analysis of groundwater discharge perennial data series from 34 observation points, uniformly spread over the Moscow region, has demonstrated a general positive trend, i.e. a tendency to increasing groundwater discharge from 0.02 to 0.19, on the average, 0.08 l/sec km^2 per year.

Revealed tendencies can serve an indirect proof for the influence of incipient climate changes on groundwater resources. Extrapolation of these trends to the future makes it possiple to roughly assess a possible increase in groundwater recharge by 2020 y on the average of 1.5 l/sec km^2 for the region, that will be more than 35 % of the weighted mean for the groundwater guaranteed recharge, assessed by low groundwater discharge, and about 16 % of the mean annual groundwater discharge, obtained by calculations basing surface runoff hydrograph separation. Calculation of exfrapolation envisages trend gradient unchangeable in future, and changing in time portion of atmospheric precipitation in groundwater recharge, i.e. groundwater discharge coefficient. Actually, the latter is not constant, and depends on the water content degree of the year, sometimes, considerably.

Prediction of groundwater recharge changes, based on a determined regularity of groundwater discharge coefficient variability, on the water content degree of the year, has

shown a possible increase of the groundwater discharge coefficient at the same period of time for a region on the average from 12 to 15 % (under atmospheric precipitation increase by 100 mm/year).

The third way of prediction, based on the models with concentrated parameters, taking into account predicted changes in effective precipitation (minus evaporation), changes in moisture reserves in the watershed and degree of inertia for aquifers, drained by rivers, has demonstrated possible increase in groundwater discharge by 0.5 l/sec, that is about 18% of a mean, for a region, groundwater discharge module and about 16% of a predicted increase for atmospheric precipitation.

Predicting assessments made for a possible change of groundwater recharge in future by different independent methods have shown close in order values. Taking into account an expert character of such assessments, and their low accuracy, the most probable order of values for predicted groundwater resources changes can be assumed equal, on the average, to 15-20% of predicted changes in atmospheric precipitation.

Predicted groundwater resources increase, on one side, will improve conditions for water supply of the region, will increase low river run-off and improve ecological situation. On the other hand, groundwater recharge increase will result in groundwater level rise by 15-20 cm in characteristic for the region sandy sediments and by 0.5 m in sandy loam ones, that constitute aeration zone. It will increase the level of underflooding some cities in the region (including Moscow), make active landslide activity, karst processes, swamping of low land territories. All these enable us to concentrate our attention on predicting these negative consequences in connection with coming climate changes.

INFLUENCE OF OPERATION OF UNDERGROUND WATERS ON GEOLOGICAL ENVIRONMENT OF CITIES OF PRIAMURIE

Kulakov V. V.
NTC Dalgeocenter, Khabarovsk, Russia

Concentrated take of underground waters in areas of cities Priamurie activates speed of course and essentially changes a direction hydrodynamical, hydrogeochemical and hydrogeomicrobiological processes, take place in geological environment in natural conditions. Hydrogeodinamical processes:

- Change of a direction, speed of a movement and termination of unloading of underground waters (tt. Khabarovsk, Komsomolsk-on-Amur, Sovgavan, Tynda);
- Downturn of levels, increase of capacity of a zone of aeration (tt. Raichikhinsk, Shimanovsk, Blagoveshchensk, Khabarovsk, Komsomolsk-on-Amur);
- Hydrogeochemical processes:
- Decrease or increase of natural concentration of components of structure of underground waters - Fe, Mn, Cl, Na etc. (tt. Khabarovsk, Komsomolsk-on-Amur, Sovgavan);
- Occurrence of new components in structure of underground waters in result technological of pollution - oil-products, B, Pb, Zn etc. (Solnechny, Komsomolsk-on- Amur, Khabarovsk).

Hydrogeomicrobiological processes, the fact of which course is established recently.

They result in change aquifers, them lithification and creation of natural clearing structures - Severny water supply of Khabarovsk, where the cementation of sandy adjourment aquifer of iron-manganese deposits' by adjourment, and also intake underground waters (Fe < 1 mg/l) is observed with concentration of iron in water outside of a zone of influence intake, exceeding 30 mg/l.

ABOUT STRATEGIC IMPORTANCE OF ARTESIAN WATERS RESOURCES FOR WATER SUPPLY OF THE POPULATION EAST CAUCASUS IN XXI CENTURY AND MEASURES OF OVERCOMING OF CATASTROPHIC PROCESSES OF THEIR POLLUTION AND DEPLETION

Kurbanov M.K.
Geological Institute of Dagestan Scientific Centre of Russian Scientific Academy,
Scientific and Prodaction Enterprise "Rodnic", Russia

The resources of fresh groundwaters of Terec-Kuma Artesian Basin (TKAB) are maintained by more than 5000 artesian wells and serve as a main source of waret supply of the population of populous arid East-Caucasus region.

Approximately hundred-year depredatory exploitation of artesian basin has resulted in a number of regions to depletion of storage, regional deterioration of composition of groundwater, waterlogging and salinization of considerable soil tract and appresiable subside of ground surface.

In Northern Dagestan 90% in a 3000 artesian wells have not a zone of sanitary guard and there are gross violations of technical and sanitary norms during their functioning. Ground water of 38% artesian wells contain more then 2-8 norms of arsenic. Repeatedly exeed drinking norms of concentration of organic acid, heavy metals, phenols. As a result more than 50% of artesian waters already do not answer normative quality, that is fraught with unpredictable conse-

quences in immune system of the population, using constantly this water.

More than 1500 artesian wells (50%) have completely passed normative amortisation term (25 years) and are mainted on 30-50 years, that has brought to packed casing string, put wells out of action. In consequence it there is the intensive hashing of saline groundwaters of overlie and lower aquifers and fresh drinking waters of productive aquifers.

Arsenic contamination and occurrence other carcinogenic elements in groundwater provoke formation large depression funnel in artezian basin; reduction of pressure, cut discarge of wells and increase mineralization of waters. At allows to assume, that the main reason of arsenic pollution of groundwater of TKAB is wear and tear of artesian wells and processes of mixture of high-mineralization and fresh groundwater.

Thus, take place irreversible processes of replacement drinking water with high-mineralization water, that is fraught with catastrophic consequences for unique artesian basin in south Russia.

Simultaneously occurs degradation of grounds of artesian basin because 90-95% of water extracted outside large villages is thrown out on a surface ground, that promotes quick increase of saline water table and processes of secondary salinity of hundreds hectares of soil yearly. Increase of Caspian sea-level on 2,5 m for the last 20 years seriously worsen the complicated ecological situation on the area of hundreds thousand hectares of coastal regions of Dagestan and Kalmykia, where a number of cities and a few tens of populated areas are placed.

Overcoming negative processes of depletion and pollution of groundwaters of TKAB can be carried out by radical reconstruction of artesian water supply system and first of all, liquidation of old wells and drilling of new instead their and capital repairs more than 2000 artesian wells. For this purpose it is necessary to carry out inspection and ecological certification of each well, to draw up a databank and constantly working hydrogeological model of operation by resources and quality of groundwaters of TKAB. It is necessary to carry out universal introduction of tap, tap-diafragm, capacity-distribute methodics and method of intensive water-extracted and subsequent accumulation of natural waters in underground reservoirs, which were developed earlier in Dagestan Scientific Centre of Russian Scientific Academy.

All these measures, including the recomendation about consideration TKAB as especially protected water object of Russia, are stipulated in the project of the Program "Rodnic", which is recommended to consider and realize as Federal East Caucasus Program of rational use, protection and restoration of groundwater resources for 1998-2005 years.

ABOUT THE TECHNIQUE OF RATIONAL USE OF UNDERGROUND WATERS OF ARTESIAN WATER-BEARING HORIZON

Melikyan N., Aloyan N.
Research-and-production association of water problems and hydraulic engineering, Yerevan, Armenia

At designing of water supply networks, for which a source of water are gushing of a chink for settlement it is necessary to accept discharge of a chink at quasi-stationary mode filtration. But meaning the peculiarity of gushing chinks, that their discharge in time monotonously decreases (in initial period considerably strongly, and hereinafter asymptotically aspires to quasistationary), there are the significant surpluses of water, which are usually dumped at operation of these chinks (especially in the initial stage).

It is offered landmark regulation throw cock of work of gushing chinks for rational operation of stocks artesian of waters.

It is developed the technique for definition of number of stages of regulation of discharge, duration (time of a beginning both end) of each stage and meaning of factors of additional resistance of entered cocks, arrangement above orifices of chinks by using the settlement formula, received by the authors for definition of discharge of these chinks at any moment of time and proceeding from the diagram of required water. In a basis of accounts is put a condition that in networks of water supply should always be provided a required quantity of water.

The offered technique is consecrated on one particular example for gushing chink, located in artesian water-bearing horizon of Ararat valley and thus economy of water in 3,5 years of operation makes nine hundred thousands м .

UNSTEADY INFLOW OF UNDERGROUND WATERS TO GUSHING WELL IN PRESSURE HEAD WATER-BEARING HORIZON

Melikyan N.
Research-and-production association of water problems and hydraulic engineering, Yerevan, Armenia

Gushing wells differ from other types of underground water intake structures by that as their discharge and pressure in them in time monotonously decrease. The discharge is defined not only by hydraulic-geological conditions of water-bearing horizon, as well by hydraulic resistance inside a well.

The problem of hydraulic-geological accounts of a gushing well is mainly in definition of its initial discharge and

forecasting of its further decrease, and also in definition of decrease of pressure in water-bearing horizon.

Existing nowadays in the theory of filtration the settlement formulas for vertical wells (with constant discharge or with constant pressure in a well) are not give. opportunities satisfactorily to solve this problem.

The arising thus difficulties are connected to non-linearity of boundary condition on face of gushing a well, which is much unknown function from time, being subject to definition at integration of the differential equation.

We create mathematical model of uniform hydraulic system on the hydraulicintegrator: water-bearing horizon - a gushing well, with providing in it of the appropriate mode of a movement of water (laminarity - in water-bearing horizon and turbulent - inside a well) with existing initial and boundary conditions by using the theory of mathematical simulation on network models and principles of hydraulic modeling.

On this model is solved a generalized problem for gushing well. The typical equation, describing the process of gushing, is made on a method of A.Zanghar, through matrixes and analysis of dimensions. There are made dimensionless complexes from parameters defining water-bearing horizon and a gushing well and by results of a generalized problem are determined their meanings. It is made the graphic connection between these complexes (here is discounted the recommendation of V.Shestakov) and with use of a method of the least squares is revealed analytical expression of this connection. As a result is received the settlement formula for determination of a discharge of a well at any moment of time. The formula on the structure is similar to the known formula of C.Theis, the difference is only the additional member, which is taking into account nonlinear hydraulic resistance inside a well.

We receive the settlement formula for definition of a decrease of pressure in any point of a water-bearing horizon at any moment of time.

Thus is used the known solution of M.Muskat for the differential equation of a filtration movement in elastic porous medium as an integral and the method of I.Chamiy on decomposition of the function of a variable discharge included in this integral into a series of Taylor. In the received formula alongside with the function of discharge enter its derivatives also.

Checking the received settlement formulas by actual measurements permit to propose them for using in designing and operation process of gushing wells.

TECHNIQUE OF DEFINITION OF AN OPTIMUM DIAMETER OF GUSHING CHINKS

Melikyan N., Aloyan N.
Research-and-production association of water problems and hydraulic engineering, Republic of Armenia

Hydraulic-geological conditions artesian water-bearing of horizons allow to make a fence of underground waters with the help gushing of chinks, without use of the electric power and of abyssal pumps, being external working forces for vertical chinks with pumping out.

Here intake of a water is made under action of internal elastic forces of water-bearing horizon, therefore it is necessary without fail to take into account intrachinks nonlinear hydraulic resistance, on overcoming of which a significant part (sometimes up to 50 *%)* these forces is lost, therefore discharge of a chink turns out much less from its potential quantity.

It is possible to reach the reduction of losses of energy in a pipe of a chink and increase its discharge by increasing a diameter of a chink. But after some meaning the further increase of a diameter of a chink becomes economically inexpedient, as in this case the increase discharge becomes insignificant (logarithmic connection), and increase of the capital charges proportionally to increase of a diameter.

If to mean the fact, that in criterion function for gushing of chinks the capital expenses make the basic part of the charges, the reasonable choice of a diameter of a chink has large economic importance.

At usual vertical chinks with pumping out their diameter depends mainly on the dimensional characteristics of abyssal pumps, and the connection between discharge and diameter has logarithmic character.

But for gushing chinks at the account of intrachinks hydraulics this connection strongly deviates from logarithmic character and accepts a very complex expression.

The choice of an optimum diameter is made by a graphical and analytical way. We reveal the kind of a function of discharge of a chink from its radius for settlement time in view of internal nonlinear hydraulic resistance and is constructed its diagram, which has three separate characteristic sites: concave, almost rectilinear and convex; the diagram has one point of inflection.

It is built the diagram of dependence between capital expenses on construction of chink from its diameter. There are determined their specific capital expenses on one litter/sec, gushing of water and is made their graphic dependence on a diameter with the help of these two connections. This diagram has a precisely expressed point of a minimum and the diameter is appropriate to it required optimum.

The offered technique is consecrated on a particular example for conditions artesian water-bearing of horizon of the Ararat valley.

Analyzing data on current here to gushing chinks, is found out, that using an offered technique at designing new such chinks, for each of them will give economy in the size from 5 up to 30 thousand US dollars.

The technique gives also opportunity to define optimum number of gushing chinks for a fence of required water with the purposes of water supply.

NICHE: A NEW MODEL FOR HYDRO-ECOLOGICAL IMPACT ASSESSMENT

Meuleman A.F.M.
Kiwa Research & Consultancy, Nieuwegein, The Netherlands
Jorov A.A.
Ministry of Natural Resources of the Russian Federation, Moscow, Russia
Yazvin A.L.
Hydrogeoecological Research & Design Company HYDEC, Moscow, Russia

The Netherlands has a great experience in the field of water management and ecological impact assessment. This might be used in other countries, in cases where the water environment is, or will be, affected. One of the possibilities to transfer Dutch hydroecological impact-assessment models to Russia will be shown in this paper.

Since the last decades, nature conservation and development in The Netherlands is one of the major aspects of water management policy. Several models were developed in The Netherlands for quantifying the impact of changes in surface water and groundwater hydrology on the species composition of the vegetation of wet ecosy stems. Most of the existing models can not be used on a local to subregional scale or need excessive input data. Therefore a new model (NICHE: Nature Impact assessment of Changes in Hydro-Ecological systems) was developed that uses easily obtainable data (local or regional scale) to predict effects on the vegetation of changes in hydrological and soil conditions (e.g. induced by changes in water management or water abstraction) and landuse.

Based on dose-effect functions NICHE calculates site conditions that control vegetation growth (trophic status, base saturation, groundwater level) from data on spring and autumn groundwater levels, soil type and land use. Dose-effect functions that are based on field observations and expert judgement, are embedded in a Geographical Information System (GIS). Predicted site conditions are compared with a database that contains site requirements of vegetation types. If predicted site conditions fall beyond the range of site requirements of the current vegetation, it is predicted that the vegetation will be replaced by a vegetation that meets future site conditions. NICHE can be used for ecological impact assessment and ecosystem restoration.

This presentation will focus on the use of the model NICHE in The Netherlands and in Russia. In The Netherlands the model is used to evaluate the effects on nature of groundwater abstraction, surface water abstraction (drinking water production) and changes in agricultural landuse or site management. In Russia and particular in the Moscow Region rather similar problems occur. Plans to use huge amounts of groundwater for drinking water supply, oblige to evaluate the landscape-ecological consequences of groundwater abstraction. NICHE will be used to predict the effects on nature of groundwater abstraction in the Oka River area (first stage: 6 m^3s^{-1}). Compared to The Netherlands, the natural and hydrogeological situation is different in the Oka river area (e.g. effects of flooding and snow cover on soil water regime and complicated relationship between phreatic ground-water, surface water and deep aquifers in limestone and dolomite). However, there is a limited amount of input data for the Oka river area. Nevertheless the design of NICHE allows to achieve the goals mentioned. In the future NICHE will be tested in other regions of Russia that are affected by ecohydrological impacts.

USE OF BURIED RIVER VALLEYS SUBSURFACE WATER RESOURCES

Minasyan R., Vardanyan V.
Republic of Armenia Association of Water Problems, Yerevan State University, Yerevan, Armenia

In the history of the Earth geological development of repeated outbursts of volcanism, accompanied by the huge lava ejection different by composition had occurred. As a result the vast areas were covered with the products of volcanic activity. From the point of view of subsurface water investigations the regions where volcanism had its place in Cenozote - Apennine, Small Asia, Caucasus, South of Syria, Iran, Western Africa, East of South America - have a special interest. In these regions the effusive rock covers and beds has marked the geological structure, their ancient relief, and, specially, river valleys. If the centers of volcanic eruption are near the valley the lava will flow down them and overlap the alluvial sediments. Considerable water bearing horizons can be formed in areas with the buried ancient hydrographic system. The rivers being backed with lava beds will form lakes. The central volcanic plateau in Armenia is one of the typical regions of recent volcanism.

For discovery and use of ancient hydrographic network waters we solve the following problems:

The stage of field works projections - generalized physicohydrogeological models (GPHM), especially the ones of expected paleo valleys, are composed on the basis of gathering and analysis of present petrophysical and water-physical characteristics of fee studied region and results of works in similar areas; if space images and air photographs are available their preliminary deciphering is carried out and control sites for field works are chosen.

The stages of field investigations - using a complex of methods - geophysical, paleomorphological, hydrogeological - for study of sublava water resisting layers condition, extraction and characterizing of water carrying collectors.

The stage of processing and interpreting of field investigation data - correlative dependencies between structural-hydrogeologic, paleomorphologic and geophysical proper-

ties are established; maps and section of hydrographic network are composed and the best sites for subsurface water extraction established.

Different methods of electrical sounding are used for distinguishing of paleovalleys in volcanic regions depending on specific investigation materials. Distingulshing of paleovalleys becomes more complicated with the increasing of its depth (>150m) and with gradual changing of ρ with depth. Affirmative results for these cases were obtained when using mathematical modeling method.

In study of ancient hydrographic network subsurface runoff, particularly when determining the depth of aquiclide and paleovalley's riverbed location, the results of field instigation firstly are the consequence of two interrelated morphostructural factors. One of them is connected to general slope of paleorelief (regional anomaly) and the second - to influence of paleovalley (local anomaly). Approximating function of regional trend may be linear (linear trend) and parabolic (parabolic trend). Less or more complicated function can be taken for describing trend e. g. cubic or of a higher degree, what may lead to less distraction of computed (theoretic) values from the ones of field investigation. We considered trend as a linear function between geographic coordinates of observation sites (sounding and drilled boreholes) and fee depth of water resistive stratum. Based on subtraction of H_b and H_b from water resistive stratum depth (H_b) new maps of ($H_b - H_b$) and ($H_b - H_b$) are composed in both cases subtraction of trend is used as a filter of high carrying capacity, that removes large-scale structural variations form preliminary (observation map) and keeps characteristical features of areas' paleorelief, particularly related with paleovalleys.

On the basis of investigations of ancient hydrographic network of Central volcanic highland of Armenia were distinguished several complexes of lava covers and streams flown over ancient valleys and having surface distribution, morphology and water carrying.

GENESIS AND GEOLOGO-HYDROCHEMICAL CRITERIA FOR SEARCH OF ECOLOGICALLY PURE WATERS

Oborin A.A., Michailov G.K.
Institute of ecology and genetics of microorganisms of US RAS, Perm, Russia

According to WHO standards and present physiologo-hygienic requirements in medicine weakly mineralized hydrocarbonate- calcium waters which do not contain increased concentrations of toxic elements, namely mercury, cadmium, berillium, arsenic, lead, etc., belong to ecologically pure waters.

Unique combination of geological and hydrogeological factors is essential in formation of underground waters with this content. Hydrochemical composition at such type of water can be formed at precipitations' filtration through vast lithologically homogenous thickness of carbonate rocks that do not contain heavy metals from load zone to discharge zone. Highly pure (over 90% calcite) limestones are formed in normally marine coastal reefogenic fades. Therefore main searching criterion for ecologically pure waters appear to be the sites of thick reefogenic formations' exposure to the surface.

These conditions are typical to the region of Uflmsky plateau in the southern parts of Perm region and in Bashkiria where subregional sites of reefs of Upper Carbonian - Lower Permian age are developed.

PROBLEM-ORIENTED APPROACH AND THE USE OF INDICATORS IN GROUNDWATER MANAGEMENT

Ottens J.J.
RIZA, Lelystad, The Netherlands

The selection and use of indicators is an important step in the development of an integrated water management policy. Integrated water management has to deal with different functions and uses of the waterbody under concern and this may lead to conflicting interests. To be able to manage this complex of interests, the right information is vital. Indicators become increasingly important in providing this "right" information, since their function is communication, simplification and quantification of information on a (groundwater) system.

Under the UN/ECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Helsinki, 1992), guidelines on the monitoring and assessment of transboundary groundwater are being developed. These guidelines will be based on the monitoring cycle, which specifies successive steps in elaborating a monitoring network. The first step, that links monitoring with water management, is the specification of information needs. The use and selection of indicators can be seen as part of this step. Therefore, the background studies, that are executed as part of drafting these groundwater guidelines, include a study on a problem-oriented approach and the use of indicators. Based on the preliminary results of this study and of an inventory of transboundary groundwater and related monitoring and assessment activities, a framework, which facilitates the development and use of indicators and which can be use to attain the goals of groundwater monitoring and assessment programmes, will be presented.

Rather than recommending the use of specific indicators (because they are a.o. time and place dependent), the aim of this presentation is to propose a method for selection and

use of indicators in the monitoring and assessment of transboundary groundwater. Stepwise it is indicated which aspects have to be dealt with for a successful process of development and implementation of tailor-made indicators. These steps can be described as:

- identification of function/use and issues (function like drinking water supply and issue like salinisation)
- if issues are conflicting with a certain function, management objectives can be formulated.
- translation of formulated management objectives into information needs
- as part of the tailoring indicators to the specified information need, the following aspects have to be taken into account:
- the stage of the management (see management life-cycle: problem identification, policy development, policy implementation and control)
- identification of stage in the PSIR concept (Pressure, State, Impact, Response -causality chain of relation between the socio-economic system and the environmental (groundwater) system). This concept acknowledges the different goals for which indicatros will be used
- the hydrological and geochemical functioning of the groundwater system
- the information users (policy makers and/or operational managers)
- the available(technical and financial) means

From the inventory an overview of the different functions/uses, issues, and management objectives, that are recognised amoung countries that have ratified the Helsinki convention, has been obtained. From this overview examples of the tailoring of indicators for particular issues will be demonstrated. And although in groundwater management there is no such thing as universal indicators, due to differences in the aspects mentioned above, let alone in a transboundary context, indicators can present harmonised environmental information at a global scale, when the development or choice of indicators is based on the same approach.

HYDROGEOLOGICAL PROBLEMS OF THE URALS AND MATHEMATICAL MODELING

Palkin S.V., Rybnikova L.S.
The Ural Committee for Geology and Nature Use, Yekaterinburg, Russia
Feldman A.L.
The Ural State Mining and Geological Academy, Yekaterinburg, Russia

The main hydrogeological problems of the Ural Region are related to the shortage of drinking groundwater supplies, worsening of groundwater quality under the influence of human and natural factors. Mathematical modeling has been successfully used to solve hydrogeological problems of the Urals since the late 1960s. At present, the role and importance of modeling have increased as groundwater monitoring systems are established, with the aim to effectively monitor a multi-variant system "the man - hydrosphere". It was generally recognized that hydrogeomigration mathematical models of objects are the «nucleus' of both local and regional monitoring systems.

A local model of the Shadrinsky deposit is an example of implementing mathematical models of different scales for the Ural Region; and the model of the Iset run-off basin - an example of a regional model.

Within the limits of the Ural Region, it is expedient to single out three areas of forming groundwater flow:

The fold-mountain Urals, which is characterized by considerably heterogeneous fractured aquifers (as a rule, one-layer systems).

The Tobolsk artesian basin is characterized by multi-layer hydrodynamic systems with a complex hydrochemistry.

The transit zone between the fold-mountain Urals and the Tobolsk artesian basin reflects specific features of both hydrogeological structures and is characterized by specific conditions of groundwater formation.

A common feature which unites these, different in the hydrodynamic respect, structures is the development of confined basins of underground flow. Due to this fact, forecasting and monitoring issues should be solved within the limits of local water catchment areas (mini-basins).

The methodology of using mathematical modeling for solution of specific tasks and implementation of monitoring systems is different depending on natural conditions.

The fold -mountain Urals. An example of a comprehensive use of several methods is the Kashinsky deposit of groundwater (Sukholozhsky District of the Sverdlovsk Region). Areas of water catchment (sanitary protection zones) and quarry drainages are defined by the modeling data. Assessment of predicted reserves has been made by a balance method, and commercial reserves of specific catchments - by hydraulic calculations.

The Trans-Urals. Productive aquifers of the Tobolsk artesian basin are well enough protected from the surface contamination, but the danger of worsening of the withdrawn groundwater quality resulting from the inflow of non-conditional water from adjacent aquifers and flanks of deposits is great. Apart from this, one should take into consideration capacity reserves of covering sediments and separating layers.

The system, typical for the Trans-Urals, is a multi-layer system on the area, to which two unique Shadrinsky deposits of sweet and mineral groundwater (Yessentuki type), situated in the valley of the Iset river, are confined . Upon additional exploration, all the predicted assessments have been made with the help of a 4-layer, continuously operating hydromigration model of the deposit. The model is a part of the ground water monitoring system which is implemented at the object.

The transit zone. Here, major groundwater deposits are confined to a regionally persistent layer of carboniferous limestones?. Water-saturated under natural conditions, a cover mass contains a considerable amount of sulfide

minerals; coaly formations enriched with sulfide mineralization also fill fractures in limestones. If deposits are used for many years, in the hydrodynamic area of their influence, there forms a technogenic zone of aeration, which results in changing the type of water, increased mineralization, hardness, and a higher content of the sulfate-ion.

To stabilize the quality of groundwater and to improve its total hardness parameters, we have to change the scheme of water withdrawal (dispersed intakes) and, probably, to decrease the withdrawal. As the maximum content of sulfide minerals is fixed in the lower part of the cover mass, requirements to the accuracy of the geofiltration forecast (the need to control the rate of lowering of layers) become more strict.

In the given case, it is expedient to base engineering measures on methods and regimes of withdrawal on a thorough geochemical and biochemical study of the cover mass, technogenic zone of the aeration and the aquifer itself (with a quantitative description of geochemical processes in the system «aeration zone - aquifer» with the help of thermodynamic modeling methods.

ABOUT SPECIFICITY OF THE TECHNOGENIC LOAD INFLUENCE ON THE CHANGES IN THE SUBSURFACE WATER QUALITY

Panteleeva T. I.
Production & Research Institute for Engineering Construction Survey (PNIIIS), Moscow, Russia

The investigation of the subsurface waters chemical composition formation has been performed at one of the enterprises which produces fertilisers. Specific technological features of the production under consideration are the following:

a) pollutions of both air basin and soil basin, surface reservoirs, surface stream flows and also subsurface water by dust outbursts;

b) fault and accumulation of sewage in the places of slime accumulation, solid waste storage i.e. phosphate of gypsum which serve as the sources of intensive subsurface water pollution, including aquifers in operation.

Phosphate of gypsum is a waste product after the phosphoric acid production from the apatites, in mineralogical relation it includes gypsum with the admixture of calcium phosphate, composed apatite, silica and sesquioxides. During the storage the compaction changes the composition of water soluted compounds, i.e. the most mobile components. Low pH values of water extracts show the presence of free acids, i.e. orthophosphoric acid and sulphuric acid, where solvent components are represented by sulphate ion, calcium, orthophosphates and fluorine. The stated components intensity of the transfer to the liquid state is determined by many factors including aquaphysical properties of the technogenic rocks.

Liquid production waster is the sewage with rather variable composition which comes into the places of slime accumulation after the treatment at the neutralisation station. At the entrance to the slime accumulation place there is water of fluorid-sulphate-calcium-sodium composition which has the mineralization 9,7 g/l and pH - 2,07 and at the exit there is water of sulphate- fluorid- calcium-sodium type with the general mineralization 6,5 g/l and pH - 2,67. The presented characteristics demonstrate that the treatment at the neutralisation stations doesn't perform well. High cost of methods and low plants capacity generate a need for the consideration of the optimum variants of utilisation systems at the design stage taking into consideration the geological medium peculiarities as a system. The control of such systems needs the knowledge of the processes which can function in the geological medium under the effect of the industrial run off.

So, peculiar gas components such as nitrogen dioxide, fluoric hydrogen, sulphurous gas entering the atmosphere and interacting with the atmospheric precipitation (including snow, sometimes heavy snow) filtrate into the soil, piles of solid waste and penetrate the ground water. Besides on the territory of with the piles of solid waste there is technogenic water with low pH values, very high mineralization up to 17 g/l and constant rize of ground water level.

In the process of sewage infiltration in addition polluted by the atmospheric precipitation there occurs the solution of the solid waste components which interact with the aeration zone rocks. As a consequence the system "technogenic solution - rock" undergoes great modification which have irreversible character. The composition of both astatic soluble compounds and less astatic fixed salts changes greatly. As a result comes leaching of the production solid waste components and formation of such chemical composition of the subsurface water which has no analogue in natural environment.

In the limits of the industrial and protective zones of the plant and also in the adjacent territories the subsurface water was subjected to serious transformations:

qualitative and quantitative macrocomponents composition had been transformed including changes in chemical type i.e. from hydrocarbonate calcium (calcium magnesium) to sulphate calcium (through intermediate types);

concentration of fluorine, orto- and polyphosphates, heavy metals greatly exceeds maximum allowable concentration in the water;

the speed of the pollution areas movement depends on both the degree of the territories underflooding by polluted water and on the intensity of the water intake by the main water intake structures of the region under investigation.

As a result on the territories located in the immediate neighbourhood of the establishment the water in all soil wells which serve for irrigation and other house keeping needs has been polluted. But the main thing is the pollution of the subsurface water of the aquifers under use providing portable

water both to close situated little settlements and other more remoted heavily build-up territories of the region.

The persued research proves urgent necessity to take protective measures to preserve the subsurface water quality. Hydrogeological and hydrogeochemical methods of investigation have been developed for such objects, located in different natural conditions, there are variants of the paramount importance measures for the substantiation of the protective measures.

The object of the report is to show one more time the depressive ecological situation which exists on the territory of the among a number of enterprises and on the adjacent territories. The situation may get out of hand and have a severe impact on the environment and mainly on the health of the people who live and work in the region.

ACIDS RECOVERY FROM SPENT PICKLING SOLUTION BY ELECTRODIALYSIS METHOD

Povorov A.A., Pavlova V.F., Nacheva I.I.
CJSC "Membranes", the city of Vladimir, Russia

Electrodialysis with ion-exchange membranes is known as a promising trend in the membrane methods of processing and recovery of spent pickling solutions (SPS) in metallurgical engineering. The electrolyte nature and concentration, current density, electrodialysers design, hydrodynamic regime, membrane type determine the electrodialysis effectivity.

A multi-sectional membrane electrodialyser consisting of a number of cells with alternating cation-and anion-exchange membranes has been developed at CJSC "Membranes". The electrodialyser cell consists of 3 compartments: cathode, concentation and anode ones. Titanium with ruthenium oxide (ORTA) coating is used as an anode and stainless steel - as a cathode.

The commercialization of nitric and sulphuric acids recovery by the electrodialysis from SPS allows to remove not less than 98% of copper, nickel, zinc contaminant ions, recycle for pickling up to 80% concentrated acids blends and the product poor in acids anions and heavy metal processed is used for further concentrating. Metals recovered on the cathode by electrodeposition can be used as non-ferrous metal scrap.

METHODS OF GROUND WATER PROTECTION FROM HEAVY METALS AT WASTE DISPOSAL SITES IN RUSSIA

Sergeev V.I., Lapitsky S.A., Shimko T.G., Ivanova T.K.
Moscow State Lomonosov University, Moscow, Russia

For many industrial processes it is characteristic a considerable volume of wastes that can contain potential pollutants, particularly heavy metals, in mobile migration forms. This is primarily true for wastes of ore-concentrating plants, electroplating, ferrous and non-ferrous metallurgy enterprises and ash-slag wastes of termo-electric power stations as well. These wastes usually bear a high amount of metals that can pass to ground water under the waste disposal site and pollute it.

A long-standing experience on the development of measures for ground water protection at dumping sites gives the possibility to define the cheapest and efficient methods of ground water pollution control. Efficiency of the use of one or other method will be determined by the correct identification of migration forms of the pollutants in the wastes.

In the wastes of works listed above metals-pollutants can be found in the following forms:

1)cation forms,

2)in the form of organo-mineral complexes,

3)in the form of oxi-anions.

As it was established in the result of study and experimental testing at some industrial works in Russia, the forms of metals in wastes determine their behavior in the soil and respectively the methods of their immobilization.

1.Cation forms of metals

They are characteristic for galvanic and some other works where simple salts of metals are used. In this case the natural soil layer of the aeration zone as well as man-made clay screens can serve as a geochemical barrier on the path of pollutants spread.

The study of sorption properties of soils shows that some clayey and loess soils have sorption capacity in respect of Cu,Zn,Pb up to 80-100 mg per g, in respect of Ni, Cr - up to 5-20 mg per g.

Recommendations are given on the use of potential sorption capacity of a soil layer regarding heavy metals.

2.Organo-mineral complexes

These forms of pollutants are typical, for example, for gold-extracting plants. Sodium cyanides used in the process of gold extraction, extract a lot of metals from the ore as well. It is established that cyan-metal complexes are not immobilized by mineral phase of soils. The absorption of metals by soils is possible only after complexes' destruction. For this purpose a multi-layer screen in the foundation of waste disposal site has been developed.

3) Oxi-anion complexes of metals

In the basic conditions of ash wastes of thermo-electric power stations such metals as Se, V, As, Mo form oxi-anions and Sb, Cd, Hg form anion hydroxo-complexes. These metals are not detained or almost not detained by clays and loams. But they are absorbed on lignin and humus of peat. For such wastes the precipitation of the metals on ferrous hydroxides is suggested.

THE PROBLEMS OF THE UNDERGROUND WATERS USAGE FOR ECONOMIC AND DRINKING AND IN THE BASIN OF THE RIVER URAL

Skvaletskiy E.N., Nesterenko Yu.M.
Orenburg Department of the Most Expedient Nature Usage and Geological Environment Protection of the College of Mines, Ural Department of the Russian Academy of Science

About 80% of prospected deposits and operating water intakes In the basin of the river Ural use the alluvial quaternary water - bearing water - level within the boundaries of water-meadowing terraces of the rivers Ural, Sakmara, Or, Ilek and the others. The water-level is connected with the surface drains, it has a high water abundance and is not protected from the pollution. Large economic and drinking water intakes of Orenburg, Orsk, Novotroitsk, Sol-Iletsk and of the other cities use this water-level: under the conditions of reinforcing technogen's influence one can observe the worsening of the underground water quality. Comparing with 1960 in the region of Orenburg the quantity of the water dry remainder in the alluvium, the content of sulfate, chloride, the general hardness have grown in 1,6-1,8 times in the average and the content of metal s (copper, zinc, lead, manganese, selenium) has grown in 2,5-6,0 times. There are centres of the underground waters, polluted with selenium and phenol, which have been formed in the regional parts of Novotroitsk' water intakes on the both banks of the river Ural, in which the limiting factor of dry remainder has been exceeded (till 1,25gr\dm^3), the limiting factor of general hardness has been exceeded (till 9-19 mg-eq.) and in places there is an exceeding of chlorine and sulfate. One can explain some kind of stability of the underground waters chemical composition in the valley of the river Ural during last years by the reduction of industrial and the other productions, with the renewing of which the tendency of water quality worsening is going to restore. The underground waters from time to time do not correspond to the norm requirements on the quantity of dry remainder, general hardness, the quantity of iron, selenium and nitrogen compounds in some water intakes of Orenburg. And in some water intakes (JSC «Strela», RTA, Kushkulinskiy) the underground waters constantly do not correspond to the norm requirements.

Because of the technogen's changes of the underground waters natural composition and their characteristics in the regions of their intensive usage the hydrogeological and ecological situation in water intakes is considered to be unfavourable. Under such conditions the questions of protection of the alluvial water-level underground waters from pollution and exhaustion come to the I place. In Orenburg the task is complicated due to the presence of non-ferrous metallurgy enterprises, chemical industry, operating gas condensate and oil deposits, which cause the oil product pollution of the underground waters, and the others. The underground waters protection is based on «The Water Code Of RF» and on «The Law Of Depth» (1995). In these documents the underground waters are attributed to the state property, which is put at the disposal on the strength of the licenses. In these documents the following things are also provided such as: the prime usage of fresh underground waters with the drinking aims; the reservation of water-supply springs on the basis of protected from the pollution underground waters; the economic activity estimation and correction to reduce its influence on the water springs; the organisation and doing the monitoring in every place of the underground waters usage. In the valley of the river Ural the carrying-out of the underground waters protecting measures from the pollution and exhaustion includes:

The revelation and elimination of pollution and salting sources of the underground waters of the alluvial water - bearing water-level in water intakes and attached territories. The analysis of the 12 functioning Orenburg water intakes shows that the main sources of pollution are enterprises, house building and places for country - houses, which are situated close to the water intake slits.

The creation of the sanitary zones of protection around the water intakes and the fulfillment of the norm provided limiting and protecting measures.

The carrying-out of the regional and local monitoring of the underground waters with the aim of revelation and studying of the pollution centres and the fulfillment of short and long - term prognoses with working out of the preventing measures from pollution, salting and exhaustion of the underground waters.

The working out within the framework of "Drinking Water" program of the measures on optimal usage arid protection of the underground waters for every city, settlement and region; the reconsideration with the aim of reducing of the economic and drinking water - supply norms and separation the last one from the industrial one,

The search, prospecting and use of more protected water-bearing water-levels as the main ones comparing with the water-meadowing ones. The parts with such water-levels which aren't hydraulically connected with rivers, are concluded with high terraces.

The water intake under the conditions of static regime of functioning at the deposits which are worked out in the quantity which doesn't emceed their natural resources quantity.

SITUATION IN UNDERGROUND WATERS EXPLOITED FOR ECONOMIC&POTABLE PURPOSES

Uzhkenov B.S., Burov B.V., Kasymbekov D.A., Nesterkina N.V., Podolny O.V., Smolyar V.A.
Ministry for Ecology and Natural Resources of the Republic of Kazakhstan, Alma-Ata, Kazakhstan

Underground waters hold an important place in the current water balance consumed for economic&potable purposes. Proceeding from problem of water supplies over the Republic especially in arid zones, the areas of administrative regions were evaluated to determine the rate of water supplies in these regions. Ratio of the demand in

fresh water to the scope of hypothetical and explored underground waters of 1 gr./l. mineralization was taken as an evaluation basis. Such a zoning resulted in determination of reliably supplied, ordinarily supplied, partly supplied and weakly supplied areas.

Comparison of the current consumption of potable water over Kazakhstan with a scope of explored water reserves for economic purpose proves that the scope of the explored reserves exceeds by 2.5 times the demand therein. In average 1.02 m3/day of the explored underground waters is allotted per person. (0.08 - 0.09 m3/day in the northern and western parts of the republic, 1.53 - 1.77 m3/day - in the southern part). Disparity in the fresh underground waters distribution determines a sharp shortage in fresh waters in North Kazakhstan and West Kazakhstan. Demand in the potable water is not met not only explored operating reserves but hypothetical reserves

Underground water reserves have been explored for 80 Kazakhstani cities and towns but this volume doesn t meet the existing demand. Rural community is suppled with potable underground waters in a worse manner. Problems related to the water supplies are solved due to exploitation of surface waters and water to be transported.

Numerous mining plants operating in Kazakhstan complete their demand in potable and economic waters due to the explored reserves excluding the plants located in west and north.

Kazakhstan has faced the challenge of underground water quality. Over 700 large potential sources of underground waters pollution have been discovered. Major sources causing the pollution are industrial and farming entities as well as municipal objects. The Almaty underground water field has been contaminating, such properties as oil pollution within the Semipalatinsk airport, mercury pollution resulting from operations of oil/chemical plant in Pavlodar-town, of the Karaganda metallurgy and Karbid Company in Temirtau-town and many other are subject to immediate decision-making,

There are approximately 250 water intake hosted in a zone of underground water pollution. Pollution of underground waters from the water intakes is caused by an economic activities, but 44 water intakes are featured with natural pollution. Not every water intake is equipped with a governmental supervisory monitoring network for underground waters. Pollution of underground water from 180 water intakes was discovered on a basis of a single observation. A supervisory network is absent in a great number of undeveloped fields. This fact arises a problem that a range of underground waters can t be developed.

Thus, the evaluation of the current situation in underground water exploited for economic and potable purposes highlights a range of scientific, organizational and legal events which could improve the situation.

ORGANIZATIONAL AND LEGAL GROUNDS FOR UNDERGROUND WATERS MONITORING IN KAZAKHSTAN

Uzhkenov B.S., Kasymbekov D.A., Murtazin E.Zh., Podolny O.V.
Ministry for Ecology and Natural Resources of the Republic of Kazakhstan, Alma-Ata, Kazakhstan

The Governmental Underground Waters Monitoring (GUWM) is a subsystem of the Governmental Subsoil Monitoring. Objectives, tasks and governing procedures of the latter are determined by the Presidential Edicts on Subsoil Minerals and their Exploitation, approved by the Resolution of the Kazakhstani Government.

Objective of the Governmental Underground Waters Monitoring (GUWM) is an information support governing the National Mineral Fund in relation with rational development and protection of underground waters respective of their interrelations with other environmental components.

Background of the Governmental Underground Waters Monitoring (GUWM) is a supervisory network established to research the underground waters under natural, weakly violated and sensitively violated conditions. This system includes National Supervisory Network of the Governmental Underground Waters Monitoring (GUWM) and specialized departmental and/or private supervisory networks. One of the essential challenges is optimization of the existing supervisory network, its re-orientiation to solve tasks of the Governmental Underground Waters Monitoring (GUWM) especially in the field of evaluation and projections for the underground waters situation.

Currently the organizational structure is described below. The Committee for Geology and Mineral Protection, responsible for organizing, controlling over and financing operations of agencies conducting the Governmental Underground Waters Monitoring (GUWM), is a governmental customer.

Kaznedra, a mineral headquarters, through its subsidiaries provides a normative and methodical supporting, analyzes, evaluates and forecasts the situation in underground waters influenced by natural and technogenic factors, keeps the national water reserves and their exploitation recorded.

Controlling and coordinating duties are levied on regional departments of mineral exploitation and mineral protection. These departments directly or through its subsidiaries form, coordinate, control over rational exploitation of underground waters and protect them against exhausting and pollution, analyze and evaluate the underground waters exploitation, collect and process the information in a set manner.

Supervisory Service of the Governmental Underground Waters Monitoring (GUWM) regularly supervises the composition, frequency, scope of underground waters, collects, stores, processes and hands initial information over to the governmental customer. Almatygidrogeologia, a general contractor, finances, organizes and methodically supports the regular observations fulfilled by specialized agencies (sub-contractors) on a contracting basis through the Governmental Supervisory System.

Mineral operators should directly conduct supervisions through specialized departmental and/or private supervisory networks, usually set up within a Mine and/or a Geological Take under terms&conditions of a License or a Contract as well as under Exploration&Production Projects or employ an agency to fulfill these operations. The initial information shall be handed over to an appropriate regional department in a stated manner.

TO THE ACCURACY OF ESTIMATING GROUNDWATER FEED THROUGH THE STUDY OF THE LEVEL REGIME

Veselov V.V., Burakov M.M., Makhmutov T.T.
Institute of Hydrogeology and Hydrophysics Ministry of Science-Academy of Sciences RK,
General Administration of Mineral Resources "Kazgosnedra" Almaty, Kazakhstan

One of the basic aims of studying the regularities of the level regime through the groundwater (GW) monitoring system is to estimate the groundwater feed. For Central and Northern Kazakhstan where the groundwater feed is a seasonal phenomenon, N.N.Bindeman's model is widely used for determining infiltration *W* or the feed intensity. This model is an approximation of a more general equation proposed by G.N. Kamensky in 1943 for analyzing groundwater regime and balance.

Methodical approaches used in estimating random errors for the feed of aquifers established through the monitoring of the groundwater level regime have been considered; in this case, however, it was assumed that the original measurements have been sorted out carefully to eliminate my systematic error, .according to the estimated model, the values of the measured increase in the GW level (h) and the period for this increase to take place (t) stand for the results of the original measurements, whereas the gravity capacity (μ) as well as value (z) for which the GW level will drop for the same time t due to run-offs from aquifers can be obtained from calculations to be done on certain algorithms using the original measurements of the initial values.

The most important among the random errors are index and methodical errors, as well as the errors of models. .All the total random errors combined absorb systematic errors that are unaccounted for - that is, they exceed them in terms of absolute value, in which case analysis of random errors ensure an increase in the efficiency of regime observations while making the complication (and the rise in the prices) of experiments and of the experimental data processing methods designed for taking every possible systematic error into account, unnecessary.

Estimates of random errors for GW feed are used in various ways. For instance, these errors in most cases determine the basic impossibility of identifying the discrepancy between the water balance of aquifers and its constituent parts, something which is also true for the analysis of the balance in the designated block of a grid model when modeling the water collecting or draining process. Errors in GW feed are responsible for the difference in the values of their natural resources and the ambiguity of mineable reserves.

Measurement errors in most geologic and geographic studies are estimated as the ultimate errors in the same way as the ultimate random errors are specified in the instructions for measuring devices used in hydrogeology. For values distributed in a normal way, the whole dispersion to an accuracy of hundredth parts per percent falls within the limit of 3σ (where σ stands for the average mean deviation), which means that the ultimate errors of measuring devices (and of the original measurements) match the confidential probability of 0,997 and therefore total 3σ. For practical estimates, the confidential probability is restricted to 0,95, in which case doubles.

We have earlier estimated the accuracy of the filtration parameters of water-bearing formations using results obtained from cluster pumping carried out at the groundwater deposits in the Zhaksysarysu river valley (Burakov, 1996a). It was found out that the relative error of water conductivity T with a confidential probability of 0,95 does not exceed 9,870. The gravity capacity can be established with a much lesser accuracy: Its relative error is not less than 24,5%. The values quoted are used as typical minimum errors. They have also been taken into account when estimating the minimum values of random errors W for regime wells at a number of stations in Northern (Kumdykol, Alzhansky, Chkalovsky and K-oksengirsorsky) and Central (the station in the Zhaksysarysu river valley) Kazakhstan. These errors are not less than 26-27% (Burakov, 1996) with a confidential probability of 0,95.

As shown by error analyses, the decisive role in their values belong to the errors of estimated values of the capacity of water-bearing formations. To considerably increase the accuracy of estimates in this ease, however, is practically impossible. For instance, using measuring devices of higher precision in pilot filtration sampling does not change the situation, since random index errors make up only an insignificant part of all the errors combined.

The fixed rate of level measurement hills a significant influence on the accuracy of determining infiltration *W*. For instance, the depth to groundwaters on the section of regime wells at the deposit in the Zhaksysarysu river valley is measured every six days. It is quite clear in this case that the ultimate error of establishing the date of commencement of the spring rise in the GW level is three days: this error is the same at any level of the confidential probability. The date when the level rises to the maximum can also be established with the same error. From here, it implies that $2\sigma_t = 4,24$ days. Given the 21 to 39 days it takes the level to rise in regime wells, the relative error *t* ranges from 20,2 to 10,970.

The accuracy of estimates *z* depends to a large extent on many factors that can be observed in form of systematic and random errors. Systematic errors, while remaining almost impossible to identify and eliminate, are insignificant in terms of absolute value and are absorbed by the random errors of values *z* (which, for instance, varies from 11,2 to 15,9%) at a confidential probability of 0,95 for the groundwater deposit in the Zhaksysarysu river valley).

Looking at the above, it follows that recommendations for estimating the errors of the values of GW feed should also be taken into account in the methodical recommendations for conducting pilot regime observations and for interpreting the results obtained from such observations. Noteworthy is also the fact that standard requirements regarding the accuracy of determining these errors have not been drafted up till today.

STUDYING OF THE UNDERGROUND AND SURFACE FLOWS INTERACTION IN THE SYR-DARYA RIVER BASIN

Vinnikova T., Pavlichenko L.
Institute of Hydrogeology and Hydrophysics of the MS-AS, Atmaty city, Kazakhstan

The Syr-Darya river is one of the main two rivers of the Aral Sea region and it has significant roll in ecology-social and sanitary problems of the region. There was not enough attention for interconnection between surface flow of the Syr-Garya river and underground flow, and namely influence of the underground water (UW) draining on the surface flow value.

To solve this problem the parcel of Syr-Darya river was chosen in the upper part of it present delta. The channel of the river is located in the upper-cretaceous stratum of the Nignesyrdarinsky raising, which goes out on the surface at that place. There is the big water take (Levoberezny) 14-15 km to south from the river, which operates on account of the cretaceous stratum UW. In geology-stratum reference the investigated territory is related to Kzyl-Orda basin of two rang, which presents the complex many layer water system. Oil the base of the hydrogeological condition analysis of this region the three layer scheme model of the filtration region was chosen. Three water stratums (negen-quarternarv, senon- turoll and alb-senonlan) is separated by weakly permeable Paleocene and down-turon clays.

The simulation solves two principal tasks:

1) The quantitative estimation of cretaceous stratum of UW income to the Syr-Darya river channel by the leakage in the natural conditions.

2) Influence of the big UW draining from the cretaceous stratum (Levoberezny) on the underground flow to the Syr-Darya river. Solution of the stationary task demonstrates that UW recharge value of the Syr-Darya river on the investigated parcel in the natural conditions is 6400 m^3/day. Epignoz simulation reproduced the water take work regime. It obtained the extension of the depression funnel in the water stratums, draining of the dram flow the Syr-Darya river (underground flow is 5600 m^3/day).

After model correction the forecast until 2001 year was made. The Syr-Darya river recharge value of the cretaceous stratum in 2001 will be 5000 m^3/day. The damage for the river flow since past 25 years is estimated of 1400 m^3/day.

Thus, on the territory of the Syr-Darya artesian basin, such big UW draining as "Levoberezny" not damages surface worse flow, though was studied conditions when river channel is placed in the water stratum.

As far as there was no constant regime hydrogeochemical observation in the investigated region the influence of the UW on the surface water quality was studied by multiple-component statistical models on the results of the UW test of the Dgalagash and Kzyl-Orda irrigation massifs and changing of the hydrochemical situation on the results of the Syr-Darya river hydrometrical post.

The results of the statistical multiple-component analysis of the chemical content of the surface and underground water of the Syr-Darya basin allow to distinguish the following ecological-hydrogeological trends: the UW is characterized mainly by the evaporative and biogenic stages (including those of lithogenetic and atmogenetic) of the infiltration cycle of forming its chemical content, the different stages of processing the organic and the season spreading of the biogenic elements. In spring contamination of the UW by the organic (its aggressive components, such NH_4^+, NO_2 and the final product of its processing, i.e.NO_3^- begin contained in it too) abates. The toxic chemicals and the organic contamination materials, including heavy metals and DDT, get into the Syr-Darya both from irrigated massifs and industrial and urbanistic objects of Aral Sea basin. The general salting of the soil-grounds and the ground water on the irrigated massifs increases in the direction of the Syr-Darya mouth with the features of the soda salting (the presence of Na, CO_3, HCO_3 and pH>7 is observed here).

With the help of the program complex realizing the standard loads method algorithm of the standard year, the hydrogeochemical data for 1983 and 1988 was counted. As a standard was chosen the matrix of the component loads for 1988. The result of the data processing in 1983 worse than in 1988 in all posts except posts located on the Syr-Darya river in the Chandara and Kzyl-Orda cities. In all posts was noted the big intensity of contamination substance transportation. The improvement of the hydrochemical situation in the Syr-Darya river basin has only cause – falling-off of undustrial and agricultural production and not technology improvement and therefore all causes for conservation crisis situation in basin is stayed.

SOME ASPECTS OF MODELING OF CONTAMINANT MOVEMENT IN GROUND WATERS

Yushmanov I.O., Frolov A.P.
Water Problems Institute, Russian Academy of Sciences, Moscow, Russia

Ground water as a source of drinking water has a number of advantages over the surface waters. Ground water quality as a rule is higher and it doesn't need expensive cleaning because it is better protected from pollution and evaporation.

The resources of ground water do not have serious seasonal or year on year fluctuations and in many cases can be received near the user. The ground water resources can be opened up gradually as and when the need arises.

By ground water pollution we mean the changes in the water quality (its physical, chemical and biological characteristics) arising from human activity when compared with its normal condition and accepted norms as a result of which the water becomes practically or absolutely unusable.

Some cases are caused by disregarding the rules which regulate the extraction of impurified water. This happens most often in regions which are located near the sea, where one can find the intrusion of see water into freshwater sources.

In the regions where irrigation takes place one can find that the soil and ground water become oversalted as a result of absorbing the salted water from the lower placed sources or the evaporation of overmineralised water in delta areas.

Although preventing pollution is the best means of preserving water quality, nevertheless pollution will sometimes take place and we have to deal with this problem.

It is possible to plan and develop the protection only on the basis of knowledge of existing ground water pollution, prognosis of contaminant spreading along the aquifer and changes of water quality in water intake. In connection with it is important to have perfect methods of predicting contaminant movement in aquifers.

The most complete is 3-dimension model of saturated-unsaturated filtration. But due to difficulties in realization and use this model is not widely spread. Much more spread are 2-dimensional models.

One of them (so-called hydrodynamic problem of filtration) is two-dimensional profile model of saturated flow, or ground water movement. This model is a subject of the report, it is well studied both in literature and by the authors and is widely used for description of various nature processes and practical problems of environmental.

The main equations of model describe the hydraulic head and level of free surface of water. The sources on the boundaries and inside the considered area, inhomogeneous and anisotropy of porous media and other factors are taken into account.

With the help of this model it is possible to determine the ground water level and the speed (discharge) in groundwater flow.

On the basis of these information about groundwater flow the dynamics of pollution in underground waters is simulated. It is possible to considerate the movement of nonconservative substances, i.e. simulation radioactive pollution. After setting the density of liquid dependent from concentration of dissolved salts, it is possible to simulate the intrusion of sea waters, more heavy, than fresh, in coastal aquifers.

It is possible to consider the evaporation of saline waters, at which the water, leaves in soil the salts, that results in increase of contents of dissolved salts.

The successful choosing of model, which is in the basis our researches, is confirmed by theme, that the small updating of initial formulation (equations and boundary conditions) permit to consider different natural phenomena and processes.

The presented examples suggest that the problem of simulation of contaminant spreading into nonhomogeneous aquifers and its implementation make it possible to efficiently simulate different hydrogeological conditions, with respect to the problem of water use in zones with pollution sources, and groundwater protection against pollution by surface and sea waters.

GEOECOLOGICAL STUDY OF THE UFA CITY LANDFILL SITE

Zainullin Kh. N., Abdrakhmanov R.F., Galimova E.G., Chechiotkin Ju. P.

The Ufa city landfill site is situated on the watershed of the Belaya and Ufa rivers, in the water catchment area of the Shugurovka river, a tributary inflowing the Belaya river upstream the city water intake facilities. The landfill site area is 101.5 hectares. The use of the landfill site began in 1962 when bitumen pits of the Ufa oil refining plant were filled, and the site extended in the direction of the Shugurovka river. From the very start the landfill site was used without any design, without strict separation of waste by composition, without engineering design of the base. About 400 000 tons of solid domestic waste is taken annually to the landfill site. Today over 7 000 000 m^3 of waste containing heavy metals and strong toxicants including dioxins has been accumulated in the territory of the landfill site. The upper layer consists of domestic waste, petro-chemical and other industrial waste (concrete, bricks, plastics, etc.), vegetation waste. The layer is of 0.6-11.3 m depth, the right side of the Firsov brook (the ravine) reaches 18 m.

The layer of clay below the landfill site is spread everywhere, excluding the left root slope of the Shugurovka river, its depth is 1.5-13.2 m.

Ground waters are at the depth of 0.5-9.8 m, with the aquifer capacity of 1.5-9.4 m. The ground flow discharge is about 330 m^3 per day. The hydroisohypse map shows three mounds of groundwater flow that are located under the reservoirs containing oil products.

The study [1] has shown that ground waters and landfill site surface drainage waters contain not only easily soluble compounds (sodium, chlorides, ammonia nitrogen, nitrites, nitrates) but also ions of heavy metals (copper, zinc, lead, cadmium, chromium), as well as phenol and dioxins in concentrations by several times exceeding maximum concentration limit.

In the ground of the landfill site the content of heavy metals by scores of times exceeds maximum permissible concentration in soil. Pollution of the landfill site soil by copper (up to 45.2 mg/l), lead (up to 24.2 mg/l), cadmium (up to 1.2 mg/l), zinc (up to 75.1 mg/l), cobalt (up to 14.4 mg/l), mercury (up to 0.96 mg/l), dioxins (up to 100 ng/kg) has been revealed.

The air of the most part of the polygon is polluted by phenol (0.0008-0.0013 mg/m^3), methane (5.07-156.72 mg/m^3), ammonia (up to 5 mg/m^3) and hydrogen sulfide (up to 5 mg/m^3).

Lack of reliable protection facilities transforms the landfill site into a hazardous source of pollution for the ground and surface waters, the soil and the air.

To reduce the hazardous impact of the landfill site on the ground and surface waters a project has been developed

with application of mathematical modelling named "Protection of surface and ground waters against the impact of the Ufa city landfill site". The project allows to build the following facilities: "Circular drainage", "Open storm water network", "Vertical drainage". The facilities "Circular drainage" and "Open storm water network" prevent the spreading of the first aquifer beyond the borders of the considered territory, partially reduce the level of the ground waters of the first aquifer in the considered territory, prevent the outflow of surface storm and melt waters and perched ground waters through the borders of the considered territory, sufficiently reduce the infiltration of storm and melt waters within the borders of the given area and replenishment of the first aquifer. A group of vertical reducing wells ("Vertical drainage") by means of forming a depression cone in the Ufa stage eliminates transition of polluted waters of the Ufa stage beyond the borders of the landfill site, eliminates the flow of water to Kungursky stage by lowering the water height of the Ufa stage. Different variants of the system of protection facilities have been computed by means of an imitation model. Computations on the mathematical model testify to the reliable operation of this system of protection facilities under the considered geological and hydrogeological conditions of the Ufa city landfill site.

Building of the system of protection facilities will allow to considerably reduce the environmental load on the surface and ground waters and to improve the environmental situation in the landfill site area.

Referenoes

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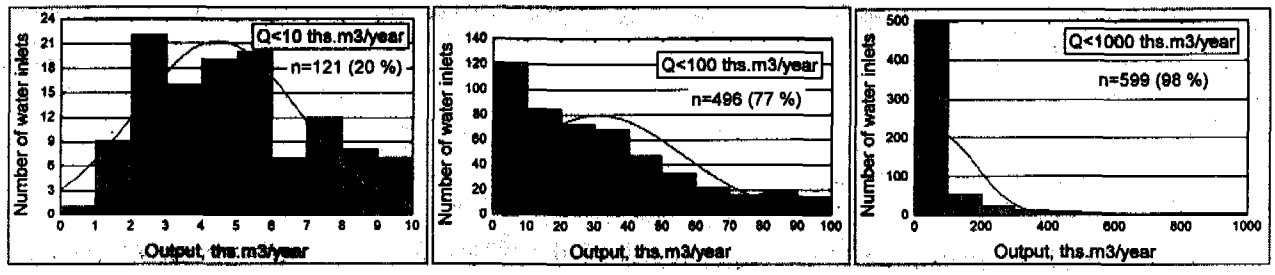
RESOURCES AND UTILIZATION OF UNDERGROUND WATERS OF TOMSK DISTRICT

Zuev V.A.
Ecological-hydrogeological enterprise "Noosphere"
Shvartsev S.L.
Tomsk branch of Institute of oil and gas geology SB RAS

Tomsk district is rich in underground waters of different destination: fresh drinkable and slightly mineralized, suitable to agricultural and industrial needs; healing-mineral and termal; and technically-valuable, perspective in ore components extraction. In addition to economic-drinkable (EDWS) and industrial-technical water-supplying (ITWS), they are widely used in oil production. In recent years the activity for water-healing nursing centers organizing and mineral waters pouring-out has been much intensified.

Because of the low quality of surface waters and a permanent rise of the anthropogenic pollution, the fresh underground waters have an exclusive, vitally important significance - they are the only and the main resource of the qualified drinkable water-supplying in Tomsk district.



Distribution of water outlets by output

Over 600 water-users of various types of property are taken into account in the district: housing and communal services, village administrations, collective farms, plants, mobile mechanized units, auto-transport agencies, timber-industrial enterprises, oil-gas production directorates, institutes, schools, hospitals, etc. They hold in their possession more than three thousand water-intake bore holes. A considerable part (25 %) of the bore holes are inactive being in damage, repairs or, rather seldom, in reserve. The capacity of some water inlets significantly differs (Picture) and largely depends not on the number but on the quality of the drilled bore holes (Table).

Structure of the underground waters production in Tomsk distict (rated by water inlets capacities)

Category of water inlets (ths.m3/year)	Number of water inlets		Total production volume (Σ, ths.m3/year)						Total number of holes				SCI (t.m3/ year)
			Sum		EDWS		ITWS		Sum		In work		
	n	%	Σ	%	Σ	%	Σ	%	n	%	n	%	
1. (< 10)	121	19.8	5	3	4	3	2	5	197	6.3	150	6.5	4.0
2. (10-100)	375	61.4	14.7	8.3	11.9	8.4	2.9	9.1	1568	50.1	1145	49.3	20.5
3. (100-1000)	103	16.9	26.4	14.9	21.7	15.4	4.7	14.8	915	29.3	708	30.5	60.5
4. (> 1000)	11	1.8	135.4	76.5	106.8	75.9	23.8	75.6	448	14.3	321	13.8	275.3
All	610	100.0	177.1	100.0	140.7	100.0	31.6	100.0	3128	100.0	2324	100.0	29.9

SCI - specific capacity of water inlet (per one active bore hole).

The most big underground water inlets have been built for Tomsk, Seversk and Strezhevoi (80, 19 и 13 mln.m^3/year respectively). A share of these water inlets in the joint balance of the underground water-supplying of the district is of 64 %.

In total, 25 deposites have been explorated, including 24 drinkable and one healing-mineral ones (Chazhemtovskoye). Only 12 of them are under exploitation. Approved reserves make up 990 ths.m^3/day. 99 % of small and medium water inlets and a big water inlet of Kolpashevo work on nonexplorated reserves (with the production under 1 mln.m^3/year).

A general chemical composition of the underground waters is chiefly bicarbonate calcium. By pH they are most often about neutral and slightly alkaline. High concentrations of iron, an elevated hardness and saturation with methane are inherent to the waters. A typical spectrum of mineralization is 200-250 mg/l. The main problems of drinkable quality of the underground waters related with their high iron concentrations (peculiar for the region) and a threat of pollution from industry (including chemical, oil-field, radiation ones) and agriculture.

The fresh waters occupy the upper part of the sedimental section: to a depth of 200-2250 m on the north-west of the district and to a depth of 1500-1800 m on the east. The most commonly used horizons are the paleogene ones, the neogene-quaternary and upper-cretaceous horizons are of the less use. The fresh waters of the paleozoic basement are greatly significant to the industrial and thickly settled southern-western outskirt (Tomsk district).

Restoring reserves (natural resources) have been estimated as 16.7 km^3/year or 1.67 l/(sec·km^2). This value exceeds the modern volume of the underground water-supplying nearly 100 times (!). Nevertheless, the practical utilization of this reserve appears to be a problem. Based upon the nature of the heterogeneity of the run-off over the territory and considering that the south regions of the district, especially the Tomsk one, will remain in the future as the main water-consumers, the restoring reserves of the underground waters can be regarded as quite never-ending in the north-east, but deficit in the south.

More than 90 % of the underground run-off occurs in a zone of the intensive water exchange. Rather unlimited resources of the subsurface zone (to the depth of 30-5- m) may be used only by small consumers. In the regions of the tense ecological condition they may be used only for technical needs. The production from the water-bearing bed of the platform body is more effective. The reserves of the water-bearing bed are estimated as 44.5 km^3/year. In theory, these reserves are sufficient for 25-fold increase of modern water-consumption, but in fact the situation is not so optimistic. Only 1/3rd of them is formed in the paleogene and upper-cretaceous horizons whicg are relatively defended from contamination.

Dynamic resources of the paleogene water-bearing body (1.17 km^3/year) are possible to provide the modern water-consumption without working out the static (capacitance) reserves.The cretaceous water-bearing body includes the essential reserves of fresh waters (0.227 km^3/year). The combined restoring resources of Paleogene and Cretaceous are able to provide the 10-fold increase of current volume of EDWS. Nevertheless, it is unable to draw on even 1/10th part of these reserves.

The potential *capacitance reserves* of the fresh underground waters are estimated at a lay of 45 m or a volume of 14 ths.km^3. At the exploitation period of 50 years the rated prognosis capacitance fresh water resources are of 350 mln.m^3/day. This amount of water is quite sufficient for 800-fold (!) increasing of the current water-consumption. The bulk of reserves occurs in the water-bearing body of Paleogene and nearly-untapped resources of upper-cretaceous horizons. The results of the prognosis rated prove that the capacitance reserves of the cretaceous fresh waters do not rank below paleogene ones but exceed them.

The distribution of the capacitance resources over the territory is rather nonuniform - 0 to 20 l/(sec·km^2). They are particularly considerable in the east where the combined might of fresh waters reservoirs is maximum (to the depth of 1800 m). Toward the nothern-western outskirt of the district the moduli decrease to 3-5 l/(sec·km^2). A trace of low values (down to 0) stretches along a thinning-out stripe of the platform sediments upon the jut of the paleozoic basement. Fresh water capacitance reserves of the paleozoic sediments have not been investigated.

The acting water inlets have been designed for the working-out of the capacitance reserves and just because of it the bulk of ecological problems appears. The orientation of the drinkable water-supplying to the restoring resources and more deep and well defended horizons calls for considerable expense but even just now it appears to be worthwhile.

SAFEGUARDING THE GROUNDWATER RESOURCES IN BERLIN BY GROUNDWATER REPLENISHMENT AND REHABILITATION MEASURES

Radke G.

Berliner Wasser Betriebe, Berlin, Germany

With a view to ensuring the supply of Berlin with drinking water, groundwater has been extracted from convenient geological layers for more than 100 years. The ever-growing utilisation of groundwater resources by the Berliner Wasserbetriebe, by own raising facilities operated by trade and industry and by groundwater pumping stations during civil engineering work has resulted in a substantial lowering of the groundwater levels during the period between 1950 and 1975.

In order to be able to re-accomplish the groundwater balance, groundwater replenishment plants with surface water treatment plants were built. These plants for the raw water extraction areas of the water works at Jungfern-heide, Spandau, Tegel, Beelitzhof and Stolpe do not only serve the qualitative protection of the raw water resources but are partly also operated as a protective measure against polluted groundwater. This applies in particular to contaminated sites in industrial areas which pose an acute threat to water extraction areas owing to changes in groundwater flow directions.

By means of a coordinated approach to groundwater replenishment and the operation of an arrangement of wells in conformity with water management, these contaminated waters are forced back, they are centrally collected, purified and discharged at the place of contamination and/or at convenient geological points.

A great number of industrial enterprises were closed down after the re-unification of the City of Berlin. Here, too, it becomes obvious that contaminations in the groundwater main flow direction of the Johannisthal and Wuhlheide Water Works in the South-East of the city pose an acute danger to larger extraction areas. Intensive investigative work was done between 1991 and 1993. The results of the investigations showed comprehensive contaminations in the groundwater main flow direction. An overall protection concept was drawn up by the competent authority, and rehabilitation measures were initiated. Protective wells and groundwater purification plants were built on the basis of a groundwater model. These protective and rehabilitation measures will make it possible to ensure the extraction of groundwater in this area in good quality and on a long-term basis.

INTERNATIONAL WATER SUPPLY CONFERENCE

ECWATECH

EFFECTIVENESS OF ADSOPTION IN WATER TREATMENT

Alekseeva L.P., Draginsky V.L.
Municipal Water Supply and Treatment Research Institute

Water treatment by adsorption is used to increase the effect of removing organic polluttants by activated carbon at final stages of water treatment as well as to remove by-products formed in the process of ozonation (or chlorination).

On the basis of vast investigations it has been established that the most rational methods of using activated carbon are as follows:

1. Employing activated carbon in special adsorption filters representing tertiary water treatment stage. The method is the most reliable from both hygienic and technological points of view. In such filters activated carbon exercises the direct function as an adsorbing material.

2. Removal of such pollutants as phenols, oil products, amines, formaldehyde and other organics. The pollutants are best removed and activated carbon is most effectively used with preliminary ozonation of water, wich also enables to encrease signficantly the period of time betwen successive regenerations of the carbon.

3. Using granular activated carbon (GAC) is feasible in cases of prolonged (or constant) pollution of a water source with chemicals. In separate periods with water quality deterioration for a short time (from a few days to 2 or 3 months), as well as in emergency cases it is more feasible to use powdered activated carbon (PAC), which enables to improve the situation.

In the course of recent years, investigations were carried out to determine effectiveness of activated carbons produced by chemical industry and of new types of carbons offered for use in comparison with foreign trade marks. Using the data obtained, it is possible to outline the following principles at using activated carbon:

a) territorial approach may be adopted for use of activated carbon; namely, in the regions of Far East and Kuzbass to use KAD-iodide (Leninsk-Kuznetsky city), in the region of Siberia to use activated carbon priduced by the "Sorbent" Co (Perm city), and in the European part of the country - to use that produced by the Dzerjinsky and the Electrostalsky enterprises;

b) the Ag-3 carbon can be used as an upper layer in rapid sand filters (in urgeny cases) and in special filters when raw water has a low level of pollution;

c) when highly polluted water sources are used (such as the rivers Kama, Oka, Tura, Tom and some others) it is required to employ highly effective types of GAC, such as AGM, AGOV, DAU, SKT-6 or "Filtrasorb" F-300 and F-400 made by the Belgian company "Chemviron", using them as filtring medium in special adsorption filters;

d) among new types of GAC the most effective are those modified or oxidated, which have better adsorption properities than the existing types;

e) in some cases it is possible to use GAC marked TL-830 and completely subshitute sand medium with it in rapid filters. Such method of using GAC has found large application abroad. It was first tried at the treatment plants in Orenburg city (production scale) and in Kemerovo (pilot scale);

f) in all cases of choosing the type of activated carbon for a given region it is necessary to carry out special technological investigations at every site. General rules for adsorption treatment of water are given in "Methodical recommendations on the use of ozonation and adsorption in water treatment technology for removing pollutants of natural and anthropogenic origin (MWS&TR), Moscow, 1995).

WATER SUPPLY PROBLEMS IN AGRICULTURES OF AZERBAIJAN REPUBLIC

Aliyev F.Sh, Musayev N.A.
State Committee on Geology and Mineral Resources of Azerbaijan Republic, Baku, Azerbaijan

The irrigation take the main place in agricultures, because Azerbaijan Republic has arid climate. Mountainous areas of Azerbaijan Republic has deforming lands, where has developed grain-crops, water melons, melons and .gourds plantations. The main place in Foot hills and lowland areas take the cotton-growing., viticulture, grain- crops, water melons, melons and gourds plantations. The irrigation land squares exceed 1353,8 thousand hectares , and its extension in 2005 year will intend 227,5 thousand hectares new irrigation lands, the complex reconstruction 715 thousand hectares of old irrigation lands, setting of drainage on the existing irrigation lands 300 thousand hectares.

More than 60% lands of Azerbaijan Republic characterized as saline soils. where subterranean waters has high mineralization (25 - 100 gr/l and more) and near bedding to Earth surface. The last ten years lands irrigation developed without taking into account hydrogeological and land-reclamation conditions of new lands.

More of this lands has bad natural drainage. Bad function existing drainage system considerable infiltration from irrigation system intensive exploitation of underground waters behave changed its regime. At last time every year used for irrigation 7047 million m water (1996 year), including 1003 million m underground water. Common water using for Azerbaijan Republic 9932 million m/year. As compared with 1970-1988 year, water using for land irrigation decreased on 35-49% because Armenia occupied 20% of Azerbaijan lands, including irrigation lands of Jebrail district and particularly Carabakh Mil foot hill valleys.

For lands irrigation long since used water of local rivers, sources and kagrieses but lately land irrigation extended and great part of water expended for desalination of lands. In this

connection local water reserves not covered requirements. Beside that oil more of lands, in shimmer, local rivers have been dry-up and river gutter- absent in the lower reaches. It hunts reservoirs on the large riv ers and its water transferred by arterial channels as Upper-Carabakh, Upper Shirvan, Main-Mil, Akstafian etc, for land irrigation. The channels passed through foot hills areas where the rocks has good filtration quality. That circumstance and the bad isolation of channels and intensive exploitation of underground water created condition for infiltration ant feeding underground water. The level of underground water of the 80-90% of foot hills and lowland areas razed over critical and for this reason, in arid climate conditions developed "secondary" salinage of lands. At last years to be observed swamping of lands on separate plots of Carabakh valleys (Ter-ter and Barda districts) Gandja valleys (Shamkir. Kazakh and Akstafa districts). Alazan-Agrichay valleys (Cabala district) from bad work of drainage systems.

Another important, problem is the using of fresh and clean underground water for irrigation and technical needs in time when 90% of rural area hasn't sufficient drinking water. Sparse cities central used water-supply system. It should be noted, populated areas Carabakh, Shirvan, Mil and Mugan valleys used for drinking channels and aryk (drain) water.

For this reason in summer there is many cases of infection diseases. Now, when Armenia occupied 20% of lands Azerbaijan territory, azerbaijan refugees concentrated. in Mil and Mucan valley quantity of infection diseases increased. At last. years in this areas to be observed augmentation of mortality cases and diminution of natality cases developed gastrit - intestinal diseases, pulmonary and kidney diseases.

Taking into account this circumstances, we offering composition for "Complex scheme rational using water reserves and their, preservation from pollution and exhaustion".

NEW FORMULAE AND GRAPHS FOR LOAD LOSSES CALCULATION IN THE UPLIFT PIPES

Ayadi A , Benhafid M.S., Hassane Med.
Ecole Nationale Supйrieure De L'hydraulique, Algerie
Kahlerras D.
Universitй D'etat Du Gйnie Et De L'environnement De Moscou, Moscow, Russia

It is known nowadays that all industries impose the necessity of networks for the transport of various types of fluid appropriate for the set industrial procedures. Thus, the degree of complexity of the networks set for the fluid transport is variable.

The load losses calculation in the hydraulic networks is still of a great importance specially for the choice and the size of the pumps, and the setting of the reservoirs, etc....

For a purpose to standardise and simplify the load losses calculation methods, we are going to present a new calculation methodology which gives a maximum relative divergence of 2% in compare with the results obtained from Colebrook formula for the absolute roughness :

K = 2 mm ; K = 1 mm ; K = 0,1 mm .

New tools and calculation methods will be available for the manufacturer and the engineer in his work to allow him to be accustomed to the present conditions and to update his knowledges according to the economic changes that are linked to the changes that take place in the world.

Today, in front of the urgent situation, the mastery and the accurate load losses evaluation of each project are necessary features for its good management by mastering the consumption and increasing its output (30% losses on a network represent 30% of the energetic power spent as pure loss during the pumping).

Our study contributes to the load losses evaluation in the uplift pipes.

I.1.1- Absolute roughness : k = 2 mm :

$v / V \geq 2{,}79 \cdot 10^{5} m^{-1}$

$J = 0.001808\ Q^{2} / D_{int}^{5,327}$

where

$j = r \cdot Ql \cdot \delta \cdot E$

The value of the resistance coefficient will be calculated by the following formula:

$r = 0{,}001808 / D_{N}^{5,327}$

I.1.2 - Absolute roughness : k = 1 mm

$v / V \geq 5{,}58 \cdot 10^{5} m^{-1}$

$J = 0{,}001596\ Q^{2} / D_{int}^{5,327}$

$v / V < 5{,}58 \cdot 10^{5} m^{-1}$

$J = 0{,}00158\ Q^{1,96} / D_{int}^{5,22}$

the resistance coefficient value will be calculated by the following formula :

$r = 0{,}001596 / D_{N}^{5.3}$

I.1.3 - Absolute roughness : k = 0,1 mm:

$0{,}4 < v \leq 2{,}4\ m / s$

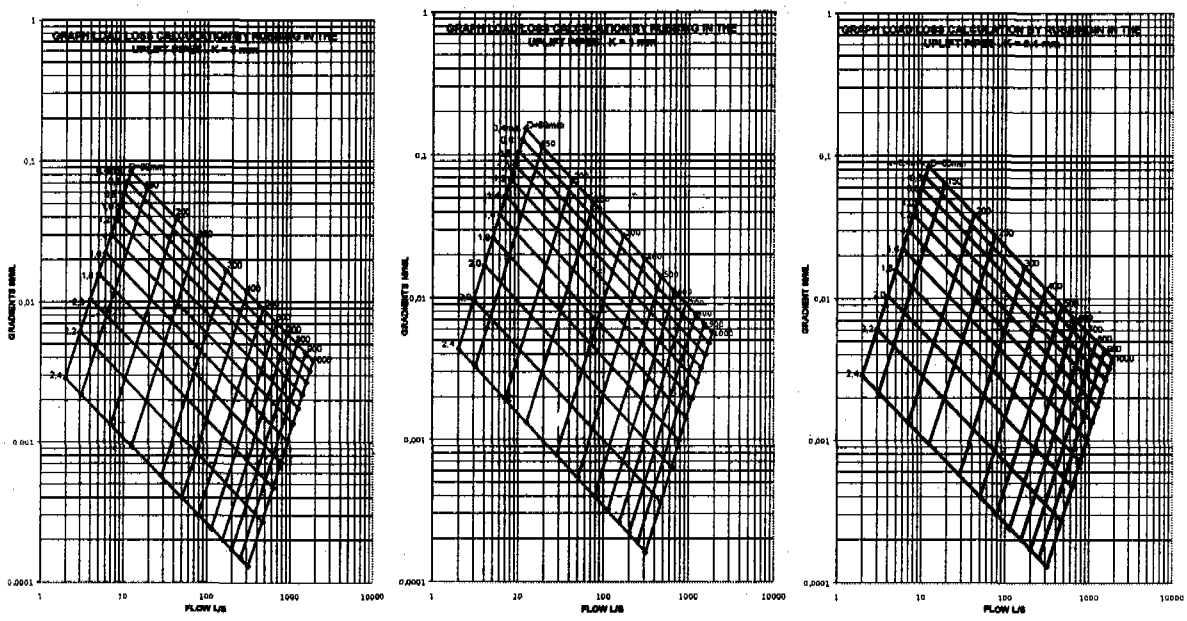
$J = r \cdot Ql \cdot \delta \cdot E$

Resistance coefficient value will be calculated by the following formula

$r = 0{,}00157 / D_{N}^{5,226}$

V. Conclusion

A bad load losses evaluation warsens directly the situation in water networks (insufficient pressure, flow reduction, the early deterioration of the electromechanical equipment, etc...) . To find a solution to this problem, a deep study and discussion are necessary. This team work allows to assemble the works concerning the topic of our study and to proceed to a discussion between different methodological approaches, hypotheses and results.



ANTIMICROBE EFFICACY ASSESSMENT OF ACTING LOW ENERGETIC ELECTROIMPULSE DISCHARGE FACTORS ON WATER DISINFECTION

Avchinnicov A.V., Zhuk E.G., Rakhmanin Y.A.
Smolensk State Medical Academy, Smolensk, Russia
Sysin A.N. Institute of Human Ecology and Environmental Health, RAMS, Moscow, Russia

A limited number of bactericidal agents used nowadays in water supply practice sets specialists the task of both creating new kind of disinfectants and improving the efficacy of known techniques of water disinfection. Studying the combined action of two or more factors with bactericidal activity becomes one of the priority directions of research in this field.

The use of submerged electroimpulse discharges (SED) allowing both to disinfect and preserve water is considered to be a perspective method of water treatment (Zhuk E.G., 1977; Hulshegen H. et al., 1983). The specific feature of biological SED action in water is a simultaneous influence of a number of physical factors: percussion wave, cavitation, electromagnetic field. Besides, active chemical substances are being formed in the process of discharge: hydroxyl and hydroperoxyl radicals, atomic oxygen, hydrogen peroxide socalled chemical factor (Gilliland S.E., Spec M.L., 1967; Yutkin L.A., 1986). In its essence this technique is a combined method of influence on water. The combination of physical and chemical SED factors is likely to create the most favorable conditions for microorganism inactivation in water. However, up to now no complex investigations on the role of some SED factors (or their combinations) in the process of water disinfection have ever been carried on.

The purpose of current study was to assess some low energetic SED (or their combinations) influence on inactive microorganisms survival in water.

Investigations were performed on portable installation developed with our participation (Patent of Russia 1790557) with working tension 2,6-4,0 kV, condensers capacity 10 mF and total density of energy 0,6-6,0 J/ml. Isolated action of each of the most significant low energetic SED factors (impulse UV- radiation, percussion wave, chemical factor) was modeled with the use of original technique described in literature (Zhuk E.G., 1978).

Standard strain of indicative microorganism E.coli was used in our study. Initial concentration attest microorganisms was $(3,1\pm0,2)\times10^6$ CFU/l.

Combined effects action of studied low energetic SED factors was assessed in ratio T/E, where T part of survived sells E.coli obtained theoretically, and E - experimentally.

While assessing values, obtained theoretically, independence of individual agent action effects was taken into account (Ragab-Depre N.J., 1982). According to this technique when T/E<I an antagonistic action of inactivating agents is observed, when T/E=I an additive action, but when T/E>I a synergisticone.

The results of our study are indicative of the fact that combined action effects of low energetic SED chemical factors and percussion wave, percussion wave and impulse UV-radiation are close to additive action as ratio T/E was 1,1 and 1,3 in these cases. On combined impulse UV-radiation and chemical factor we observed clearly marked synergistic effect - ratio T/E was 27,1 ($p<0,01$).

Thus, it is revealed that on general bactericidal action of the whole complex of low energetic SED factors on water combination of impulse UV irradiation and oxidizers forming in the process of discharge play a decisive role.

Evidently, the techniques of water disinfection studied are in its essence close to a group of oxidizing techniques of

water conditioning under the name "Advanced Oxidation Processes" (AOP), where combined action of oxidizers and UV-radiation is used. The obtained findings enabled us to improve the existing installations for water disinfection with low energetic SED.

SECOND LIFE OF PIPES

Batalov V., Kunz K., Ustimov D.
NII "Resources safing of technology and corrosion"

The complete replacement of the pipelines being under operation is being used during the overhave of water and heat supplying networks. The old pipelines are used as the secondary row materive or left in the ground. However, as it has been found out during the inspection of these pipes and especially taken out from the pipe trays, the significant part of them (up to 70 ...80 %) can be reused in water supply systems after their appropriate checking up, clearing their surfaces and covertly them with anticorrosive protection.

In **NII** " Resources safing of technology and corrosion " are developed new methods of restoration and repeated use of second-hand metal pipes, providing mechanical clearing and processing by the converter of corrosion "Прекор" of outside and internal surfaces, drawing on an outside surface of means sofeization and on internal surface cement-land covering. The latter is realized according to original technology, receiving the patent for a way of drawing cement-land covering.

The table shows the expenses for overhaul of networks in urban conditions with replacement of pipes by the new ones (1-th variant) and restored according to technology NII RTK (2-th variant), showing by the high economic efficiency of use of worn out pipes.

Table

Diameter of pipes, mm	Expenses on 1 m of pipes, thousand ruble.		Parity(ratio) of expenses (2-th variants / 1-th variant) x 100 %
	1-th variant	2-th variant	
100	161,48	116,63	72,2
150	235,47	150,13	63,8
200	330,83	191,93	58,0
250	393,12	221,51	56,4
300	518,48	272,30	53,0

At the moment an experimental - industrial site on restoration of pipes works at NII RTK, the project and design documentation for organization of the appropriate manufacture has been prepared.

SYSTEM OF WATER QUALITY RATIONING FOR IRRIGATION

Bezdnina S.Ya.
All-Russia Research Institute of Hudraulic Engineering and Land Reclamation, Moscow. Russia

Water quality rationing for irrigation is closely connected with water quality rationing in a water body (source of irrigation), chemical elements and compounds in soil, plants (object of irrigation), food products of vegetational and animal origin (produce of irrigated agriculture). At the same time, rationing of irrigation water quality represents an independent trend of scientific studies, developed in different countries within recent decades.

Russia is related to the countries with low biological productivity of lands, since nearly 80% of the area of agricultural lands are located in the zones of inadequate and unstable moistening. The irrigation adds stability to agriculture, increases productivity of agricultural lands and creates real prerequistes for management of regulated factors in a life of plants. At the same time, under conditions of irrigation the processes of mass transfer in the systems "water-soil", "water-plant", "water-soil-groundwater" are intensified and, depending on properties, chemical composition of irrigation water, availability of pollutants in it, the yield of crop and quality of agricultural production, soil fertility are formed and water consumption is changed. At the same time, water quality exerts influence on safety, durability and reliability of operation of irrigation systems.

Irrigation water influences on the system "soil solution-soil absorbing complex", changing established balance of exchange processes and, depending on the new qualitative state of ion-salt comlex, the medium for development of agricultural crops is formed.

Quality of irrigation water has direct (during sprinkling), indirect (during surface irrigation) and combined (during inundation) influence on the growth and development of agricultural crops. The analysis of experimental investigations demonstrated a regular crop yield reduction of various agricultural crops with increase of irrigation water salinity. Along with joint influense of salts in irrigation water and soil solution the physiological processes in plants are

affected by chlorine, sodium and boron. Pollutants in irrigation water and soil suppress fruitage, reduce crop yield and quality of agricultural production. The experimental investigations in Russia, America, Japan, Romania, Ukraine and other countries have shown the reduction of crop yield of different agricultural crops with increase of heavy metals, pesticides and other pollutants in soil and irrigation water. The excess content of pollutants in irrigation water and soil stipulates translocation and accumulation of harmful substances in plants and their ingress into animal and human organisms. To a greater extent heavy metals are accumulated in the roots, then there follow stems, leaves, seeds, tubers, and root crops. Cadmium and zinc are accumulated in generative organs of plants. The plants are most sensitive availability of harmful substances in water during germination of seeds and at an early stage of development.

The entering of pesticides into soil plants with irrigation water takes place with the use of drainage water for irrigation, especially from rice fields. Pesticides are easily absorbed by the plants from sand soils, in soils, enriched by organic matter, the process of absorbtion becomes less intense.

Complexity and consequences of the processes, taking place in the system "water-structure", point to the fact of the necessity to form a special branch of irrigation water quality rationing in compliance with technical criteria according to suspended solids, Lanellier index, pH, dry residue and other ingredients, provoking enlargement of finely divided particles, their sedimentation in pipelines and plug of water outlets.

A system of assessment of irrigation water quality, consisting of five classifications, is developed in conformity with ecological, agronomical and technical criteria:

- Soil-reclamation classification of irrigation water quality;
- Classification of irrigation water for the crops of different salt tolerance;
- Classification of heavy metals and other elements according to the extent of hazard of their content in irrigation water, soil, and plants;
- Classification of irrigation waters by the extent of hazard of their influence on structures.

The influence of chemical composition of irrigation water on soil fertility, water, crop yield and quality of agricultural production are considered; restrictions in the systems "water-soil", "water-plant", "water-structure" are listed; principles of rationing, criteria and a system of assessment of water quality for irrigation are given in the author's monograph "Quality of water for irrigation: principles and methods of assessment" (Publishing House "ROMA", Moscow, 1997-p.187). It is shown that to a great extent the efficiency of the use of irrigated lands is dependent on irrigation water quality.

MAGNETOHYDRODYNAMIC ACTIVATION OF NATURAL WATER

Bondarenko N.P.,
RAAS, St.Petersburg, Russia
Rokhinson E.E.
Gak , St.Petersburg, Russia
Elizabeth Z.
Agrophysical Research Institute RAAS, St.Petersburg, Russia

One of the ecologically non-polluting ways of affecting natural water with the aim of intensification of agricultural production, decrease of salt accumulation and yield increase may be the method for magnetohydrodynamic activation of natural water (MHDA NW). It consists in creating the water flows through spacely nonhomogeneous magnetic fields. The method may influence positively on preservation of the planet water resources.

Natural water used for irrigation presents an open nonstationary heterogeneous multicomponent system closely connected with atmosphere. One should consider such water as a gas - liquid solution where there is a water - gas - solid inclusions equilibrium. The magnetic field being chosen as a reagentless physical factor capable of affecting certain physical and chemical processes.

Magnetic treaters present hydrodynamic direct-flow systems with a variable cross-section. Inside these systems nonhomogeneous magnetic fields are generated. In natural water flow through a magnetic field there arise volume forces of magnetohydrodynamic nature in volume and in the region of interphase boundaries. The rotary character of this mass force in conducting liquid causes a number of effects such as changes of the gas content, number of salt crystallization centers, etc., successfully used in agricultural practice.

Reclamation effect of the magnetoactivated water is achieved by creation more comfortable conditions in root inhabited layers owing to:

- the best permeability of the irrigated water;
- washing salts harmful for plants from the cation exchange complex;
- the best dissolution and availability for plants of mineral fertilizers.

At the same time soil hydrophysical properties and (as the consequence) conditions for microbiological activity in root layers are also improved.

Based on the data obtained for many years the method may be recommended for irrigation water having alkaline reaction (pH > 7.2; ion content of Ca^{2+} and HCO_3^- > 2 mg·eq/l).

The reagentless and non-polluting MHDA NW-method may serve a reserve for increasing soil fertility. It should be of interest from the point of view of saving resources and it can reduce irrigation water rates in arid regions.

THE PROBLEMS OF SUPPLYING THE POPULATION OF THE PRIMORSKY KRAI WITH DRINKING WATER AND THE WAYS TO SOLVE THEM

Bortin N.N., Balyabin V.F., Gorchakov A.M., Kreta S.L.
RosNIIVH, Far Eastern Branch, Vladivostok, Russia
Kovalenko Yu.A.
NII VODGEO, Far Eastern Division, Vladivostok, Russia
Barysheva L.G.
Primorsky territorial center of GMGS Primgeologiya, Vladivostok, Russia
Smoliyaninov Yu.V., Ostanina E.P., Lunina S.K, Karlina E.V.
JSC "Primorgrazhdanproekt", Vladivostok, Russia
Petrova R.M.
Administration of the Primorsky Krai, Housing Communal Services (ZhKH) Department, Vladivostok, Russia
Tkachenko N.D., Dashkevich V.N.
MPP VKH, Vladivostok, Russia
Kompantzeva L.L., JSC "PIROU ", Vladivostok, Russia
Glushak A.Ya., Uvarov A.A.
PKTs GSEN, Vladivostok, Russia
Golovin V.L.
GP DalNIIGiM, Vladivostok, Russia

Owing to the traditionally set residual principal of financing water supply systems in the past and the liquidation of the uniform mechanism of centralized management and financing at the moment the problem of supplying the population with quality drinking water has taken sharp shape in the Primorsky Krai.

In a number of regions the problem of drinking water supply has become crucial not so much for the reason of water resources deficiency which exists because of irregular distribution of surface drainage over the territory and through the seasons. remoteness of underground sources from the consumers (which is technically solved by deep regulation of surface waters and transportation of ground-water resources), as because of anthropogenic pollution of the sources of drinking water supply and deterioration of water quality in the reservoirs.

As the barrier role of the water-purifying facilities operating in the Krai has grown insufficient the population has been supplied (especially during floods) with the water of inferior quality, often bacterially polluted. This results in a different sort of infectious diseases.

Disturbing and inadmissible is the fact that against the amplifying anthropogenic pollution of the sources of drinking water supply only 50 "/o of the water caught for household-drinking needs is exposed to purification; up to 60 "/o of the rural population uses the water without any preliminary clearing; 75 % of villages and settlements of the Krai do not have a centralized water supply with water- purifying facilities, and about 10% of them consume the water brought from other places. The Krai virtually lacks the monitoring of water-gauge control and drinking water quality.

Neither any city (including cities - ports) nor any regional center where the major part of the population is concentrated have a drinking water reserve in case of emergency. Deterioration of the water supply facilities in the Krai is estimated at 60- 100%.

In this connection on the instructions of the Krai Administration a group of the leading experts at RosNIIVH (Russian Research Institute of Complex Use and Protection of Water Resources), Far Eastern Branch, has worked out the Krai target program "Supply of the Primorsky Krai population with drinking water" which constitutes a complex of interrelated technical, organizational and financial measures. The program has been prepared in conformity with the requirements of the Resolution of the Government of the Russian Federation' 594 of 26.06.95. According to the technical project the program was carried out in two stages.

At the first stage the results achieved on the basis of using the diagrams, general plans, feasibility reports drawn earlier and the data of the design research studies were the following:

- the estimation of water resources and water supply adequacy of the existing and prospective zones of drinking water supply development was given;
- the analysis of the present condition of drinking water supply in view of the existing technology of water purification was made;
- the cadastre of active water supply objects was drawn up;
- the concept of developing the safe drinking water supply for the population of the Krai was developed and approved.

At the second stage the additional data on the operation of the water supply facilities in the cities and regions of the Krai produced by the administrations, housing-municipal departments, and offices of water supply and sewerage services were used. The program measures developed on the basis of the above-mentioned data include:

- reconstruction of the existing and formation of the new sources of water supply and water-purifying systems;
- formation of drinking water reserves for the period of emergency situations;
- water protection measures on preserving the natural landscape of drainage basins and water intakes for drinking purposes;
- monitoring of the condition of water objects and the quality of water in the water-supply systems;
- resource and technological maintenance;
- mechanisms of financing and realization of the program;

priority list of measures.

The program covers all kinds of work on the reduction of water losses, which can lead to an increase of its supply. The optimum specific norms of water consumption are substantiated in the program. The technological parameters and the estimation of the expected socio-economic efficiency from the realization of the program measures are also given.

The measures in the priority list include the reconstruction of the existing water supply objects and the construction of the objects which have the documentation approved at the governmental level and on which the construction of the water supply objects at the expense of the federal funds began since 1985, but since 1991 the financing stopped.

The program is recommended by the Ministry of Natural Resources of RF and Minstrel of RF for its inclusion as a component in the subprogram (Regional programs) of the Federal target program "Supply of the population of Russia with drinking water".

IMPROVEMENT OF PIPE WATER SUPPLY SYSTEMS IN BUILDINGS BASING ON METAL-POLYMER PIPES APPLYING

Boukharev E.Yu.
Research and Design of Montage technology

World and home experience in development of modern water supply systems determines main directions of metal-polymer pipes manufacture and applying in Russia. Here are presented the results of research and development of new technologies in metal-polymer pipes production, as well as our experience in equipment development and maitenance.

Montage technologies improvement, reliability and durability increase of prospective water supply systems are considered.

NEW MEANS OF WATER PURIFICATION

Calkin E.A., Alifanova N.N., Zorina E.L.

Nowadays the problem of supplying Russian citizens with quality potable water of sufficient quality is a very urgent one. Programme "Pure Water" has been worked out in different ways. They include complex decision of this problem waste water purifying , use of chemical and adsorbing methods in preparing of potable water.

To realize the programme "Pure Water" JSC "Sorbent" performs in the following directions:

- production of activated carbon of different types for potable water preparing and waste water purifying;
- production of chemical reagents coagulants, flocculants;
- manufacture of modular water treatment systems of TJPV type with complete cycle of water purifying and capacity from 5 up to 200 mi/hour:
- manufacture of potable water treatment systems of individual and collective use.

Nowadays it is generally understood that use of activated carbon in water purification technologies is the main demand of world standards.

Methods of carbon adsorption with activated carbon use provides a certain barrier against different kinds of impurities (chlor, derivatives, amines, phenol, etc.).

To realize carbon adsorption methods in water treatment process JSC "Sorbent" worked out and began to produce in quantity two types of activated carbon granulated and powdered.

Granulated activated carbon of different fraction compositions is recommenfled for feeding of adsorbers and filters. Changes in design and in arrangement of technological scheme, as well as special equipment, time and expenses are required while using such type of activated carbon. One of the preferences of granulated activated carbon use is its time multiplexing, possible regeneration (after activated carbon completes its term) in order to get its primary qualities.

Such types of granulated activated carbon as SK-D-515, AGM, AG-3 were checked on water treatment plants with different types of filters.

Powdered activated carbon types are for promt and extra respond to water quality changes while flooding, accident effluents, ettf.

Flooding and accident periods are characterized by multy-increase of impurities In water during 1-20 days. Most of Russian water-treatment plants don't guarantee good protection against the most organic and inorganic components in water and don't support specific level on muddines, colour and odour after purification.

Experts of JSC "Sorbent" together with special Institutes of Russia worked out technologies of water treatment, which are based on use of new type of powdered adsorbers. Thanks to high sorbent's activity and possibility to regulate concentration depending on water quality such schemes provide necessary potency of water treatment plant's protection in any accident situation

Sorbents take off 60-90 % of pesticides, dioxine, xenobiotics and other polyaromatic compounds.

Introduction of these teenologies in water treatment takes 4-6 months, expenses to reequip construction make up 1-2 % of plant cost.

APPLICATION ACTIVATED HUMIC ACIDS FOR TREATMENT AND UTILIZATION OF DEPOSITS, FORMED ON WATER-PURIFYING STATIONS

Choulguine A.I., Putsykin Yu.G., Chapovalov A.A.
Closed joint-stock company "Special biological-physical technologies", Moscow, Russia

The technolodgy of production of activated humic acids (AHA) from cheap and accessible raw material is istablished. This has allowed to offer an effective method of treatment of deposits water-purifying of complexes with the purpose of their utilization as meliorants.

The applying AHA in a deposit provides effective floculation and coagulation of an organic and inorganic making solid phase of a deposit and allows by concentration to lower humidity of an initial deposit from 92 % to humidity of the condensed deposit 70%.

Detoxication of a deposit about the sorbtion of aluminium, provides reduction its phytotoxicity. Thus in ground containing deposit treated by AHA shooting of seeds was 93%. In ground containing deposit not treated by AHA the seeds did not sprout.

The entering of a deposit treated by AHA in recultivating grounds considerably increases there waterreteuting and adcorbing propertes, raises the stability to water and wind erosion, and also makes active the microflore of ground. Volume brought in recultivating grounds of the treated deposit can make up to50% about volume of ground.

Neutralization of waste water.

The efficiency of unitary processing and clearing of filtrate on CIO (chemical index of oxydgen) makes more than 97 %, on BIO (biological index of oxydgen) more than 95 %, on common microbial to number and bacteria practically 100%. The contents of heavy metals is reduced on 50-90%.

With two-multiple processing the parameters of clearing of filtrate practically correspond to parameters of water of reservoirs for fish.

The technological reglament on clearing of filtrate of range of a burial place firm household and industrial wastes, was work out.

USAGE OF NATURAL QUARTZ AND ZEOLITE AS SORBENTS FOR DRINKING WATER SUPPLY

Chudnova T.A., Balojan B.M., Parjushkina O.V., Mamina N.A., Ivenin V.A.

Filtering and sorbiting properties of such natural materials as grinded fractional quartz and zeolite were investigated.

Chemical granulometric and physical-mechanical properties of the above materials permit to use them together for treatment of drinking water with high content of iron iones (0,5-3 mg/l) and ammonium (1-3 mg/l).

The relationship of the degree of drinking water treatment from iron to the different rates of water, the degree of its aeration and fractional quartz composition was obtained.

Optimal compositions of the combined filtering batches in relation to technological conditions of water preparation and also required rate of filtering bed aeration were determined. Two types of clinoptilolites from Sokirnitza and Kholinskoe as zeolites were studied (Fig 1, 2).

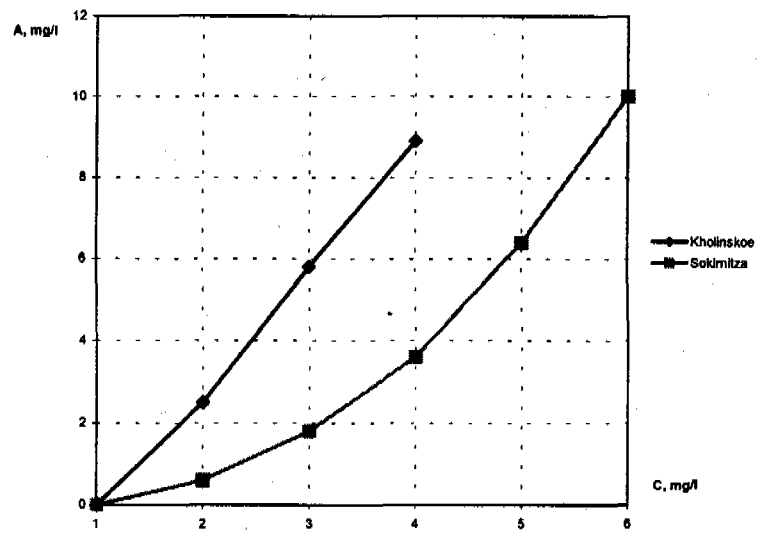
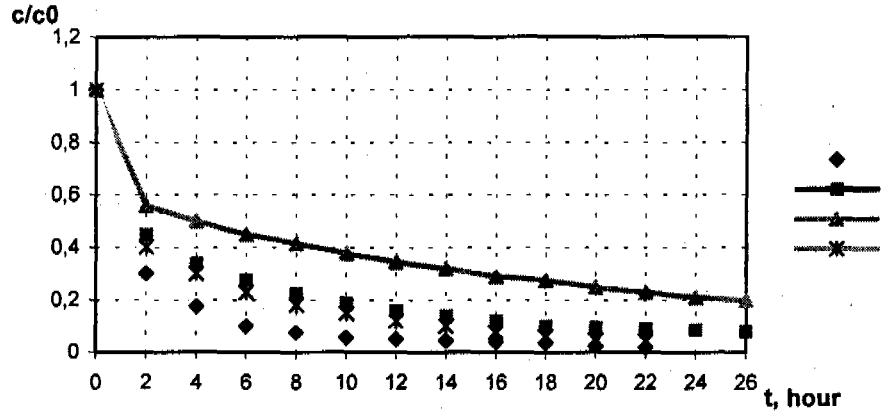


Fig. 1. Isotermal corve adsorbtion of ammonium iones on zeolites.



1, 2, 3 - fraction -Sokirnitza

5, 6 - fraction - Kholinskoe

Fig. 2. Cinetics of ammonium iones adsorbtion on zeolites

It was found that both zeolites have the same properties to absorb ammonium iones. Tests have shown that usage of municipal drinking water treatment filters with output of 1.2 m^3/hour and domestic filters with output of 60 l/hour having combined filtering material including zeolites improves quality of purified water, reduces its muddiness for 98%, chromaticity for 100%, content of iron and other hard metals for 95%, content of ammonium nitrogen for 30-50%.

These results have been used to make filters with quartz material (filter volume is 7m^3, out-put is 50 $м^3$/hour). This filter treats water from iron, reduces muddiness and chromaticity to the requirements of standards GOST 2874-82 "Drinking water. Hygienic requirements and quality control".

The usage of grinded fractional quartz instead of Pogransky quartz sand in the deferrization station of water intake centre № 1, Dzerzhinsky town, Moscow Region has permited to increase the operation period of quartz material and quality of purified drinking water. The characteristics of the drinking water treatment filters having optimal quartz compositions show that filtering and sorbing properties of the grinded fractional quartz are improved.

Technical and economical evaluation of usage of quartz sand and natural zeolites have been made.

Conclusion

The usage of natural materials to treat drinking water during water preparation was proved.

The usage of quartz sand with optimal fractional composition, specific surface and other physical and chemical properties was shown to permit purification of drinking water from iron, reduction of muddiness and chromaticity up to the standards of GOST 2874-82.

It is recommended to use zeolites and quartz sand for complex treatment of drinking water from ammonium iones, hard metals etc.

Estimations and plant tests has shown technical and economic merit of usage of natural zeolites and grinded quartz in drinking water supply system.

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WATER AND SANITATION DELIVERY IN UNSERVICED INFORMAL SETTLEMENTS IN GAUTENG PROVINCE, SOUTH AFRICA

Everatt D.
CASE

Since the first democratic elections in South Africa in 1994, delivery of basic infrastructure to the majority of citizens has been a top priority for national and provincial governments. Gauteng province is the most populous province, as well as one of the richest. It exhibits dramatic extremes from the wealthiest, formerly white suburbs in the north through to unserviced informal settlements scattered around the province, which include people living in burned-out car wrecks, self-constructed shacks made of plastic bags and twigs, and so on.

In this context, development delivery might appear to be uncomplicated, since the need is so huge. Delivery by

provincial and local government, however, has hit a major obstacle: namely, a boycott of service payments by a great number of citizens as well as a considerable number of large-scale business concerns. This paper is based on a sample survey of unserviced informal settlements in Gauteng. The survey focused on peoples' attitudes to and participation in development projects, particularly water and sanitation projects. It went on to analyse the supposed 'culture of non-payment'.

The paper analyses in detail levels of social involvement in these economically depressed and crime-ridden areas. It looks at stratifications within these areas by gender, class, and so on. It uncovered and quantified the fact that although 'squatters' are most frequently blamed for the culture of non-payment, they are in fact the basis for a future culture of payment for services. Already more than a fifth of these citizens are paying for (illegal) water connections. This is despite unemployment levels approaching almost two-thirds of all adults. The paper goes on to examine which forms of organisation are most effective amongst people living in unserviced informal settlements, and which are likely to be allies of those government structures trying to mobilise citizens in support of development.

The paper concludes that people living in unserviced informal settlements, at this moment in time, are willing to pay for service provision as set out by the government in its Reconstruction and Development Programme. Some are willing to pay more money for a better service, including water being piped into their houses. This positive attitude towards engagement with delivery and payment for services, however, is not a permanent feature of the political landscape. Government needs to move swiftly if citizens are not to be pushed beyond the pale and to join the 'culture of non-payment', which is (currently) a more middle-class and formal township-based phenomenon.

ON THE APPLICATION OF TITANIUM AND ZIRCONIUM HYDROXOPHOSPHATES IN THE DOMESTIC FILTERS FOR DRINKING WATER PURIFICATION FROM TOXIC IMPURITIES

Farbun I.A., Bortun A.I., Khainakov S.A., Strelko V.V.
Institute for Sorption and Problems of Endoecoloey of the National Academy of Sciences, Ukraine

The high level of environment pollution by industrial admixtures, the aggravation of ecological situation causes the necessity of protection human being, foodstuffs and drinking water from toxic elements. The current industrial methods of purification of drinking water do not provide the necessary standard of quality. For this purpose the sorptive methods, using selective inorganic materials, are perspective ones.

The inorganic ionites on the base of titanium and zirconium hydroxophosphates, synthesized according to the gel method and converted into sodium form are investigated as active elements of sorptive filters for complex final purification of drinking water from ions of heavy metals (Pb^{2+}, Cd^{2+}, Cu^{2+}, Fe^{3+}, Zn^{2+})and radionuclides (^{137}Cs, ^{90}Sr, ^{144}Ce). These materials are characterized by high mechanical strength, thermal, radioactive and chemical stability to oxidizing reagents and organic solvents; and the most important is that they have high selectivity to ions being present in mixture in small quantity. This allows to use them for concentration of important elements and final purification of solutions from cations micromixtures.

The tests were hold under dynamic conditions with drinking water, polluted by ions of heavy metals (Cu^{2+}, Cd^{2+}, Pb^{2+}, Fe^{3+}) and radionuclides ^{137}Cs, ^{90}Sr. The quantity of water pollution by ions of heavy metals exceeded the permissible levels of concentration in 2-10 times and the quantity of water pollution by radionuclides exceeded the concentration in 10-100 times. In some extent such composition models the water, contaminated by radionuclides and heavy metals after Chernobyl accident.

The influence of different factors (the rate of filtration; the concentration of ions of heavy metals in model solutions; the nature of ions of heavy metals and radionuclides; the granulometric content of sorbent) on the level of extraction of all these admixtures from drinking water was investigated.

It was discovered that the usage of titanium and zirconium hydroxophosphates stipulates the effective water purification (to 90-99%) not only from ions of heavy metals and radionuclides, but from toxic organic admixtures. The obtained levels are essentially lower then permissible ones are. At the same time the considerable reduction of water hardness, comparable with extraction of Ca^{2+} and Mg^{2+} ions by organic cationites, is observed.

The possibility of regeneration of such materials by NaCl and $NaHCO_3$ solutions of 5% concentration is also shown. It allows to increase considerably the effectiveness of purification and to prolong the filter lifetime and to lower the cost of drinking water purification. The lifetime of synthesized materials complies not less than 5000-10000 column volumes, depending on conditions of preparation and types of sorbents used.

The investigation of hydrolytic stability of materials showed that Zr-containing sorbents are more stable than Ti-containing ones. The pH interval of sorbents functioning is 2-6,5 for titanium hydroxophosphate and 1-9 for zirconium hydroxophosphate.

The laboratory experiments are confirmed by 2-3 months field tests (10000 column volumes of purified water) In different areas of Ukraine (Kiev, Zaporozh'e and Dnepropetrovsk). Taking into account the low initial radionuclides, content in drinking water, is possible to say that the obtained results of activity reduction demonstrate a high purification effectiveness.

Titanium and zirconium hydroxophosphates, combined with charcoals and other materials, have passed through all the necessary medical, biological and toxicological tests and the Ukrainian Ministry of Health gave the permission for their usage in domestic filters for final purification of drinking water.

PRACTICAL ASPECTS OF NITRATES REMOVAL FROM THE GROUND WATER

Filipek K., Korczak K., Sewerynski J.
Department of Water Protection,Central Mining Institute, Katowice Poland

The problem of nitrates removal from the ground water has attracted the attention of research. workers- and designers for several years. It is well known that nitrates in drinking water can be a reason of some serious diseases, especially for children.

There are generally two main reasons of the nitrates presence water: anthtopogenic and geogenic, however the former are more dangerous.

Three main groups of methods for nitrates removal have been, known for many years: ionic exchange, membrane methods and biological methods. However, it still remains a challenge to optimize the method for the particular case (the costs, the environmental influence)

In the presented paper- the criteria for the choice convenient method are discussed i.e. capital and revenue costs, working capacity, ecological efficiency, the methods of analysis.

In the second part of the paper the working results of the recently built unit (ionic exchange) are presented. The main parameters of the unit ale listed below:

- method: ionic exchange,
- capacity: 15 m^3/hour,
- nitrates: raw water: 90 mg/l, after unit: 15 mg/1
- other chemical parametres: standard,
- depth of well: 60 m.

For a few months the experiments have been made in the unit to optimize the following parametres:

- the amount of regeneration solution (NaCl),
- the duration of a working cycle,
- the intervals and the scope of analysis,
- the automatic and manual control parametres

It was shown that die amount of regeneration solution can be reduced up to 60%), and, as a consequence, the revenue costs can be decreased up to 70% of initial value. The control parametres and the time-table of analysis depends on the stability of the water quality.

On the basis of the obtained results some suggestions for other units, being under consideration, actually on the stage of the basic design, have been presented. The complete chemical analysis data and the complete revenue and capital costs have also been presented

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OPTIMISING OZONE AND GAC IN POTABLE WATER TREATMENT

Flier A., Boere J.
NORIT Nederland B.V., The Netherlands
Barker T.
Bristol Water Plc, UK
Dyer-Smith P.
Ozonia Ltd, Switzerland

The combination of ozone and granular activated carbon (GAC) is state of the art technology in numerous potable water plants nowadays. The role of both processes is mainly complementary. Ozone/GAC provide a powerful tool to cope with several water quality issues effectively, like: disinfection and removal of dissolved organics (taste and odour, organic micro pollutants, AOC/BDOC, THM-precursors). Major process design variables and optimisation routes are discussed. The recent retrofit of Purton WTW (Bristol Water, UK) is discussed. The ozone/ GAC step is equipped with modern tools in order to achieve a flexible and efficient operation:

- ozone: on site oxygen supply using a PSA system; optional dosage of H_2O_2.
- GAC: 2 filters in series with up/downflow and pseudo moving bed operation (Biflux type); optional phosphate addition for stimulating bio-activity; computer software for filter management; on site reactivation facility.

Optimisation of the GAC adsorbers is an area of major interest. It is vital to manage this stage effectively to reach water quality targets cost effectively.

SYSTEM OF DRINKING WATER PRODUCTION MODULES

Frogg N.P.
SOVINTERVOD, Design and Engineering Co.

Problems on provision of peoples with drinking water in many regions of the world are still to be solved. Their solution depends on a number of factors. Among them, first of all, are the conditions of water-supply sources and of the centralized water-supply systems, i.e. treatment plants of these systems can not serve as barriers against pollution, and distribution water supply pipelines appear to be sources of secondary pollution of water to be supplied to the people.

Besides, it is practically obvious that in many cases not only deep or advanced water treatment is required, but the enrichment of water with fluorine, calcium, magnesium and other micronutrients is required for production of drinking water.

The fact is that it is necessary to develop without any delay new production methods (technologies), and this will result in reequipment of many centralized water-supply systems.

The solution of problems in this way will require much time and facilities.

But the people health hazard is constant-growing because the consumed water is not only polluted with toxic substances, but it is invaluable as to physiological aspects.

Taken together, all these reasons stimulated the search for a new solution of the problems.

For the most part, the existing public water-supply systems are constructed to meet requirements for:

- drinking water consumption;
- domestic consumption;
- industrial water consumption;
- watering of streets and green plantations.

Drinking water is expected to be separated out of water to be supplied to the people, and this water only will be treated so, as to reach drinking water standards.

This approach is supposed to be used in regions located as near as possible to the water consumption areas.

For realization of the above-mentioned approach, it is recommended to apply a system of versatile drinking water production modules (UPPV), offered by the Sovintervod, Design and Engineering Company.

Taking into consideration that drinking water consumption makes up 10 to

12 l/day per a person, this solution of the problems is economically effective.

The UPPV modules system includes modules of two types and of three standard capacities:

- I type - for fresh water treatment (UPPV - П);
- II type - for treatment of saline water (UPPV - M);
- Standard capacities, - 2,15,25 m^3/day.

Production plant process lines for the UPPV are designed for each specific case proceeding only from fundamental physical and chemical analyses of raw water, according to drinking water norms and standards recommended by the World Health Organization.

The system is based on progressive domestic engineering in miniaturization of constituents of the production plant process lines and on the use of "cold" corona principle for generation of ozone from air.

UPPVs are used for treatment of natural waters and for advanced treatment of town water. If necessary, the town water is enriched with fluorine and other micronutrients.

A number of water specimens were studied prior - and after treatment of water in the module. The results are as follows:

- As to bacterial and virus parasitic pollution, effective (100%) disinfection of water is provided.

- Total salt content decreases down to the required degree.
- Advanced treatment of town water improves its organoleptic characteristics (odor, coloration, turbidity).
- High efficiency of advanced water treatment was recorded as to volatile halogen organic compounds, in particular, chloroform (92%), toxic inorganic elements (aluminium - 73%, arsenic - 80%, barium - 57%); reduction of the complex content index for chemical substances of the Ist and IInd hazard classes down to the required degree.
- Reduction of significant mutagenesis effect of total chemical polution of town water.
- Fluorine content in raw water specimens was recorded to be by 8 to 12 times less than the standard values, but after treatment of the water the fluorine content has increased up to optimum values.

Listed below are the processes and methods to be applied for production of drinking water which is epidemic safe, deeply treated against chemical pollution, favourable as to organoleptic characteristics and physiologically valuable as to macro - and micronutrient content:

- Water treatment against mechanical pollution in the centrifugal force field.
- Extraction of ozone from air.
- Oxidation of water pollutants with ozone.
- Sorption of oxidation products by activated carbon.
- Separation of air out of the water and unreacted ozone in the centrifugal force field.
- Membrane desaltation.
- Water enreachment with required micronutrients (fluorine, calcium, gnesium, etc.) by adding into water suitable reagents with the help of special dosing apparatus.
- Disinfection of water with ozone by maintaining its content in drinking water on a level of 0.1 to 0.3 mg/l.
- The UPPV modules are intended for production of drinking water just in the areas of the water consumption.
- The UPPV modules are widely used to meet the drinking water requirements of dwellings, hotels, sanatoriums, hospitals, schools, farms, construction sites, oilman settlements, geological research expeditions, etc.
- The use of UPPV modules provides sanitary and technical reliability at high economic efficiency.

OPERATING EXPERIENCE WITH THE NEW GENERATION OF LOW PRESSURE REVERSE OSMOSIS MEMBRANE ELEMENTS

Gerard R.
Hydranautics Europe, Almelo, Netherlands

Introduction

In early 1995 a new generation of Energy Saving Polyamide (ESPA) reverse osmosis membrane elements was introduced. This membrane is characterized by a very high specific water flux, while maintaining high rejection for organic and inorganic species. The specific flux of this new membrane is about double the flux of the previous generation RO membranes. The higher flux results in a more economical design and operation of RO units.

The actual field performance, including flux and rejections characteristics and fouling behavior will be discussed. Novel RO system design concepts, that take full advantage of the improved membrane performance, will be evaluated.

Membrane design

Through the use of molecular structure imaging a new membrane was developed with a unique surface structure. Transmission Electron Micrographs (TEM) and Field Emission Scanning Electron Micrographs (Fe-SEM) confirm that the structure of the skin layer of the new membrane is significantly different from the conventional membrane. From the micrographs it can be estimated that the actual skin layer area per square meter of membrane material has been doubled. This new structure is the explanation for the high specific water flux of 5.9 l.m-2.h/kPa (flux per membrane area and per net driving pressure). Since the chemistry of the skin layer is identical to the conventional membrane, the rejection properties as well as chemical stability of the membrane have not been changed.

System design requirements

RO systems using the new low pressure membrane elements are designed to operate at the same flux rate range as conventional technology. For an average flux rate of 26 l/m2.hr, the required net driving pressure (NDP) is only about 4 to 5 bar. Such a low NDP may require a different approach to RO system design. In a system operating at high recovery and/ treating a high salinity feed, the increase in osmotic pressure along the elements in the system could be significantly higher than the average NDP. Consequently a steep decrease of NDP along the system could be encountered resulting in a high flux in the lead elements and a low flux in the tail elements. Such operating conditions may result in excessive fouling of the lead elements and high combined permeate salinity due to the low permeate flux of the tail elements. In order to improve the permeate flux distribution a different system configurations would have to be utilized. These may include an interstage booster pump, partial permeate trottling or a hybrid membrane element system designs.

Operating Costs Savings

The lower operating pressures for the new membrane translate into a savings in energy costs of approximately $ 100 to $ 400 per element per year. The savings are increased at lower system recovery, higher specific flux, higher energy cost and lower feed water temperature and TDS.

In particular for systems being able to operate at high specific flux, i.e. systems with UF pretreatment or the second

pass in a double pass RO system, full advantage can be taken of the high flux capabilities of the ESPA membrane.

Long Term Operating Results and Fouling Behavior

Large systems have been in operating for over two years with the ESPA membranes. It will be shown that properly designed systems exhibit stable operation in terms of operating pressure and product water quality.

It was originally envisioned that the difference in membrane structure might have a negative effect on the fouling behavior of the element. Actual field performance data shows that the fouling behavior of the ESPA membrane is the same or better than the conventional membrane operating on the same feed water. Transmission Electron Micrographs of cross sections of membranes with organic and inorganic fouling confirm that the foulant is not able to penetrate the new membrane structure. Standard cleaning procedures are able to restore the membrane performance to the original level. The lower fouling rate observed in several systems could be the result of the larger area of skin layer per unit area of membrane. Due to this higher area the actual specific flux is lower than the calculated specific flux resulting in less concentration polarization and less fouling.

Future developments

Since its introduction, the ESPA membrane has been used both for new units as well as for replacement of conventional membranes in existing units. The majority of the membranes currently being installed for new or replacement projects in Europe are of the low pressure type.

A high rejection version of the ESPA membrane has been introduced recently. It is expected that with the addition of this new product, the new generation low pressure membranes will replace almost all conventional products. Also for applications that require very high rejection i.e. RO systems followed by mixed bed ion exchange, the ESPA type membranes will show excellent performance.

RESEARCH AND DEVELOPMENT OF INNOVATIVE SYSTEM FOR THE IMPROVEMENT OF DRINKING WATER QUALITY

Gevod V. S., Reshetnjak I. L., Khokhlov A. S., Gevod S. V., Ruzhentsev V., Belimenko G.
Ukrainian State Chemical - Tecnology University, Dnepropetrovsk, Ukrain
Birdi K.S.
Danmark Pharmaceutical Highschool, Copenhagen
Gasik M.M.
Mat Tech Centre ry, Espoo, Finland

On the average each person uses daily approximately 2-3 litres of water for cooking and drinking. The present pollution of European rivers, lakes and other open reservoirs originates from industrial waste, household sewage, fertilizers etc., is the main cause of modern problems with drinking water. At present the situation considered as critical, because drinking water in many countries is being supplied to consumers from open water sources and from subsoil water reservoirs without satisfactory purification.

All this has forced to use more extensively drinking water purification (DWP) systems on both home and industrial scale. There are great number of models of DWP units, were majority of them use the principle of filtration of water through some cloth or membrane and adsorbancy of impurities by activated carbon or ion exchange resin. All these systems require regular cleaning as well as change of filtering cartridges and therefore become rather expensive on a long term exploitation time. So, there is a big demand of new effective and low cost DWP system, which does not have filter elements, activated carbons, resins etc. and neither require expensive maintenance. This demand may be satisfied by water purifiers of new generation with use a bubble film extraction principle. Such DWP devices could be easy to produce, install and maintain.

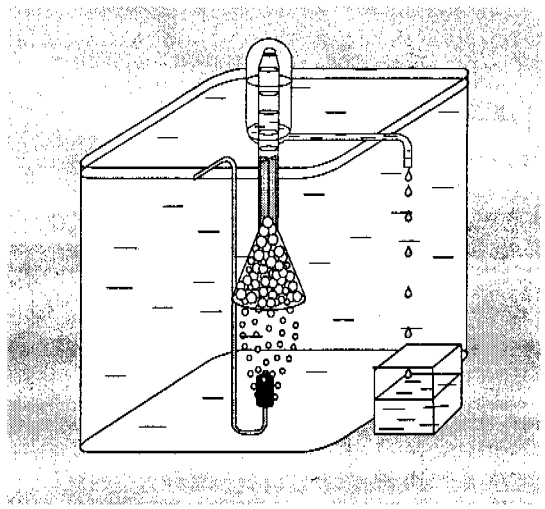

Fig 1. Schematic representation of air bubbles flow behavior in the space of bubble-films extractor.

The main feature of innovative principle is that (DWP) takes place by blowing of air bubbles flow at the certain flow rate, pressure, etc. through layer of water. Surface-active substances (SAS), which are always present in water in small amounts, are adsorbed on the surface of bubbles and are removed together with other pollutants. In this device there is no replaceable elements, no filtering nor absorbing units, which would require regular maintenance and repair.

In general the theoretical basis to use a bubble-film extraction phenomena for purification of tap water is the following: the air bubbles feeding into tap drinking water of bad quality (i.e. water which contains a certain amount of endogenic and exogenic surface-active substances among other kinds of pollutants), leads to the formation of hemispheres (half bubbles) at the plane air - water interface. Life time of these films depends upon the concentration of surface-active substances in water.

The air bubbles feeding into the space of low-quality tap water under the cone of special semi-immersed device, which consists of a funnel connected to a piece of an appropriate cylindrical pipe with a cone at its top makes it possible to transform the air bubbles flow inside of a pipe into a flow of very thin plane liquid films (membranes), fig 1. These films consist of concentrated solution of pollutants extracted from water and the surfaces of films are stabilized by monolayers of withdrawn SAS. The life-time of films inside the pipe is sufficient for reaching the top aperture of a pipe. It allows to achieve the water purification process by feeding air bubbles into tap water and removal of a concentrated film of pollutants through the top aperture into a separate storage area (condenser) or directly into a sewage system.

Preliminary experiments have shown that this method reduces the concentration of different surface-active substances in tap water up to the level of a few micrograms per litre (from the initial concentration of these substances in water of 0.1 - 0.5 mg/l). In such a procedure the bubble-films extraction approach expands the possibility of classic flotation method at least by an order of magnitude. Other kinds of drinking water pollutants, which are not surface-active, are removed together with the surface-active substances. Purification of water by means of bubble-films extraction is achieved without the use of adsorbents or any other reagents, which makes this process much more economical in comparison with all other known methods of water purification.

Tests of this DWP system in Ukraine has shown that by the help of additional purification of drinking water supplied to consumers by sanitized water plants in Kiev (capital of Ukraine), the final amounts of typical water pollutants (which usually exceeds the levels of toxic safety) in the output of bubble film purifier reduces to .low levels, as shown in fig.2.

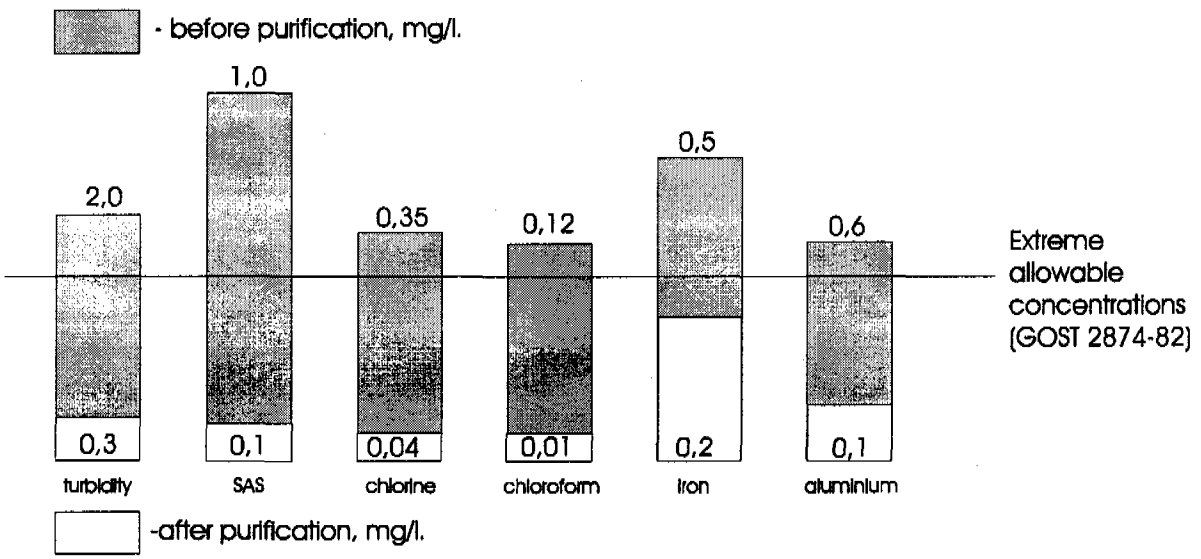

Fig.2. Efficiency of tap water purification by experimental DWP device in Kiev.

Development of research activities in this direction may result in many advantages for people in Europe. First of all, suggested method can document that it is able to solve the actual problems of low quality drinking water supplied to consumers in many places. Second, the bubble-film extraction method may be considered as a new area of research activities directed towards modernization of contemporary technologies at water purification stations and waste-water treatment plants. Third, because bubble films extraction method essentially expands the possibilities of flotation, it may have good opportunities to create a new bubble-films extraction system for selective bubble-films withdrawal of different mineral components (de-mineralisation) from water (mineral and sea water in particular).

Literature.

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ABOUT THE POSSIBILITY OF SMALL POWER PULSE DISCHARGE APPLICATION FOR WATER PURIFICATION FROM MICROBE AND CHEMICAL POLLUTION

Goryachev V.L., Rutberg Ph.G.
Institute of Problems of Electrophysics, Russian Academy of Sciences (IPE RAS), St-Petersburg, Russia

The work presents the results of the experimental investigations of pulse-periodic electric discharge exposure to water, containing microorganisms (bacteria, phages, etc.) or chemical substances. The main parameters of the discharge pulses are: pulse energy, equal to 0,3...1 J, pulse recurrence frequency, equal to 50-100 Hz. Experiments were executed with the model water solutions, containing E.Coli bacteria, with natural water of Northern Purification Plant "Petersburg-Vodocanal" state enterprise, with water, containing CCl_4 organic substances and three-chlorine ethylene. The latter were performed together with the SUI American company, just as the exposure experiments on water, infected with parasites (Cryptosporidium). The results of the experiments are as follows:

Exposure effect depends on the average specific discharge energy magnitude. At the magnitude of average specific energy, equal to W = (3-5) J/cm^3 bacteria concentration is decreased for 5-6 orders. Greatly polluted water becomes suitable for drinking (E.Coli index is less than 3 1/1 after the discharge effect). In the course of the experiments, it has been established that the distinguishing peculiarity of water being treated by electric discharge is its extremely long-duration bactericide properties (from several months to a year).

Concentration measurement results of hydrogen peroxide and heavy metals ions, formed in water in the course of electric discharge treatment, are given in the paper. It has been determined that these substances concentration magnitude is smaller than tolerable concentration. Besides that, hydrogen peroxide concentration decreases practically up to zero-level during several days. Heavy metals concentration does not drop significantly.

Organic substance decomposition has been detected at the condition of the discharge exposure to water, containing organic impurities. However, purification efficiency depends substantially on the initial concentration quantity. This process is mostly effective when the impurities initial concentration is insignificant and is equal to (1-10) ppm.

The obtained results show that it is quite possible today to use electric discharge method for water and liquid foodstuffs sterilization. Information about the facilities, needed for this technology realization, designed and developed in the IPE RAS, is given in the concluding part of the paper. This equipment can be produced in serial by "Sila" JSC (St.Petersburg).

Scientific work has been performed with the support of the Russian Fund of Fundamental Investigations (RFFI) (Grant 97-02-16002).

THE MODERN STATE OF WATER ACCOUNTING SYSTEM AND MAIN TASKS OF ITS PERFECTION

Gumen S.G., Bezdenezhnykh A.G., Zaitsev A.P.
SUE - "Vodokanal of Saint Petersburg", Saint-Petersburg, Russia

The SUE "Vodokanal of Saint Petersburg" parallel with the problem of the improvement of water quality pays rather serious attention to the problem of water accounting in the system of the city water supply. The large per cent of water waste during purification and transportation in combination with the obsolescence and physical wear of water accounting devices, and also the sharp change of water price within the last years required the radical change of an attitude to the measurement of water consumption and quantity both on waterworks, and during water accounting for the subscribers of water-line net.

Existing water counters on the outlets of waterworks, based on the principle of the changing of pressure difference, are not the devices for commercial water accounting because of the absence of metrological provision. The water counters BT-50 and BKMC, which were taken away from production in 1987 because of discrepancy with existing standards, were, as a rule, installed for water-lines subscribers. Taking into account the formed situation, the decision about the perfection of water accounting system in the city is being adopted by the leaders of the SUE "Vodokanal of Saint Petersburg".

The main tasks of this direction are:

- the decrease of wastes and liquidation of water deficit in the city;
- transition to payment according real water consumption.

The programs developed by the SUE "Vodokanal of Saint Petersburg" are directed at the fulfillment of these tasks. "The aim program of the development of the accounting system of water production and consumption in Saint Petersburg until 2000" is the main among them.

For the realization of the tasks upon the perfection of water accounting systems the specialized affiliate "The Center of the measurement of water consumption" (Center) attached to the SUE "Vodokanal of Saint Petersburg" was created in Saint Petersburg in 1995.

Its main task is the provision of the real accounting of water during purification, transportation and distribution to water-lines subscribers. The main places of water waste were analyzed on the first stage of the aim program realization. They are distributed according the articles of water production as follows:

- *at water purification stations:*
  - imperfect technology of purification;
  - obsolete equipment;

- devices of water accounting without metrological provision;
- *at water-lines:*
  - leakage;
  - the use of unprotected steel pipes and accessories;
  - absence of the devices of the accounting of water and pressure in water mains;
- *for water consumers:*
  - the absence of modern accounting devices;
  - bad technical condition of water demountable accessories;
  - the absence of complex water saving policy;
  - the absence of propaganda about the necessity of water saving.

In this situation the waste of water in the system of the city water supply is from 20 to 30 %. That is why the task of the restoration of water accounting units in the housing fund of Saint Petersburg and at the outlets of waterworks into a normal state was put before the Center on the first stage of two years duration. In accordance with the decision of the Mayor of Saint Petersburg and the Order of the municipal economy management Committee the Center must reconstruct about 1400 water accounting units in the city municipal housing and 2600 in leaving construction complex. In 1997 the "Address" program upon the reconstruction of water measuring units in housing fund was finished.

The absence of native counters made the SUE "Vodokanal of Saint Petersburg" to effect the complete of accounting units with modern imported water counters. For the convenience the work with two west European companies was carried out.

The main differences of these counters from the ones used previously are the following:

- high sensitivity;
- reliability;
- longer exploitation period.

Taking into account the importance of the problem the European Bank for Reconstruction and Development granted a credit to Saint Petersburg for the purchase of the devices of water accounting and lock accessories in 1998. In the announced tender for the delivery of devices and accessories in the frames of this credit all main producers and suppliers of this production take part.

After finishing the work upon municipal and cooperative housing, the SUE "Vodokanal of Saint Petersburg" plans the transition to the payments for the consumed water from leaving houses according to its real consumption. In 1998 together with the Administration of Saint Petersburg the SUE "Vodokanol of Saint Petersburg" will begin the realization of the Program upon the restoration of water measuring units in budget organizations of the city subjection (culture, health services, education) and departmental housing fund.

Except the direct purchases from foreign countries, the SUE "Vodokanal of Saint Petersburg" concluded contract with the companies "Premex" and "Schlumberger Industries" about the joint production of water counters. At the present time the production of the bodies for the counters of the Diameter conditional of 80, 50, 40, 30 mm is organized at the plant AO "Armalit".

Taking into account the large exploitation period of water-lines and as a result often failures of water counters, the Center together with AO "Armalit" organized the production of mechanical filters, magnet and mechanical filters and filters-transitions. Filter-transition is the device combining two elements of water measuring unit - transition and filter. The use of this device will help to include filter as a part of water measuring unit, preserving its initiate length. Instead of the obsolete album of typical schemes of water measuring units the new documentation for water measuring units, corresponding the modern requirements, was developed in the Center.

Taking into account the importance of the servicing of water accounting devices, the SUE "Vodokanal of Saint Petersburg" creates the modern technical base for the adjustment, setting-up and calibration of water counters on the basis of the Center. The Center has two solid stands for the calibration of water counters having the diameter from 15 to 80 mm, two weight stands of the company "Premex" for the calibration of water meters from 10 to 200 mm. The stand for water counters having the Diameter conditional from 50 mm to 200 mm is fully automated. Moreover, there is the possibility of calibration of hot water counters and consumption meters on the weight stands.

Side by side with the stationary means of service the stock of the devices of mobile base of supersound type mainly is created in the Center. At the present time it consists of two devices PTP-868, "Portaflo MKII-R", route searching device RD 400, flaw detector EPOCH III.

The inducing factor for the development of this direction of works became the absence of metrological provision for narrowing devices of large diameter in the conditions of exploitation and the necessity to offset the balance of given and received water at water conduits. That is why originally the tasks, connected with the calibration of the means of consumption and water quantity measuring at the place of the dismounting were on the first place.

In the process of work new directions were added to these ones: the search of water waste, control of operating water counters, offset of water balances, control of accessory closing and others. As a result at the present moment the following directions of work were determined:

- routine monitoring of water consumption and quantity in the case of necessity and disputable situations upon water consumption;
- adjusting and setting-up works in technological processes;
- determination of water consumption regimes;
- calibration of the means of consumption and water quantity measuring, which are not subjected to metrological investigations because of the impossibility of their dismounting;
- search of the ways of the carrying out of calibration of water consumption and quantity in the conditions of exploitation.

The second large task of the Center is the perfection of water accounting at the outlets of waterworks. The creation of the modern units of water accounting at 46 outlet water conduits of the plants effecting water purification gives the possibility to determine the real capacity of water for the needs of the city. At the present moment the works upon the dismounting of accounting units at the North and South waterworks are carried out.

Supersound time pulse devices of stationary fastening are installed as the devices of water accounting. As upon mechanical water counters, the work upon the delivery of supersound devices is effected with some companies. Information about the quantity of water, dispensed to the city, is transferred to the control panel of the SUE "Vodokanal of Saint Petersburg".

The first results of the Center activity confirmed the correctness of the chosen way. It is impossible to make the real water balance without the devices of water accounting, and it is mainly impossible to control water resources, and therefore to solve the problem of resources saving and rational use of water.

Besides the direct benefit from the realization of "The Program" measures (the decrease of losses and economy of water) it is necessary to indicate the following positive factors:

- the increase of the effectiveness of waterworks operation;
- the prevention of the pollution of environment in the result of the decrease of sewage discharge without purification into sewerage and especially into opened reservoirs.

REMOVING SUSPENDED MATTER FROM AQUEOUS MEDIA USING HIGH-GRADIENT MAGNETIC FILTERS

Gusev B.A., Efimov A.A.
Alexandrov Research Institute of Technology

The modern technologies of suspended matter separation from water are based on the use of filtering membranes of pore sizes commensurable with the removed particles sizes and having hydraulic resistance which increases as filtration progresses. The efficiency of mechanical filtration is improved through either replacement or regular cleaning of filter elements. Filtering water flows through high-gradient magnetic filters is based on the effect of filter matrix magnetic fields/ removed particles interaction. Particles are removed if they have at least weak magnetic properties. To apply this process, the magnetic field gradient of $10^5 - 10^6$ A/m should be established in a filter matrix. Such magnetic field gradients can be created in matrix elements of a minimum radius of curvature by using a magnetic system of high-coercitivity permanent magnets. The suggested method was tested in removing corrosion produced particles of 0.5 ÷ 50 mu with paramagnetic properties from water flows, and decontamination efficiency was found to be about 80 ÷ 90%. Since the particles are retained due to magnetic interaction of particle dipole and matrix magnetic field, the process is not filtration in the true sense of the word; as filter matrix porosity is 80 ÷ 90%, hydraulic resistance of such a matrix will grow at much lower rate than in standard mechanical filters. The developed high-gradient magnetic filters with magnetic systems of Sm-Co permanent magnets allow easier operation and regeneration of filter matrices. The proposed filters exhibit the most promise for treating condensable sludge.

METHOD OF TREATMENT OF POTABLE AN₂) WASTE IN HYDR.ODYNAMIC CAVITATIONAL R.KACTOB

Ichanov A.D.
State Tecimical Umvefs^ naned after I.Pulyuy (TSTU),
Tenlopol, Ukrane
Tazalova N. N., Tikhonova I.A.
State Umversi^ "Lvovskaya Politeidmika" (SU "' LP"), Lvov, Ukraine
Vitenko T.M., KarpmsfcaLya L.A.
State Chechmcal Umversity tiamed atter j...L-hJIyuy ('IS'I'IJ), Ternopol, Ukraine

Unsatisia.ctoiy state of ecological situation atid. patticulallv, the condition of water basins in tiumefous regions tiec:es5itates tlie elaboration of new tec^inologies foi piji.«±u:atKm and decontamination of potable and waste water. Trie greater majority of these technologies are based o& the application of ozone and hydrogen peroxide. Traditional equipment used tor these purposes with application of silent discharge is complicated and expensive due to the high capital operating costs. For tj:iis reason it is important to elaborate and introduce some simple and econoniical equipment for the treatment of large quantities of water. Application of hydrodynainic cavitational reactors (HCR) remarkable for their small size and low energy and metai consumption is one of the ways of striving this problem.

TSTTJ and SU "'LP" have carried out a research work- on the meth.od of oxidation of organic contamination and. deconfaimmation of natural and. waste water using HCR, m which cavitation occurs through turbulization of liquid beliind an obstacle m a pipe -line (cavitator) with a present orilise size. When liquid, flows ovei the obstacle at a high speed., it forms behind the obstacle a vacuum cavity" (caverrf) , which under pressuie detomis and splits mLo lmy bubbles. When these bubbles attain the dimensions of several micrometers, electrical break.-d.owii of the gets bubble takes place due to high voltage of die electrical field arising in the result of adsorption of negative and positive ions on the opposite sillfaces of the bubble with simultaneous generation of ozone

and hydrogen peroxide. The effect of the fomied reagents with simultaneous turbulization of the liquid is svne^getic., which essentially improves quality of die treated water.

Investigation of kinetics of oxidation of organic admixtures in waste water as well as morgaiiic and bacterial eontammation of natural water was conducted on actual industrial waste wateis containing petroleum products, dyes, milk products, compounds of bivalent iron and -microorg-anisitts in the regimes winch appear to be die subject of '"Imow- how". Noticeable reduction of die values of chemical consumption of oxygen and colli-index testifies to the efficiency of water treatment in HCR.

Feasibility evaluation of the obtained results has shown., dial the cost purification and decontamination is reduced by 2 -3 times, while the cost of equiptinSnt is lower by a degree compared to the application of traditional ozonizers. .In addition, undisputed advantages of die described method are the following features:

- there is no need for costly frequencies and high - voltage transfonners widi applicaion of costly materials,
- there is no corrosion and cavitational failure of the pipes walls, as die speed of liquid flow along die reactor's axis is, ' maxm^al, and ozone and hydrogen peroxide are formed along the flow.s axis arid quickly disappear m the result of oxidation of contaminations,
- design of diese installations is simple, which permits dieir usage on a wide scale fw local water supply and water distribution for small objects (schools, hospitals, pools, recreatiotial facilities, etc.) .

A DISINFECTION AND CLEARING OF WATER BY MEANS OF POWERFUL PULSE OPTICAL RADIATION

Ilkaev R.I, Rahmanin Yu.A.
A.N.Sysin Research Institute of Human Ecology and Environmental Health RAMS, Moscow, Russia
Sviridov V.A.
VNIIEF, Moscow, Russia

Nowadays an antropogeneous influence on biosphere and, in particular, hydrosphere, has a so great scales, that without an effective sanitary measures directed on prevention and liquidation of pernicious consequences of such influence, the Earth is threatened with global ecological accident. Therefore development and introduction of new ecologically pure technologies, in particular, of unreagenting methods of a disinfection of drinking and waste water, becomes vital necessity.

The existing methods of bactericidal processing of water have a number of essential lacks. The thermal method is rather power-hungry, requires the bulky equipment, has low power efficiency and consequently is applicable only for sterilization of a small volumes of water. It's common nowadays the chemical ways of disinfection of water by chlorine and by ozone are connected with the definite ecological detriment for the human and environment out of pollution of water by the disinfecting substances and products of their interaction to water. The way based on use of a stationary ultra-violet (UV) radiation of mercury quartz lamps is applied in practice of an industrial disinfection also. However with safe concentration of energy of UV-radiation the disinfected effect is achieved only partially, therefore this method is effective only in a combination with chlorination. Thereto, the large productivity mountings of UV-disinfection are contains a plenty of lamps - radiators; it needs for the maintenance of efficiency of disinfection an often clearing of their surfaces of chemical and biological stratifications, that with their quantity essentially complicates of a continious using of mountings.

The new way of a disinfection of drinking and waste water by means of powerful pulse optical radiation developed by us is deprived of the listed lacks. The bactericidal effect is achieved at the expense of selective frequentative pulse thermal influence on microorganisms, and also of a physical destruction of environments of crates in a result of pulse mechanical influence. It is important, that a degree of infected and transparency of water essentially do not influences on efficiency of disinfection. The radiation is effective concerning of all microorganisms: viruses, bacteria, parasites in all forms of their existence. Besides the contents of the weighed particles is reduced in processing, it is decreases a pollution by toxines, organic substances and mutation ability of treated water.

The efficiency of the developed way is confirmed by researches on the stand trial-industrial mounting by productivity 25 $м^3$/day. On the data of All-Russian State scientifical-research institute of Ecology of the Human and Hygiene of an Environment (Moscow), processed on the this technology waste water of infectious hospital conforms GOST (State Standard) 2874-82 « Water drinking », and processed waste water of hennery - to the requirements of Ambulance Epidemical Control 4630-88 " Guards of superficial waters from pollution ".

The specific results of researches are reported on the previous congress and are published in the collection of the reports.

Advantages of offered technology also are the high economic and operational parameters: expenses of energy are low and are comparable to energy expenses on chlorination; a high reliability and large resource of work of mountings; a minimum quantity of the attendants and preventive measures. Besides, the significant expenses for input of technologicalmountings in existing system of clearing structures and construction of expensive structures, which are necessary for technologies chlorination and ozonation, are not required.

The technological mountings can be made of domestic materials and furnishing at the enterprises of the customer.

Possible(probable) applications of technology:

- Conditioning of natural superficial and underground waters in practice of drinking and technical water supply;

- Clearing and disinfection of water in work cycles of the plants;
- Disinfection of waste water of the occupied items, plants and cattle-farms;
- Disinfection of turnaround water in pools;
- Food and alcohol industry;
- Pharmacology.

The technological mountings have a modular design. One of developed is the mounting «Bio-Pulsar» by productivity 250 m^3 of waste water per day mounted on Istra hydrounit near the Moscow, is the base. On the basis of its design it is possible the creation of the automated one-modular technological mountings by productivity up to 5000 m^3 per day of drinking water. From modules by nominal productivity 1-5 thousand m^3 per day the stations disinfection by productivity 10-50 thousands m^3 each can be mounted.

The introduction of offered technology can be carried out by manufacturing and statement of necessary quantity of technological ountings of a modular type in an existing water network of the occupied items, for example, at regional distributive stations, quarters and houses, or on clearing structures, and also in builded objects.

It is possible the creation of mobile variants of mountings.

On technology 3 patents for the invention are received, and three patents are at a stage of registration.

The price ofmountings varies at the rate of 30-300 US dollars for 1 $м^3$ of productivity: the it is higher, the below specific cost of the equipment.

THE DEVELOPMENT OF POTABLE WATER TREATMENT MODULAR SYSTEMS

Ishtchenko I. G., Kouzmina N. P., Prjanishnikova E. N.
MOSVODOKANALNIIPROJECT Moscow Institute for Water & Wastewater Research & Design
Penzin R. A.
NPF ITEM Joint Stock Company
Alfjorov M. A.
Instrument Factory - TENZOR Joint Stock Company

The report includes the results of our work of 1996 concerning the development of flexible modular systems for drinking water treatment. This problem is urgent for a number of industrial megalopolises (the Urals Region, the Region of the Volga River, the Siberian Region) where the potable water quality meets neither the requirements of WHO's standards nor the requirements of the Russian State Standard.

The goal of the work was to develop a versatile small-size filter of modular type providing the possibility to obtain potable water (1-2 m^3/day) treated up to the international standards with minimal operating costs. The treatment process was based on the sorption-microfiltration methods (previously developed by our specialists) which incorporated the application of selective non-organic sorbents, carboxyl ion-exchange fibers and meso-porous activated carbons. These combined methods have no analogues in the world water treatment practice.

We have used the principle of double-stage cartridge treatment which has provided the possibility to design flexible systems characterized by easy operation and maintenance. The first cartridge consists of five sorption cartridges with the versatile sorption medium; it provides the removal of the main technogenic admixtures. The second cartridge provides fine purification by means of microfiltration elements (of 1-5 micrometer pore size). All the sorption and microfiltration materials used for the work were of Russian make.

The testing of a breadboard specimen of the filter revealed the fact that it provided the production of high quality potable water removing from it such technogenic admixtures as iron, cadmium, ammonium, chlorine and organic phosphorus compounds as well as bacterial microflora; at the same time the treated water preserved all its useful mineral components. The filter design makes it possible to reliably operate it under various conditions including the conditions of a military garrison. The operation of the filter during a year period in one of the military garrisons has proved its reliability and high treatment indices concerning all the limiting admixtures. The filters of the series are awarded of the Sanitary Certificate and the Certificate of Compliance. We are of the opinion that the introduction of such versatile modular water treatment systems is one of the most promising trends in the field of drinking water supply improvement.

UNACCOUNTED -FOR WATER IN COMMUNITY WATER SUPPLY SYSTEMS

Jeleznova G.L., Kolesov V.V., Orlov G.A.
Municipal Water Suppy and Treatment Research Institute

According to Russian official statistics on operation of community waterworks , the difference between quantites of water pumped to a distribution system and delivered to consumers is indicated as "leakage and unaccounted-for water use". Formerly that parameter was everywhere shown to be within 8 to 10 per cent, which, of course, was far from reality, but it was artificially understated, otherwise operation of waterworks was considered unsatisfactocy.

In recent years, the stated values of the parameter have grown considerably, still they are usually less than they should be, as not all water losses are properly evaluated.

The fact is confirmed by results of investigations carried out by the Institute at a number of urban waterworks, as well as by analyses of data published in technical papers, in purticular by the International Water Supply Association.

It was established in many cities, both in Russia and abroad, that the value of the parameter varied from 20 to 30 per cent and that there was no uniformity in methods of the evaluation.

Exidently, proper evalution of this parameter and its components is very important, as this allows to work out and inplement measures aimed at improving control of unaccounted for water use and decreasing water losses, as well as to avoid mistakes in calculations of water cost and substantiated water tariffs.

To solve these problems the Institute, together with specialists from the waterworks of St.Petersburg and Ufa has worked out a document named "Instruction for evaluation and normalization of unaccounted-for water use in community water supply systems"

In this document the term "unaccounted-for water use" is applied to all water losses from a distribution system, wich are not paid for by consumers, i.e. not only leakages, but also all water used for operation needs of the waterworks, no matter whether the water is metered or evaluated by calculation.

This parameter is subdivided into three main groups: effective (productive) water use, water losses, and commercial losses,

Effective water use includes:

- water use for technological and personnel needs of a waterworks itself;
- water use for fire protection needs;
- water use by customers, having no water meters, in exess of norms or limits set for each group of customers;
- water use not registered by customers' meters at small flows due to metrological characteristics of the meters.
- Water losses include:
- leakage from pipelines and reservoirs in accidents;
- concealed leakage from buried pipelines and structures;
- stealing of water through unauthorised connections.

Commercial losses are caused by a difference between the valumes of water delivered to customers, as shown by their meters, and the volumes actually paid for in a given period of time. They do not represent physical losses, but they affect financial standing of the waterworks.

Total value of the unaccounted for water parameter in determined as the sum of above mentioned component parameter values (without commercial losses). The overall parameter is expressed in cubic meters in a given time or in per cent of distribution network pumpage.

The Instruction contains methods for determination of every type of unaccoaunted for water, table forms to be filled in by waterworks personnel to make up a bank of data and calculate the value of these parameters using corresponding formulae. It contanis also methods for normalization of the stated water use based on average actual values, acting regulatory documents and coefficients less than unit accouning for measures to reduce various water losses.

TIME-DEPENDENT INTRODUCTION OF BIOCIDES AND ITS INFLUENCE ON BIOCORROSION OF WATER DISTRIBUTION SYSTEMS

Jigletsova S.K., Kobelev V.S., Gogotova G.I., Rasulova G.E., Alexsandrova N.V., Kholodenko V.P.
State Research Center for Applied Microbiology, Moscow region Obolensk, Russia

Biocides is the mostly common means to combat biocorrosion which is responsible for 50% of total corrosion damage in water distribution systems.Lethal biocidal concentrations to be used for treating destructive strains and their associations are usually defined at laboratories by introducing simultaneously microorganisms and biocide into a medium.

Microorganisms are known may become resistant to biocides, if they have enough time to form a metal surface biofilm. The action of katamine AB toward an association of micromycetes as well as toward sulphate-reducing bacterium *D. desulfuricans* and its dependence on the time of introducing the biocide were studied. All the microoganisms were found to be potent steel destructors. The cultures under investigation were screened for symbioic relationships.

Investigations demonstrated that when being introduced together with an inoculate, katamine inhibits completely the growth of *D. desulfuricans* even in the concentration as low as 0.005%. Single viable cells were observed only when the introduction was 15-day delayed. There were no similar cells with the biocide used in higher concentrations. However, it was found that biocorrosion loss increased significantly due to the delay, and corrosive damage (deep pits) turned to be harmful for water distribution equipment.

The time effect on biocorrosion caused by association of micromycetes is similar to that observed above. The addition of katamine together with an inoculate results in a complete inhibition of the growth of fungi and biocorrosion is getting minimum. The biocide introduced with a week delay showed that the degree of corrosion loss achieved practically the initial one observed in the absence of biocide.

This suggest that microbial populations are able of recovering in the case of the time-delayed introduction of the biocidal minimum lethal concentration, thus nulling or diminishing the biocidal effect. To avoid this phenomenon, high biocidal concentrations, their synergetic compositions or corrosion inhibitors are needed.

Investigations were performed in the framework of Project #119-95 of International Science and Technology Center (ISTC).

IMPROVING WATER SUPPLY FOR ECONOMIC AND POTABLE PURPOSES IN THE RURAL AREAS OF THE ARAL ZONE

Kalmykova N., Kasymbekov D., Smoliar V.
Ministry for Ecology and Natural Resources of the Republic of Kazakhstan, Alma-Ata, Kazakhstan

The deficite of fresh water is the sharpest problem in the Aral region, considered as a zone of ecological disaster. Health and prosperity of living and the up-coming generations depend on its solution.

4 towns, 20 settlments and 380 other small settings are located on the region's territory. The population amounts of 670,000 people, including 232,800 in the rural areas.

Now the water provision in towns is partly solved by construction of a number of water-pipes. This issue requires, however, large investments. In addition, the problem of water supply of rural areas still remain very sharp.

In the Cenozoic-Mesozoic sediments of the region a number of water-bearing complexes have been found. The most prospective is the Cretaceous, where 20 deposits with common exploited reserves of 945,650 m3/d have been developed, including 14 deposits for economic purposes. The total amount of water recovered from the Cretaceous complex makes 327,000 m3/d.

The prospective demand of potable water in the Aral region equals to 379,500 m3/d. The proved reserves of underground waters of good quality (7,227,700 m3/d with mineralization up to 3g/l) used for this purpose.

Expenditures for centralized water supply of 77 settlments (1096 km of water-pipe) amounts of US$ 49,400,000. According to the feasibility study, construction of the local water intake by 13 times cheaper compared to centralized system. Water supply of additional 76 settlments requires more US$ 3,000,000 (including facilities installation).

Before the water supply was performed by construction of the main waterway transporting underground water to consumers.

The consruction of common water-pipe is going very slowly. The Ministry for geology offers a complex decision of this problem. According to its project water supply of a number of small settlments (about 170) consists in construction of local well water intakes directly on the territory of consumers using slightly mineralized underground waters with preliminary desalting.

Currently, electrodialysis equipment have been produced by Almaty elecromechanical plant. The direct agreements iniciate the arrange works. Domestic facilities are cheaper compared to foreign desalters by 3 times.

The implementation of this project suppose to solve shortly the problem of potable water in the Aral region.

THE SCIENTIFIC PRINCIPLES OF THE ECOLOGICAL SITUATION CONTROL UNDER CORROSION OF HEAT POWER INDUSTRIES EQUIPMENT

Kaluzhina S.A.,Kobanenko I.V.,Nafikova N.U.,Sanina M.Yu.
Voronezh State University, Voronezh, Russia

The corrosion of the heat power industries equipment,where water use is very large,increases not only ecological pollutions scales, but aggressivity of heat-transfer agent itself.Obviously, elaboration of scientific principles of the control for corrosion process and the real ecological situation should be based on knowledge of corrosion mechanism under exploiting conditions.In the present work this problem decides for example of iron's and copper's corrosion (basic components of the heat power industries equipment's constructional materials) in carbonate waters with different mineralization degree.

Complex investigations were carried out on original experimental models (with nonisothermal flat plate and rotating disc heat-transferring electrode).These researches have shown that the purposeful influence on the nature and intensity of the metal damage and, consequently, on the ecological situation is possible with the aid of regulation of the thermal regime (the temperature, tangential and normal temperature gradient) and of the carbonate water's mineralization degree.

The occurence of the tangential temperature gradient causes additional losses of iron and increases the local character of distruction due to thermogalvanic corrosion. The variation of sodium hydrocarbonate concentration in water changes zone of preferential corrosion: at C<0,05mpl it is the most cold area of metal surface, at C>0,10mpl-the most heated area.The change of anode and cathode zones location the nonisothermal system supposes it's total protection from thermogalvanic corrosion in water contaning 0,07mpl sodium hydrocarbonate.

These data correlate with the results of the investigation of iron corrosion under conditions of heat-transfer from solid phase to liqued (the normal temperature gradient).According to the latter the concentration of sodium hydrocarbonate solution 0,07mpl is boundary.Iron is actively dissolved under the room temperature in waters with low mineralization degree, but the transition to the severe thermal regime is sharply damped the process up to transfer the metal to the stable passive state.At concentration of sodium hydrocarbonate above 0,07mpl iron is founded in passive state, the temperature increase causes the partial activation of the metal surface, and heat flux, on the contrary, stabilizes the metal.

The opposite effect is observed on copper in analogical conditions, but the concentration of sodium hydrocarbonate 0,07mpl is defined the transition from one type of distruction

to another.Under the room temperature at C<0,07mpl copper is subjected to the local corrosion, and at C>0,07mpl metal is founded in passive state.The temperature and heat-transfer increases in waters with low mineralization degree parallely intensifies the metal surface's local activation and repassivation of pits.At the same time on the thermoequilibrium electrode predominates the latter process and on the heat-transferring electrode majorizes the first process .In waters with the elevated mineralization degree the stability of the passive state of copper is raised with the temperature increase but it is indifferent to the heat flux.

From the results of this investigation the conception of the mechanism of corrosion process on the nonisothermal systems is made.The scientific principles of corrosion protection and the control of the ecological situation in materials for heat power industries eguipment from alloys on the iron and copper base (cooled by the mild water)is recommended.

PROBLEMS OF WATER SUPPLY IN LATVIA

Kartunova L.
Latvian Civil Enineering Institut, Riga, Latvia

The underground waters is the main source of water consumption of the population of Latvia. The rural population uses water generally from water-bearing levels of Quaternary deposits. Cities, settlements and industrial enterprises use water-bearing levels of Devon deposits'

- Arukula - Amata ($D_{2-3\,ar-am}$ including Gauya, Amata and Burtmeku water- bearing levels);
- Plyavinyas - Daugava ($D_{3\,pl-dg}$ including Plyavinyas, Salaspils and Daugava water-bearing levels);
- Famena (DE_{3fm} water-bearing level).

The underground waters of Devon deposits do not contain industrial, agricultural or microbiological contaminators. The shortcomings of such waters are:

1. High contents of iron (up to 3 mg/ cub.dm.). Redundancy of iron in water upsets liver activity, causes cirrozis and cancer of liver, impacts development of fetus both of men and animals causing grave disfunctionings in their organisms. More than 62,7% of communal systems, 22,8 % departmental systems and 36,3 % of industrial systems in Latvia are not equipped with water de-ironating plants. This accounts for the fact that about half laboratory tested samples of water do not meet sanitary requirements on the contents of iron.

2. In many places hardness of underground waters of Latvia is high. Redundant hardness causes stones in bladder, rapid formation of scum on the inside of boilers and tubes, impedes laundering. Equipment for mitigation of water is a rather rare thing in Latvia.

3. Underground waters of Latvia are poor in chemical elements. There is a marked deficiency throughout Latvia in Se, Co, I, F, Cu and some other elements. The contents of chemical elements in the waters of different regions of the country is not uniform. Traveling on from the western parts of the country to the eastern ones, a gradual quantitative decrease of chemical elements in underground waters can be traced. As, for example, in Valka region (near the Latvian border with Estonia) in 3 underground water-bearing levels used for water supplies there were found only 2 elements, iron and uranium (Fe^{2+3+}, U) out of totally 11 tested chemical elements.

Deficiency of chemical elements in water and soils is the cause of many serious diseases of the population of Latvia. Therefore, analyses of water must contain a detailed information on the contents of vitally important chemical elements.

At the present time the sanitary regulations provide only for the upper limits of microelements contents in water (maximum quantity of an element allowed per I unit of water volume) and the lowest limit is unprovided for. However, the knowledge of the lowest limits is of no less importance in order to control the water's quality and its biological properties. This issue still requires a thorough studying and has to be included into the regulations.

PLANT FOR CATALYTIC DEFERRIZATION OF WATER

Kasperovich A.I., Propisnova J.A.
Karpov Institute of Physical Chemistry, Obninsk Branch, Russia
Kolodyazhny V.A.
Institute of Nuclear Power Engineering, Obninsk, Russia

The fresh ground water with 30 mr/l content of iron can be used for different needs of the public utilities, including drinking water supply, only after preliminary deferrization has been made.

Aeration is the most frequently applicable technique for iron removal. However, there is a significant disadvantage of the method because of long-term treatment of water (up to several hours) and substantial floor space requirements to install the equipment (cooling towers, pools, filters).

Iron removal time is significantly reduced, when aeration uses different catalyzers, including manganese containing compounds applied onto mineral sorbents. Anothher disadvantage relates to tearing the sorbent with time and subsequent manganese carrying into the treated water and desactivation of the granulated catalyzer surface by the layer of iron hydroxide. Recovery of the filter is still a complicated technical problem.

The purpose of this work was to develop an iron removal method that could combine the efficiency of the conventional aeration with high speed catalytic oxidation and efficient sorption of iron hydroxide.

The method has been developed for applying a catalyzer on the surface of the mineral sorbent to ensure high bonding strength. This enables to decrease carrying the catalyzer into the treated water.

To increase the efficiency of iron hydroxide removal from water formed in the course of aeration, a special optimal natural mineral sorbent has been selected (usually sand filters are used).

Based on these results, the plant for catalytic defferization of water has been developed that contains the following units:

- a bubbling chamber with two false bottoms and fine-dispersed catalyzer between them. The upper bottom prevents from carrying away the catalyzer and the lower one enables to supply dispersed air;
- a filter containing mineral sorbent to create the condition of additional efficient oxidation and retention of the newly formed iron oxide (III);
- pumping compressor to supply the air into the bubbling chamber.

The plant operates as follows. The water to be treated is supplied into the bubbling chamber and then goes to the absorbing filter by gravity through the upper drain plug. In the meantime the air is pumped into the chamber. After the air and water mass exchange has taken place, the air releases through a special pipe (nozzle). The water containing iron hydroxide in a solid phase is supplied into the absorbing filter. The filter is cone-shaped to ensure dense packing and increase the retention ability of the filter. After the filter capacity has been exhausted, the recovery with air-water mixture in a counter-flow mode is a proper procedure to be applied. The accumulated solid phase is separated and discharged. Then the cycle is repeated.

The figure shows the comparison of the experimental results under different laboratory conditions of deferrization. Curves 1 and 2 give the change of Fe^{2+} concentration at the outlet of the bubbling chamber (static aeration); curve 3 shows additional adsorption filtering of the water after bubbling procedure has been completed. Deferrization conditions include 17.5 m/h air supply and 4 g catalyzer loading per liter of the treated water.

Based on the developed method of deferrization, the Karpov Institute of Physical Chemistry has designed a pilot plant of 25 l/h efficiency. A package of design documentation has been worked out for a commercial plant of 15 m^3/h efficiency.

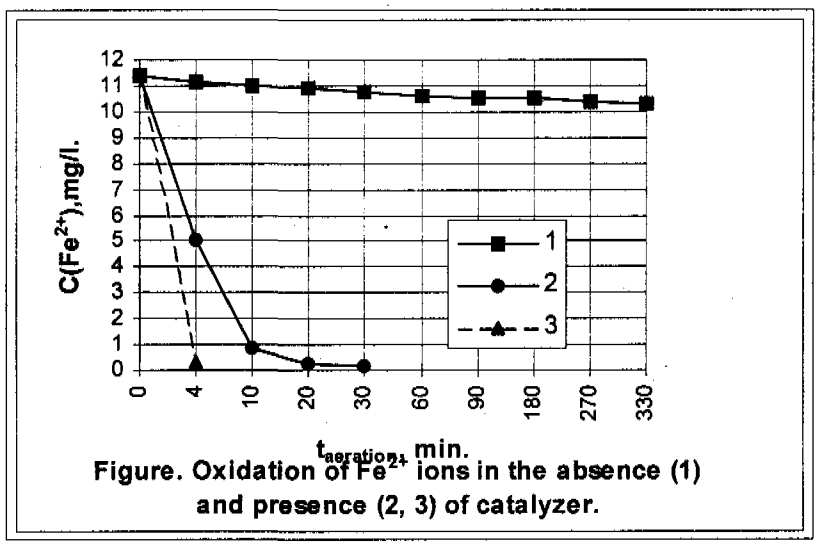

Figure. Oxidation of Fe^{2+} ions in the absence (1) and presence (2, 3) of catalyzer.

ELECTRODYNAMIC CONDITIONS OF MASS TRANSFER IN ELECTRODIALYSIS CELL

Khanmamedov M. A.

Scientific and Technical Department of Ministry of Land Reclamation and Water Management of Turkmenistan, Turkmenistan

Simplified mathematical model of electrodynamic conditions of mass transfer in electrodialysis cell that allows to calculate major parameters for optimum work organization of electrodialysis apparatus (EDA) is presented in report (1).

Here the following parameters U_c, i, L are presented as functions of dimensionless concentrations X and Y.

I proved that these parameters can be only presented as functions derived from Y. As a result, more simplified formulas can be obtained:

$$U_c = 2\frac{RT}{F}\ln\left[\frac{f(Y)}{\beta}\right] + i\left\{\frac{\rho}{C_\partial}\left[1+\frac{1}{f(Y)}\right]+\kappa\right\} \quad (1)$$

$$i = \left| \frac{C_s Y \left\{ U_c - 2\frac{RT}{F} \ln\left[\frac{f(Y)}{\beta}\right]\right\}}{\rho\left[1+\frac{1}{f(Y)}\right] + \kappa C_s Y} \right| \quad (2)$$

$$L = -\frac{FVd_\partial}{\eta} \int_{Y_1}^{Y_2} \frac{\rho\left[1+\frac{1}{f(Y)}\right] + \kappa C_s Y}{U_c - 2\left(\frac{RT}{F}\right)\ln\left[\frac{f(Y)}{\beta}\right]} \cdot \frac{dY}{Y} \quad (3)$$

With regard to (2) formula, mean value of current density when Y varies over Y_s to Y_f range can be described by the following formula:

$$i_{mean} = \frac{1}{Y_f - Y_s} \int_{Y_s}^{Y_f} \frac{C_s Y \left\{ U_c - 2\frac{RT}{F} \ln\left[\frac{f(Y)}{\beta}\right]\right\}}{\rho\left[1+\frac{1}{f(Y)}\right] + \kappa C_s Y} dY \quad (4)$$

In the first approximation the following simplified formula can be used instead of (4) formula:

$$i_{mean} \approx \frac{C_s \bar{Y} \left\{ U_c - 2\frac{RT}{F} \ln\left[\frac{f(\bar{Y})}{\beta}\right]\right\}}{\rho\left[1+\frac{1}{f(\bar{Y})}\right] + \kappa C_s \bar{Y}}$$

when $\bar{Y} = \left(\frac{1}{2}\right)\left(Y_s + Y_f\right)$; $\rho = \left(\frac{\delta_M}{\chi}\right) + \left(\frac{d_\partial}{a}\right)$;

$$f(Y) = \left(\frac{1}{Y^2}\right)\left[\left(1+\beta\right) - \left(1-\beta^2\right)Y - \beta^2 Y^2\right];$$

$\beta = \frac{d_p}{d_\partial}$; F - Faraday constant.

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ANALITICAL INVESTIGATION OF DESALINIZATION PROCESS IN SOLAR DIRECT-FLOW ELECTRODIALILYSIS APPARATUS (EDA)

Khanmamedov M.A., Novruzkhanov A.R.
Scientific & Technical Department Of Ministry Of Land Reclamation & Water Managenent Of Turkmenistan, Turkmenistan

On the basis of some assumptions we have made a simplified mathematical model that describes changes of salt eliminated solution along desalinization route. In this case it is supposed that working density in apparatus varies according to the law of change of solar radiation density during the clear day of the locality. At the same time its maximum value does not exceed depolarizational limitation. It can be presented as linear differential equation in partial derivatives:

$$\frac{\partial C\ (x,t)}{\partial t} + V\ \frac{\partial C\ (x,t)}{\partial x} = J\ (x,t) \quad (1)$$

with starting and boundary conditions:

$$\left.\begin{array}{l} \text{when } t = 0,\ C(x,0) = C_i,\ 0 \le x \le L \\ \text{when } x = 0,\ C(0,t) = C_i,\ 0 \le t \le \infty \end{array}\right\} \quad (2)$$

It is necessary to find the solution of equation (1) in D zone meeting conditions (2).

X=vt characteristic devides D zone into two subzones:

$$D_1 = D \cap \left\{ t < \frac{x}{v} \right\} \quad (3)$$

$$D_2 = D \cap \left\{ t > \frac{x}{v} \right\} \quad (4)$$

We have found solution for equation (1) in D_1 zone and D_2 zone separately and then they «were glued». So it is established that function:

$$C(x,t) = \begin{cases} \varphi(x - vt) + \frac{1}{v} \int\limits_{(x-vt)}^{x} J\left[\eta, (t - \frac{x}{v}) + \frac{\eta}{v}\right] \partial\eta & (5) \\ \psi(t - \frac{x}{v}) + \frac{1}{v} \int\limits_{0}^{x} J\left[\eta, (t - \frac{x}{v} + \frac{\eta}{v})\right] \partial\eta & (6) \end{cases}$$

is the solution for equation (1) with additional conditions (2) that can have a break on x=vt line.

Next it is shown that c(x,t) function that is described by equation (5) and equation (6) is the solution for problem (1) with conditions (2) in D zone if the following correlations are realized:

$\varphi(0) = \psi(0)$, (7)

$\psi'(0) + v\varphi'(0) = J(0,0)$, (8)

when v=const, $J(x,t) = -[\eta_1 i(x,t)/\delta F]$;

η_1 - current efficiency;

F - Faraday constant;

δ - membrane distance;

v - linear rate of solution flow.

JSC "SORBENT" A DEVELOPMENT OF PRODUCTION OF WATER TREATMENT CHEMICAL REAGENTS

Kharitonov V.P.

Such dmctkm as "Materials, feagmts, technologies and water- tlcatAlcnt slationg" takes a very important place ull scientific and production OAO "Sorbent".

The beginning of creation of chemical reagents manufacture was made in 1994 by pilot production of aluminium sulphate. Nowadays experts of the enterprise fly to widen the range of products used for potable water purification and also for waste water treatment.

Most of technologies, used in water-treatment plants, are based on coagulants, floculants and disinfectants which take the greatest part of tonnage and help to separate the main impurities. The base reagent for impurities coagulation is aluminium sulphate. Its production volume takes an important place in JCS "Sorbent's" activity. Today capacity of JTSC "Sorbent" let us supply all Vodokanal enterprises of the Urals with this product.

In order to improve consumer properties of the product JSC "Solbent" worked out technologies on granulated aluminium sulphate manufacture which are planned to be realized in 1998-99. Aluminium sulphate in granules doesn't slump, can be delivered packed and has a very good solubility in water during stage of solutions.

In 1996 JSC "Sorbent" together with experts of Pkrmvodokanal, hymenergo worked • out composite coagulant-Oocculant of SA-3N-600 type (based on aluminium sulphate and polyaclylamide), which makes the process of purification easier and promotes efficiency on stations which don't have separate units for preparation of flocculant solution. Composite coagulant-flocculant passed industrial tests on one of Pconcncrgo thermoelectric plants and had good results. Nowadays pilot batches of this product are delivering to consumers for tests.

Since 1994-95 some of water-treatment plants of Russia have began to use polyaluminium chloride for coagulation as a more effective reagent, especially for water with low temperature and alkalinity.

Together with Pkrmvodokanal in 1995 JSC «Sorbent» accomplished laboratory tests of polyalutnuuufn chlonde salnplcs, and in 1996 with support of (city administration it put into operation polyalutninilhn chloride production line. Production tests of this coagulant began in fovjmnnber 1996 in Ptnnvoiokanal. In order to tnake reserve of polyaluminium chloride in small, distant water-treatment plants it is planned in 1997 to put into operation pilot production of dory polyaluminium chloride and later composite coagulant on its base. Season instability of water alkalinity influences on effectiveness of impurities coagulation, so it is need to correct water alkality by caustic soda or lime. For this purpose it is suitable to use alkaline coagulants based on alhninates. Irheir 1"! help to stabilizate pH factor in puf?

lwater vyith consumption 0,5-2,0 mg/l, and to intensify coagulation process. The Orst samnplcs of liquid alkaline coagulant based on alulninates nere sent to Vodokanal for tests.

Based on the results of analysis of nomenclature and quality of Russian flocculants thole was walked out production strategy of flocculants of polyampholytes type with "Kama" name. This type of flocculants is polyfunctional and combines cation and amen active groups.

Labolatoly tests of Oocculant "Kama", produced by JSC "Sorbent", were made by Pcrmvodokanal and also other enterprises of P6rm lepon and were a success. In 1996 JSC "Sorbent" began to develop industrial technologies and to manufacture large batches of Oocculant for industrial tests on waste and industrial water treatment.

Flocculants of "Kama" type, in comparison with polyaclylamide chemicals, have a vely good water soluability and help to quicken process of Ojocculation to 2-5 minutes, even in water with temperature near 0*C. They make dose of flocculant 20% less with low content of impuntics after coagulation. In 1998 JSC! "Sorbent" is going to put into operation experimental and industrial manufacture of occulant.

Experts of JSC* "Sorbent" sec the tnain task 1]% supplying 'of' V()dokanal cntelpnses wfith high quality chelnmcal leagents for water purification which can compete with other world analopes.

ON THE NECESSITY OF ACCOUNTING OF WATER SECONDARY CONTAMINATION AT THE WATER TREATMENT PROCESSES

Kholodkevitch S. V., Viktorovskii I. V., Zyuzin I. A.
Saint-Petersburg Scientific Research Center for Ecological Safety, Russian Academy of Sciences

Water disinfection at one or two technological stages of water treatment is carried on essentially at all the water supply stations from the beginning of XXth century.

The main purpose of the present work was revealing and identification (screening) of organic water pollutants - pollutants (OWP) of water, which do not belong to HCS (Halogen Contained Substances)and are generated as a result of water treatment according to the technological schemes based on the complex usage of both ozone and chlorine as oxidants.

Water of Neva river and river Suda (town Tcherepovetz) was used as initial. Samples have been made taking into account climatic differences, i.e. in May, February and September. Water treatment was performed on the complex laboratory installation, which allows to model technological stages of water treatment in dynamic mode in accordance to the following technological schemes.

1. Preliminary chlorination (both with preammoniation and without it),

2. Reagent treatment (with aluminum sulfate as a coagulant),

3. Sedimentation and filtration.

In the present paper results of research of water samples taken and treated in compliance with above-mentioned technological schemes with the regard to seasonal fluctuations of water quality indices are represented.

Data on chemical analysis of six groups of water samples were processed. For each group analysis of initial water taken directly from water intake and analyses of water samples obtained by the treatment of initial water with different methods were performed.

Selection of optimum dose of coagulant was done on the basis of results of a test coagulation. Doses of chlorine were chosen on the basis of results of test chlorination in the event that water quality matches GOST 2874-82 -Drinking water- by the index -Residual chlorine. Besides, water treatment methods and regimes were chosen in such a way that water in respect to HCS content meets requirements and standards of World Health Organization(WHO). Screening of OWP in investigated water samples was performed in the following manner:

a) sample preparation consisting in concentration of OWP from water;

b) gas-chromatographic (GC) and chromate-mass-spectrometric (GC-MS) analysis of obtained concentrates.

There was used the scheme of sample preparation, employed by the Environment Protecting Agency of USA (EPA, method 625).

Chromate-mass-spectrometric (GC-MS) analysis was performed on the GC-MSpectrometer QP-5000(Shimadzu, Japan).The process was done in the capillary tube 60meters long, and 0.25 mm in diameter. Gas - helium.

Component identification was performed by means of a computer library search within -Willey- mass-spectra library. Quantitative analysis was done by the method of internal standard.

More than 100 organic water pollutants (OWP) have been identified. As investigation showed, during water treatment procedures concentration of different OWP can changed, both decreased and increased. In addition, new type OWP, not typical for initial river water, can be produced.

This unexpected at first glance effects can be easily explained. Natural waters usually contain an abundant amount of OWP of biogenic and technogenic origin. Concentration of these compounds might be significantly less than detected thresholds for the most up-to-date analytical techniques. During water disinfection with chlorine and ozone as oxidants, a portion of these compounds are inevitably utilized by OWP oxidation. In response to this oxidation, OWP are increasingly -simplified- - transforming into a more narrow group of similar compounds. These compounds appeared to be detectable in concentrations close to the Margin Limited Concentrations or even higher. Unsatisfactory quality of all water samples in respect to integral OWP pollution index is observed when almost all water quality indices traditionally controlled at the water

supply stations meet the requirements of GOST 2874-84 - Drinking Water-.

Taken together these facts led to a conclusion that during water chlorination it is necessary to provide a control over not only HCS but over OWP which do not contain chlorine atoms as well. Moreover, possibility of OWP appearance should be taken into consideration when choosing doses of oxidants for water disinfection. Acids, phthalates, aldehydes, and ketones - these four groups of compounds are the main which effects the water quality over disinfection procedure and oxidative treatment. Moreover, concentration of these substances use to increase when active chlorine and ozone are used in doses usual for surface waters disinfection. This demonstrates the necessity to introduce these four discussed groups of compounds in the list of substances tested and controlled over water treatment procedures.

COMPACT WATER-PIPE UNITS IN THE SYSTEMS OF AGRICULTURAL WATER-SUPPLY

Khoruzhxi P.D., Muromtsev; L.N., Khomutetskaja T.P., PetrenkoT.A., Charnyj D.V.
Institute Of Hydrotechnics and Reclamation of The Ukrainian Academy of Agricultural Sciences

The most important requirements that can be placed upon the systems of agricultural water-supply are: maximum use of industrial elements and units of industrial manufacture, simplicity and reliability in operation, the possibility for mechanization and automatization.

The technological diagrams of agricultural water-pipings and compact units of industrial manufacture, allowing to provide the reliable water- supply of good quality to the agricultural population and enterprises of agroindustrial complex at reasonable costs for the construction and exploitation of water-supply installations.

In central, western and northern regions of Ukraine the local agricultural water-pipes are constructing with the use of underground waters bearing the enhanced content of ferrum and in southern, eastern regions a group water-pipes are applied which are based on the use of surface waters bearing great deal of different admixtures not easily removing by classical methods of cleaning.

The tower water ferrum-removing units were offered for the ferrum removing from the underground waters.

The tower water ferrum removing units would may be assembled inside the trunk of Rozhnovski tower or any other without-pressure installation (pipe) with diameter from Im to 3.2m and height no less than 6m. It's productivity is from 200m to 500m per day.

The next operations are carried out when removing the ferrum from water in TWR units: simplified aeration, contact coagulation and filtration through die floating load. The unit is built up from the next principal elements: aerator, contact and whitening filters, upper, middle and lower drainage-distributive systems, pipe-lines for the delivery of initial water, the drainage of clean and discharge of washing water.

This unit is protected by the patent of the Ukraine and Russian Federation and offers the following advantages over the known constructions:

- simplicity in production and maintenance,
- at a reasonable cost,
- free from washing pumps (the washing is carried out by the initial water),
- a short time for washing and less consumption of washing water,
- a high filter's mud-capacity and high duration of filter-cycle (up to 7 days),
- the lack of progressive colmation off filterable load,
- reliability of securing-distributing systems which provide the durability of the unit.
- Such units are constructed and has been in successful operation in villages of Kievan region.

The compact water ferrum-removing (CWR.) units are assembled inside of the premises where the pumps, bacterial units and the units for regulating of water volume arc placed. The unite includes: ejector, air- separator, contact penopolystirol-ceolite filter, securing-distributing system, low drainage, and die pipe-line system with controllable apparatus. Such units were constructed on the enterprises specialised in processing of agricultural products in Kievan region. These units offer the following advantages: a high effectiveness of cleaning, a reasonable cost and simplicity in operation.

The watershed-cleaning constructions detaining the young fishes and suspended particles presented immediately in water-source were worked out for die preliminary water cleaning from surface water-sources as well for providing the reliable fish-protection in the drip irrigation systems and for the agricultural water-supply. They are or waterside, river-bed either floating types. The operation of the constructions is based on the filtration of fee water from fee bottom to top through the light floating load to the limiting amount of pressure losses in the systems being regulated by vacuummeter. The washing of the load is carried out by the reverse water current.

A deep cleaning of surface waters in local systems of agricultural water supply is advantageous to carry out on two-step penopolystirol-sandy pressure filters. Such filters are produced in industrial situations and are assembled on water-cleaning station with capacity to 500m per day.

Filters are consisted of such major elements: cylindrical body drainage from assembled polymerconcrete of the I-st and 2-nd level differ from each other by the filtering load, the place of drainage accommodation and the direction of water flow. Such type of station was constructed in the village Primorskoje of Kiliyski district, Odesskaja region. This technology offers the following advantages: easiness in assembling and mounting, simplicity in operation, flexibility of technological scheme allowing to work in reagent and non-reagent technological regimens depending on the quality of initial water.

THE PRINCIPLES FOR THE CALCULATION OF THE CRITERIA OF SPECIFIC WATER CONSUMPTION OF THE CITY

Khramenkov S. V., Petchnikov V. G., Palgounov N. V.
MOSVODOKANALNIIPROJECT Moscow Institute for Water & Wastewater Research & Design, Moscow, Russia

The evaluation and the calculation of specific water consumption of the units included into a water supply centralized system should be based on the fact that the specific indices values depend largely on the water consumption structure by categories as well as on the demographic structure of the water consumers.

Various combinations of these factors make the specific water consumption range extremely broad.

For instance, a selective analysis of specific water consumption for the Russian water supply centralized systems revealed that they fluctuate within the range of 90 - 1200 l per capita per day.

This broad range of fluctuations makes the notion of "the average specific water consumption" meaningless; one has to carry out the zoning of the level of specific water consumption according to the climatic zones, the zones of different levels of water resources provision, the level of comforts and the equipping with services and utilities.

It is necessary to take into account the design features of the water supply and disposal systems for the evaluation of specific water consumption levels for various cities and other inhabited localities. For instance, the water consumption of an inhabited locality differs greatly in case of hot water supply availability or absence within the water supply system; the wastewater disposal system availability or lack, etc.

The analysis of the experimental data obtained from a number of units of the available housing of the City of Moscow reveals the fact that the factual average water consumption is within the range of 120 - 900 l per capita per day.

Apart from that, for the calculation of the specific water consumption it is necessary to take into account the fact that the water supply to a city is carried out to satisfy the needs of the population not only when the citizens are present in their dwellings but also during the periods when they use the services of the public utilities sector as well as during their presence at the enterprises and in administrative buildings.

In this case the demographic indices of the water consumers structure for every water consumption category is of great importance.

It is known that the water consumption structure by categories in Russia may vary considerably but in general it is within the following ranges: the population (of the first category) consumes 55 - 75 % of the water supplied (the first category including public utilities) and the industrial enterprises consume 10 - 20 % and 10 -25 % correspondingly.

It should be also taken into account that large and medium size cities are characterized by a large number of visitors who stay in a city temporarily (students, migration streams, hostels, hotels, etc.). As a rule some categories of the water consumers are not taken into account during the calculation of specific water consumption. The distortion of the calculation results is caused also by the fact that in some concealed form the values of specific water consumption include the water consumed for the process needs of the Water Supply and Wastewater Disposal Administrations which carry out the water supply networks operation (emergency repair operations, fire extinguishing, leakages corresponding to norm); these needs require at least some 15 - 20 % of the water supplied to a city. Apart from that, to evaluate the specific water consumption values it is necessary to take into account the water consumed for the needs of industrial enterprises and the water consumers establishments which have nothing to do with the satisfaction of the vital needs of the urban population.

The separation of the above-mentioned consumption characteristics from the total city water supply provides the possibility to carry out the specific water consumption calculations more accurately.

It is necessary to carry out the calculation of specific water consumption for the City of Moscow taking into account the existing water supply and distribution structure according to water consumers, the structure and the composition of the water consumers categories, the demographic structure of the water consumers. This approach may be used as a model one for the various administrative districts of the City of Moscow as well as for the other cities, since the general principles of water supply, control, payment and specific indices calculation are identical for large urban agglomerations.

Some conventional nature of the water consumers distribution into various categories is a specific peculiarity of water distribution according to various groups of consumers practiced in the City of Moscow. Thus for detailed analysis of the structure of the water consumption by every category within the total amount of water supplied for its needs, the amounts of water supplied to the consumers that do not correspond to the definition of this category are recorded. Thus the water supply to the population referred to the first category includes the water supply to a number of users of the public utilities sector and the industrial sector; a number of the users of the third category according to their functional purpose correspond to the nature of the communal servicing of the population.

This structure of the every category is expedient and provides sufficient optimization of the entire city's interests as well as the interests of the enterprises producing potable water from the point of view of needs of distribution, registration, tariffication and the social status of the users (enterprises and organizations supported by funds from the state budget, self-supporting, private, state-owned enterprises and organizations, etc.); nevertheless in case of the calculation of the factual values of the water consumption specific indices this fact requires more detailed studying as well as taking into account the role of the each factor in the development of the water consumption criterial basis for a city.

THE SCIENTIFIC PRINCIPLES OF THE ECOLOGICAL SITUATION CONTROL UNDER CORROSION OF HEAT POWER INDUSTRIES EQUIPMENT KALUZHINA

Kobanenko I.V.,Nafikova N.U.,Sanina M.Yu.
Voronezh State University, Voronezh, Russia

The corrosion of the heat power industries equipment,where water use is very large,increases not only ecological pollutions scales, but aggressivity of heat-transfer agent itself.Obviously, elaboration of scientific principles of the control for corrosion process and the real ecological situation should be based on knowledge of corrosion mechanism under exploiting conditions.In the present work this problem decides for example of iron's and copper's corrosion (basic components of the heat power industries equipment's constructional materials) in carbonate waters with different mineralization degree.

Complex investigations were carried out on original experimental models (with nonisothermal flat plate and rotating disc heat-transferring electrode).These researches have shown that the purposeful influence on the nature and intensity of the metal damage and, consequently, on the ecological situation is possible with the aid of regulation of the thermal regime (the temperature, tangential and normal temperature gradient) and of the carbonate water's mineralization degree.

The occurence of the tangential temperature gradient causes additional losses of iron and increases the local character of distruction due to thermogalvanic corrosion. The variation of sodium hydrocarbonate concentration in water changes zone of preferential corrosion: at C<0,05mpl it is the most cold area of metal surface, at C>0,10mpl-the most heated area.The change of anode and cathode zones location the nonisothermal system supposes it's total protection from thermogalvanic corrosion in water contaning 0,07mpl sodium hydrocarbonate.

These data correlate with the results of the investigation of iron corrosion under conditions of heat-transfer from solid phase to liqued (the normal temperature gradient).According to the latter the concentration of sodium hydrocarbonate solution 0,07mpl is boundary.Iron is actively dissolved under the room temperature in waters with low mineralization degree, but the transition to the severe thermal regime is sharply damped the process up to transfer the metal to the stable passive state.At concentration of sodium hydrocarbonate above 0,07mpl iron is founded in passive state, the temperature increase causes the partial activation of the metal surface, and heat flux, on the contrary, stabilizes the metal.

The opposite effect is observed on copper in analogical conditions, but the concentration of sodium hydrocarbonate 0,07mpl is defined the transition from one type of distruction to another.Under the room temperature at C<0,07mpl copper is subjected to the local corrosion, and at C>0,07mpl metal is founded in passive state.The temperature and heat-transfer increases in waters with low mineralization degree parallely intensifies the metal surface's local activation and repassivation of pits.At the same time on the thermoequilibrium electrode predominates the latter process and on the heat-transferring electrode majorizes the first process .In waters with the elevated mineralization degree the stability of the passive state of copper is raised with the temperature increase but it is indifferent to the heat flux.

From the results of this investigation the conception of the mechanism of corrosion process on the nonisothermal systems is made.The scientific principles of corrosion protection and the control of the ecological situation in materials for heat power industries eguipment from alloys on the iron and copper base (cooled by the mild water)is recommended.

CALIBRATED MODEL OF WATER DISTRIBUTION NETWORK AND OPTIMIZATION OF PUMPING STATION OPERATION IN THE CONDITIONS OF SUBSTANTIAL DECREASE OF WATER CONSUMPTION

Koppel T., Karu J.
Tallinn Technical University, Tallinn, Estonia

To improve water supply in Estonian towns and settlements many projects have been started in the recent years in Estonia. These projects addressing problems in two main areas:

The first is the deterioration of water quality caused by a longer stay of water in the distribution network due to a radical decrease of water consumption. For example, Tallinn to-day consumes 100 000 cubic meters of water which is half as much as in 1987. The lower volume has also caused water velocity in the ducts and pipes to fall considerably below the economically optimal delivery velocity.

The second problem area is the loss of water because of leakage, which in some areas of Tallinn can reach over 50 percent. This is caused mostly by substandard quality of networks built in the seventies and eighties.

Network optimisation goals are: energy efficient operation, reduced water losses, optimal distribution of water pressure and minimised duration of stay of water in the pipes. This is accomplished by adjusting pump speed (VFD pumps) and on-off times, and by making measurements of water quality at different points of the network. Pressures and consumption are also measured and calculated length of stay related to the water quality measurements obtained. The result is an indication of which sections need repair or replacement.

Computer simulation of water quality changes in distribution networks by a mathematical model is becoming

increasingly popular in the world. It has been found that pumping station optimisation can affect water quality. For meaningful analysis, the mathematical model in the computer needs to be calibrated by the actual measurements of water consumption and pressures in the distribution network. Actual friction factor of the ducts and pipes is also an important factor. In Estonia, experience has shown that the pipe friction factors are considerably bigger than the published values in the special literature on the subject.

A calibrated model has been framed for water network at Lasnamде quarter in Tallinn. The expected pressure loss in the pipes has been calculated by Hazen-Williams formula.

By using calibrated model of water distribution network is possible to fix optimal operating regime for the pumping stations with variable speed pumps, to estimate water distribution network areas with big water losses, and to locate dictating pressure points for network. On the basis of the model is possible to get necessary information for rehabilitation of the network pipes, considering water quality deterioration in distribution network as well.

ON THE BYPASS WATER SUPPLY FOR PERRN URBAN INDUSTRIAL CONGLOMERATION

Kostarev V.P.
"MAngAam"
Aristoy E.A.
'Waro"

One of the most important federal tasks consists of supplying the population of Russia with good drinking water, especially on the territories of urban industrial agglomerations, which are still sufrering itom strong technogenic pressure despite the considerable reduction of industrial output. According to state statistic reports of 1995, the amount of analyzed samples from communal water supply net, that failed to satisfy the norms of COST 2874-82 standard, reached 28,7 «/o by chemical criteria and 11 '/4 by biological ones. It must be taken into consideration that the quality control system is far from ideal, and the measured criteria do not always conform with international norms (demands of World Health Organization, 1993 in particular).

The centralized water supply of the city of Perm is implemented by the transportation and adequate treatment of surface water from Kama and Chusovaya rivers with the total specific consumption above 310 liters per day per person. But the sources of water supply often fail to conform by some chemical, hydrobiological and microbiological criteria the demands that are established for water sources of Class 3 (COST 2761-84). The existing water intake with two-stage treatment systems do not provide complete purification of such water. According to laboratory data of 1996, 32,8 'Xi of water samples did not meet the chemical acceptance criteria of GOST 2874-82, and over 3 «/o did not meet the microbiological criteria. Some weeks saw bad samples over 50 % of total (data of the Expert Committee of Perm City Administration).

In the aim to improve the situation «Pure Water» Program was developed, based upon the process layout of «New Chusovaya» project, which, in turn, was developed by the Janko-Lisyak Orm, Yugoslavia, taking into account the range of modern coagulants and flocculants produced by Perm enterprises. But the implementation of the program demands significant expenses and time. Besides, it does not guarantee the necessary quality of water aAer possible accidental pollution of the main sources of water—chief waterways of the Urals. We need a more reliable bypass source of water supply, which in some cases can be found in the underground waters. They are quite actively used by Perm enterprises, in spite of insufOcient hydrogeological study of the territory of the urban industry agglomeration due to the sophisticated conditions.

In accordance with the division of Perm Region into hydrogeological districts according to the water supply conditions (Shimanovsky, Shimanovskaya, 1973), the territory under c5nsideration enters the Sheshminsky terrigenous water-bearing complex, Kama hydrogeological region of fracture-ground and fracture-stratal waters of lens-shaped reservoirs. The main specific features of the water-bearing. complex are lithologic-fades instability, irregular and mostly insufficient water content and permeability, gypsum content, and change of water mineltalization not only within the depth, especially below erosion down-cutting, but laterally.

In spite of absence of reliable water-bearing horizons, that may be prospective for centralized water supply of the one-million-inhabited city by underground waters of Sheshminsky deposits, some districts contain enough (due to demand) watery and protected from pollution by clay strata of aeration zone, it is possible to provide the water supply of several objects. The analysis of materials under consideration proves it.

Over fiAy enterprises and organizations of the city are known that use underground waters. But, until now, just a few of them have got a license to use underground resources. The data of underground waters are not classified, the environmental control is weak.

Nevertheless, the data of hydrochemical research for Perm Underground Line in 1980s (Kostarev ef at 1982, 1984, 1986) and data of underground waters depletion monitoring of 1990s (Ikonnikov ef at. 1996) witness of quite acceptable macrocomponent, chemical and bacteriological composition (in accordance with the criteria of COST 2874-82 and SNIP 2.1.4.554-96) and of total hardness of water at several territories outside the zone of intensive industrial pollution. The yields of 'conditional' wells and springs are usually about 50-200 m* per day.

In connection with the change of general layout of the city (that is it re-orientation to few- storeyed and individual

building) and widening the borders of the agglomeration, the necessity of classification for the materials of the existing sources of non-centralized water supply and the study of the underground waters of the territory gains ever greater importance. The areas to the west and to the south from the city border are the most prospective. Regular testing (chemical and bacteriological), reliable isolation of Quaternary deposits, and prolonged experimental and experimentally exploiting outpumping are necessary during the drilling of prospecting boreholes.

NEW GENERATION OF INDUSTRIAL ULTRAVIOLET STERILIZERS FOR DRINKING WATER

Kostioutchenko S.V., Vasilyev S.A., Volkov S.V., Yakimenko A.V.
"LIT-Technology", Moscow, Russia

Starting from the 70-th a new tendency to decrease the use of chlorine based chemicals in the water treatment process was motivated by the growing understanding of negative influence of the chlorination byproducts on the health of the human beings. In many places it gave rise to the creation of the dechlorination stages in the waste water treatment plants and use an alternative disinfection technologies in the drinking water treatment processes. In Russia this tendency was fixed by the new sanitary regulations issued in December 97 where new more strict limitations on the content of chlorination byproducts appeared.

One of the well known alternative technologies used for the drinking water disinfection is the ultraviolet disinfection, which ensures the desired effect without any toxic byproducts. There are more than 3000 UV-disinfection stations currently working in the world water industry, the largest are capable to treat more than 1 000 000 m^3/day (Montreal - drinking water, Calgary - waste water).

Recently this technology has been developed also in Russia and is presented on the Russian market with the equipment produced by "LIT Technology" (Moscow).

Main features of the equipment produced by "LIT Technology" are:

- effective UV-dose more than 16 mW·s/cm^2, corresponding to the European standards,
- new effective low pressure mercury lamps with the lifetime exceeding 8 000 hours and intensity reduction less than 15% at the end of this period,
- low power consumption: 0.012 kW·h/m^3,
- simple and effective system of cleaning the quartz sleeves,
- disinfection chamber made of stainless steel,
- automatic system to control the disinfection efficiency including the UV-intensity sensor,
- small size and modern outlook with high reliability.
-

The full set of the drinking water UV-disinfection equipment produced by LIT Technology includes the installations with the capacity of 10, 50, 100, 150, 500 and 1000 m^3/hour.

The use of UV light for the underground water disinfection is well known and is considered to be the simplest and most effective because of the very high transparency and low microbal contamination of this water. However, recently appeared new industrial UV-disinfection stations produced by LIT Technology where UV light is used as a part of the surface water treatment process instead of the primary chlorination. This way the risk of the formation of toxic halogenated byproducts is strongly reduced. Examples of such UV disinfection stations are working since 1997 in Tolyatti (405 000 m^3/day) and Otradny, Samara region (75 000 m^3/day). It should be noted that these stations were mounted by LIT Technology in the old existing buildings without extra construction works.

OPTIMISATION OF THE TREATMENT TECHNOLOGY WITH THE AIM AT PREDICTION OF CHLOROFORM CREATION IN DRINKING WATER

Kozhushko S.G., Sinelnik N.A.
Research and Development Institute of Municipal Facilities and Services of Ukraine (NIKTIGH)

In the treatment drinking water practice one of the main treatment methods for its stable decontamination and also for supporting of sanitary condition of portable purification facilities is the chlorination.

According to the data of domestic and foreign researchers for treatment of surface water of high doses of chlorine, the volatile halogen organic compound (VHC) is generated, which has cantherogenetic and mutagenic properties.

The Department of Water Supply of NIKTIGH has developed the method of chloroform (trichlormethane) and some another VHC testing by the gaschromatograph method with using of sorbing on the carbopack and thermodesorption. Since 1982 great amount of Water Supply Plants of Ukraine have been investigated and great statistic materials have been accumulated, which contain the information about quantity of drinking water in various cities of Ukraine, according with trigalogenmethane (TGM). It was determinate, that there is no chloroform in Dnieper river water in the water scoop, as a rule. The concentration of chloroform is not in correspondence to the standards in drinking water at the water supply plants in Ukraine with the surface sources in some seasons what is a direct result of chlorination practice.

According to the laboratory research, the creation of chloroform in the water on the Water Supply Plant is a result of preliminary and many times repeated treatment of raw water by chlorine and depends on the temperature, pH, availability of organic compound, both natural and antropogenic origin, chrominance, oxidability, total organic carbon content, ammonia, etc., and also the dose of chlorine and quality of treated water before its addition. Further more, it was showed, that natural gummous substances are the ones, which come before trigalogenmethanes. The research has arranged, that increase of the temperature of Dnieper water activates the process of adding radical of chlorine and creation of chloroform, especially with the temperature of water more than 10 °C. Increase of treated water pH is caused by increase of the chloroform concentration with the same chlorine dose. At pH 5,9 the concentration of chloroform is increased approximately two times in comparison with the concentration at pH 3,7, at pH 8,2 — increased to 7 times, and at pH 9,9 — to 10 times. The chlorminance of raw water is the indicator of chloroform generated quantity during of water treatment. On the process of chloroform formation also the oxidability permanganate of influent water influences. The increase of this unit to 2,5 times to 6,0 mogul/dm^3 increases chloroform concentration to 2-3 times. Availability of ammonium salts more than 0,5 mg/dm^3 in treated water is blockaded of high chloroform concentration formed for chlorination as a result of chemical reaction. Main reaction of nitrogen-chlorine influences on reaction of chlorine breaking with formed oxidised and chlorinated offside products.

But, the main factor in the formed chloroform process under water treatment on water supply plant from the surface resources is a result of using preliminary chlorination and high chlorine doses. The concentration of VHC is depended on applying chlorine dose and adding place of it, under the constant quality descriptions. The main part of concentration is formed at the moment of water treatment by chloride and for existing of free chloride continue until the concentration of chloride or admixtures is not exhausted. Therefore, the chloride concentration is drinking water continue to increase for flowing water through the distributive system. For second chlorination of treated water by chloride the chloroform content is increased proportional.

The application of ozone as an oxidiser is not challenged of creation of TGM in treated water. However, addition of ozone in chlorinated water activates the processes of decarboxylization of acid with introduced into carbonhydrogen radical of chloride atoms in consequence that the chloroform concentration in chlorination ozonization water increases. For jointly using of ozone and chloride the ozonisation must be precede of chlorination, because of ozone is subjecting of degradation of organic pollutants, is decreased of it ability to interaction with the chloride, preventing of TGM formation. The application of ozone on the first stage of surface water treatment with the following complete clarification and chrominance of it at the technological facilities, is allowing decreased the formation TGM level in treated drinking water for it chlorination small doses (1,0 - 1,5 mg/dm^3) on the finish stage of water treatment, before it coming into the distributive system. The same action of kalia permanganate has. With accounting of more high demands to the drinking water quality it is reasonable to provide preliminary treatment of water for removal f organic and other pollutants at the water supple plants.

The employment of dioxide chloride with following chlorination before it coming into the distribute systems provided more less chloride concentrations, instead of the same quantity of only chloride.

WAYS OF MUNICIPAL WATER TREATMENT PLANTS PERFORMANCE INTENSIFICATION

Kozhushko S.G.
Research and Development Institute of Municipal Facilities and Services of Ukraine (NIKTIGH)

As the practice showed the most reliable surface waters treatment technology is the classical double-stage scheme with application of reagent treatment methods by means of coagulants, oxidants, flocculates and sorbents.

By reason of the centralized water supply sources progressive contamination caused by the antropogenic influence, the considerable attention is paid to the protection of water storage basins and rivers from their pollution, the stiffening of requirements to the water quality in centralized water supply points, increasement of water treatment plants efficiency in order to guarantee the normative potable water quality.

Actually, the operating water treatment plants in the whole are constructed according to SNiPs II 31-74, 2.02.02-84 "Water Supply. External Networks and Constructions". They can't be considered as the real obstacle for some substances and micro-organisms which penetrate to the water sources.

Lately the water supply systems intensification was being performed in order to increase their capacity, to improve bacteriological and organoleptical water quality indexes. As the majority of water supply systems in Ukraine filters occupy the main position. In order to improve the potable water quality, firstly it's necessary to optimize the production cycle of the reagent water treatment, to decelerate the filtration speed to 5-6 m/hour in accordance with Table 21 of SNiP 2.04.02-84"Water Supply. External Networks and Constructions".

It's also necessary to improve the construction of sumps and clarifiers by means of the lamella modules installation (in various versions), to apply more efficient reagents, flocculates of native and foreign production.

The removal of toxic chlororganic compounds arising as a result of the river water preliminary chlorisation in considerable doses, containing organic contamination also consists a serious problem. It's possible to prevent their formation and to reduce their concentration by means of chlorine

doses lowering, use of ammonization, replacement of oxidant by alternative compounds (ozone, potassium permanganate, chlorine dioxide, etc.), construction of provisional treatment installations.

In order to guarantee the stable potable water quality in view of strict requirements, the performance of water intake constructions should be improved. The special attention should be paid to the tower water intake constructions at water storage basins which provide the selective level water intake depending on water quality at different levels.

The one stage water treatment schemes performing in water supply systems of some Ukrainian cities are not reliable and efficient, in particular in conditions of increasement of surface waters contamination. They don't provide the necessary contact between water and reagents.

In water supply systems of a number of Western Ukraine's cities the clarifiers with suspended sludge are not efficient. They should be reconstructed according to the NIKTIGH developments.

In order to provide the improved normative potable water quality, the choice of optimal schedule for intensification and reconstruction of river water treatment plants should be performed with consideration of working constructions composition, quality of water sources and economic resources.

It's also necessary to draw up normative acts in collaboration with operators and specialists of municipal water supply systems in view of real conditions of their execution. The criteria for definition of the centralized water supply points categories should also be reviewed in accordance to their water quality indexes.

The above mentioned questions of optimization of legislative and normative acts on potable water quality improvement will be reflected in draft of the Ukraine's Potable Water Act.

SCIENTIFIC AND PRACTICAL BACKGROUND OF WATER PREPARATION FOR FOOD PRODUCTION ON THE BASIS OF UNDERGROUND SOURCES

Krasnova T.A., Kirsanov M.P., Naidanov V.P., Samoilova N.A.
Food Technology Institute, Kemerovo, Russia

At present most food industry enterprises use tap water without any additional purification. Surface water is the main source of water supply in most large towns and settlements; its quality worsening, the existing water preparation technologies fail to purify water in compliance with world standards. The use of such water in food industry is one of the factors reducing the quality of foods. In the circumstances the use of purified underground water characterized by a high degree of protection against pollution and invariability of the composition of impurities during all the seasons will ensure the production of high quality foods.

On the whole the quality of Kusbass underground water corresponds to the existing GOST 2874-82 "Drinking water" requirements, however, in some water sources there has been noted an excess in the maximum permissible concentrations of iron and phenols.

To develop a preparation technology for water used in food industry a set of research aimed at effective removing of iron and phenols from the underground water of Kemerovo source has been conducted.

Effective iron removal has been stated to be obtained by aeration with air or oxygen. Operating conditions of iron removal from underground water have been tried out.

The possibility of sorptional removal of phenol microimpurities from purified water by carbon of different brands as well as adsorption equilibrium over a wide range of phenol concentrations under static and dynamic conditions have been studied. The main parameters of adsorption equilibrium, dynamics and kinetics allowing to choose adequate sorbents for underground water purification have been calculated. According to the data of derivatographic analysis optimum conditions for preliminary preparation of sorbents have been determined. The possibility of thermal recovery of carbon has been studied.

A pattern for preparing Kemerovo underground water to be used in food industry has been worked out; it includes the following purification stages: aeration (with oxygen or air), purification on percolating filters, sorption on carbon filters, disinfection with sodium hypochlorite.

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At present most food industry enterprises use tap water without any additional purification. Surface water is the main source of water supply in most large towns and settlements; its quality worsening, the existing water preparation technologies fail to purify water in compliance with world standards. The use of such water in food industry is one of the factors reducing the quality of foods. In the circumstances the use of purified underground water characterized by a high degree of protection against pollution and invariability of the composition of impurities

during all the seasons will ensure the production of high quality foods.

On the whole the quality of Kusbass underground water corresponds to the existing GOST 2874-82 "Drinking water" requirements, however, in some water sources there has been noted an excess in the maximum permissible concentrations of iron and phenols.

To develop a preparation technology for water used in food industry a set of research aimed at effective removing of iron and phenols from the underground water of Kemerovo source has been conducted.

Effective iron removal has been stated to be obtained by aeration with air or oxygen. Operating conditions of iron removal from underground water have been tried out.

The possibility of sorptional removal of phenol microimpurities from purified water by carbon of different brands as well as adsorption equilibrium over a wide range of phenol concentrations under static and dynamic conditions have been studied. The main parameters of adsorption equilibrium, dynamics and kinetics allowing to choose adequate sorbents for underground water purification have been calculated. According to the data of derivatographic analysis optimum conditions for preliminary preparation of sorbents have been determined. The possibility of thermal recovery of carbon has been studied.

A pattern for preparing Kemerovo underground water to be used in food industry has been worked out; it includes the following purification stages: aeration (with oxygen or air), purification on percolating filters, sorption on carbon filters, disinfection with sodium hypochlorite.

DYNAMICS OF DIOXYGEN SORPTION FROM WATER BY COPPER-BEARING REDOXITES IN FLOW SYSTEMS

Kravchenko T.A., Krisanov V.A.
Departament of Physical Chemistry, Voronezh State University, Voronezh, Russia

Theory. For the first time in our works the concept of sorption with complex chemical reaction as a process of space-time division of separate reaction steps and diffusion of sorbed substance (reagent) through a multilayer system of products has been introduced. On this basis a generalized kinetic model of sorption with space-time chemical reaction has been constructed. A numerical and, in particular cases, an analytical solution of the problem for sorbent (in the membrane, fiber or grain form) with the production of a two-layer system of products has been presented.

The presented concept of redox sorption kinetics and its mathematical models have been used as the foundation of the dynamics of redox transformations on redoxites. A certain relationship between redox sorption under dynamic conditions and the redox-reaction mechanism has been established. The form and length of a redox front, sorbate exit into filtrate depend on the relationship of the rates of redox reaction intermediate and final steps. The obtained solution most precisely describes experimental results on the most important process - reduction sorption of O_2 from water.

Experimental. The experiments were conducted on the grain copper-bearing redoxite EI-21 in the sodium form placed in a vertical cylindrical tower with $S=1.2\ cm^2$ in section and l=30 cm in height. In the tower the samplers to determine dioxygen concentration dissolved in water were arranged in every 5 cm. Water was passed through the tower from the top down with a constant linear velocity u=0.5 cm/s. At the given velocity the effect of longtitudal diffusion on the front washout is estimated to be negligible. The dioxygen concentration in the initial water was in equilibrium with its partial pressure in the gaseous phase, and it varied with room air temperature within $2.5\cdot10^{-4}$ - $3.3\cdot10^{-4}$ M.

To calculate the characteristics of the dynamics, we need to know kinetic parameters of the process. For this purpose the kinetic curves of dioxygen redoxite reduction under the specified conditions were found. The curves were obtained as the space coordinate ξ_i relationship of time of the reaction of copper oxide formation by the transformations: $Cu \rightarrow Cu_2O$, $Cu_2O \rightarrow CuO$. The kinetic parameters have been numerically found from the solution of the reverse kinetic problem.

The experimental exit curves of dioxygen reduction at layers of different height are shown. The curves are of an asymmetric form, especially under high oxidant concentrations, that agrees with the theoretical analysis.

Theory and experiment correlation. Besides the experimental data, the exit curves were worked out numerically by the model of redoxite step oxidation at constant values of dioxygen concentration at the input of the reactor $C_0=2.5\cdot10^{-4}$ M, u=0.5 cm/s, layer height l=5n cm (n=l, 2,..., 6), the fraction of the redoxite volume in the tower $\chi=0.63\pm0.01$ and the above kinetic parameters. The exit curves of deoxygenation obtained experimentally and worked out by capacity and kinetic parameters are in satisfactory agreement for all studied heights of the grain layer (5-30 cm).

The suggested theory allowed to calculate all dynamic characteristics of a redox sorption process (the form and the length of a redox front, stationary conditions) by using only capacity and kinetic data, i.e. without long and expensive experiments on towers with redoxite. At the above example the advisability of applications of the theoretical model to find the conditions of deep water deoxygenation with redox filters in open flow systems has been shown.

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PROBLEMS OF DRINKING WATER STANDARDIZATION

Kruglov N.S., L.F.Kardashina, O.M.Rosental, V.N.Sursyakov
Gosstandard of Russia, Yekaterinburg, Russia

1. Gosstandard and its subdivisions are working on the problems of supplying the populaton with high quality drinking water in conditions of total ecological crisis in the country. Continuously worsening quality of surface and underground waters and exclusion of more and more water sources from economic turnover are the most characteristic features of this crisis. The assortment of water polluting admixtures is growing. The basic funds in drinking water supplying systems are used up morally and physically. Lack of money makes it impossible to keep them in proper state or replace them in proper time. The existing normative documents do not provide a necessary protection of water objects from destructive and inexpert operation. As a result, more than 50, and in some regions even 80, per cent of Russian population drink bad quality drinking water.

2. Standardization aims at regulating hydroeconomic activity by means of establishing norms for universal use to provide access to high quality drinking water. It includes:

- works on standardization of drinking water, materials, technological processes and equipment, used in economic drinking water supply, as well as working out the state standards for bottled up drinking water, coagulants, charging filter materials etc;
- working out the instructions on inculcating existing standards such as State Standard of Russia 2874-82 "Drinking water" and State Standard 2761-84 "Sources of centralised economic drinking water supply";
- regulating the standards which determine for general use rules, characteristics, requirements and methods dealing with hydroeconomic objects.

3. Work on inculcation and improvement of certification system of hydroeconomic objects has been intensified, as it is a very effective means for achieving conformity to the established requirements of drinking water, materials, technological processes and equipment. This work aims at:

- drinking water quality indices confirmation;
- consumers' rights protection;
- environmental safety control of hydroeconomic activity.

4. There can be traced a distinct regional character of these problems. But it is not taken into proper account either in hydroeconomic practice itself, or in drinking water quality supervision in regions. The methodical base of this work has become absolutely obsolete. Gosstandard subdivisions are now working on improvement of drinking water quality assessment methods, on material resources development and personnel preparation on standardization, metrology and certification in the field of economic drinking water supply. Much attention is paid to the test laboratories system creation, to data base forming and expert systems working out.

5. The existing in Russia water-consumption management system is not able to stop growing exclusion of water objects from economic turnover. Therefore Gosstandard of Russia is now working on promoting the compulsory certification system for natural water objects and technical systems. Also the necessity of reducing the gap between the existing water-consumption system and market relations interests is taken into account.

6. Russia is lagging behind the leading foreign countries as far as scientific-methodical and normative ensuring of hydroeconomic practice is concerned. Modern foreign publications and reference books can be of great interest to the native specialists both from the point of view of forming and developing the drinking water quality indices system and from the point of view of improving the requirements to water purifying equipment, the system of water quality-control means and methods, etc. In particular, foreign specialists' suggestions on admixture classification, based on new investigations, as well as suggestions made by the European Union and the World Health Organisation present great interest for working out the drinking water quality assessment methods.To stop lagging behind Gosstandard is now working very intensively on developing the native analogues to the foreign standardization systems ISO 9000 and ISO 14000 along with developing of "State certification system".

VARIANTS OF TREATMENT OF UNDERGROUND WATERS FOR PERSPECTIVE DRINKING WATER SUPPLY OF KHABAROVSK

Kulakov V.V.
NTC Dalgéocente,r Khabarovsk, Russia
Steblevsky V.I.
Khabarovsky Gorvodokanal, Khabarovsk, Russia
Chaykovsky G.P.
DVGUPS, Khabarovsk, Russia

The circuit of water supply of Khabarovsk in the long term plans translation of drinking water supply of city from a superficial source on underground. The underground waters of a perspective deposit do not satisfy to the specifications GOST 2874-82 "Drinking water" because of the increased concentration of iron (up to 20 mg/l) and manganese (up to 2mg/l).

Under the direction of the authors with scientific and technical cooperation to the experts from Slovakia and Sweden within three years the special research and experienced works on development of technology of clearing of underground waters from iron and manganese on a

source of water supply were carried out. An opportunity treatment both on superficial structures, and on trial installations deferrization and demanganese of underground waters in aquifer experimentally was investigated. Three basic variants of the technological circuits treatment are considered:

- Clearing underground waters on filtrate superficial structures;
- One well of installation deferizzation of underground waters in aquifer with clearing of manganese on filtrate superficial structures;
- Many wells of installation deferrization and demanganese of underground waters in aquifer.

By results of researches the third variant treatment is accepted, since the ecological problems on utilization waste waters and as economically essentially preferable are removed.

CLEANING OF HEAT EXCHANGERS FROM DEPOSITS AND FOULINGS

Kucherenko A.D., Kucherenko D.I.
Moscow, Russia

The examination of heat exchangers in the recycling water supply systems of many industries has revealed that deposits and foulings of various kinds are often formed on the surfaces of heat exchangers thus sharply decreasing a heat transfer coefficient and consequently leading to some violations in the production processes, reduction of the facilities capacity and inconsistency of the output quality, and to excess consumption of raw materials and power. While for big water recycling systems having the capacity of several thousand m^3/h of recycling water different water purification methods have been developed and are being used at a wide scale to protect them from deposit and fouling formations, for a smaller systems with recycling water flow rates reaching dozens and hundreds m^3/h it does not often seem possible or economically reasonable to construct and operate water purification units. So, to eliminate continuously growing formation of the deposits and foulings in the heat exchangers of such systems another method has to be used, i.e. their periodical cleaning.

For cleaning of heat exchangers various mechanical processes are often practiced with the involvement of very labour consuming jobs on disassembly of heat exchangers and separate cleaning of each individual tube. One should also note, that mechanical methods fail to provide an effective removal of the most typical and very strong calcium carbonate deposits, especially in the heat exchangers with a sophisticated geometry of the heat exchange surfaces.

A great number of chemical treatment techniques are known using strong mineral or organic acids, chelating agents and other compounds. In general,chemical methods provide sufficiently good cleaning of heat exchangers from salt deposits, however they also have some significant disadvantages, for instance:

- many of them to some or other extent cause damage of the materials the heat exchangers are made of. As a result of several chemical cleaning procedures the heat exchangers have to be replaced;
- waste chemical solutions should be neutralized or treated down to the concentrations permissible for their discharge into the sewer;
- when using many of chemical cleaning techniques offered by both domestic and outside companies, large quantities of chemicals have to be applied, sometimes dozens and even hundreds kilos of them.

CONDIVOD has testes a method of stage-by-stage treatment of heat exchangers using the feed-back control systems which provides the process management and monitoring by the quantities of removed deposits to be estimated by the analysis of water which is recycling in the closed loop. In contrast to other known methods, this technique, on the one hand, ensures a possibility to achieve a complete treatment of the whole heat exchanger from the deposits, irrespective of its initial degree of pollution, and, on the other hand, permits to spend only such a quantity of chemical agent on cleaning one group of heat exchangers that is required for and corresponds to the quantity of the contaminants deposited.

CONDIVOD company has gained an experience in cleaning several hundreds of heat exchangers using this method. In the course of cleaning procedures some interesting characteristic features of the method were observed and the regularities typical of this particular method were found. For instance, hardness of the water which is circulating in the closed-loop system was found to grow at the very beginning of the cycle, then the growth of hardness slows down and finally stops completely. Both the hardness and the alkalinity values reach a certain steady level dependent on the initial layer of carbonates on a heat exchanger an on the dosage of chemicals applied.

As soon as the above mentioned steady state has been reached, the treatment cycle is over, the system is flushed with tap water and a new cycle starts.

Some other types of build-ups that are frequently formed in heat exchangers, for instance, drifted deposits of corosion products, some mechanical impurities and biological foulings, can be also removed by this method and installations therefor. The cleaning is ensured by a possibility of increasing the velocity of water movement inside the tubes 3-4 times as compared to the operating velocity value. A s a result of this increse the kinetic energy of the flow grows 9-16 times, accordingly, thus providing removal of the said sediments and foulings and a sharp growth of the heat transfer coefficients.

ANALISIS OF LEVELS AND CONSEQUENCES OF ANTHROPO-CAUSED BURDEN ON WATER-SUPPLY RESOURCES (EXAMPLE OF MOSCOW-RIVER)

Kusnetsov O.Yu., Venitsianov E.V.
Water Problems Institute of Russian Academy of Sciences, Moscow, Russia
Kuzmina N.P., Romanova G.I.
Mosvodocanalniiproekt, Moscow, Russia

Moscow-river is the important Moscow-city sources of technical water supply for industry and fuel and energy complex. It's share in technical water supply approximately 60% and prognosis says the level of consumption will be 2 millions m^3 daily by 2000.

Thermo-electric power stations (TES) are situated along Moscow-river and consume water, which quality directly depends on anthropo-caused influence when it passes Moscow-city. Technical and economical indexes of water softening and cleaning , processes of equipment cooling, preparation technological solutions depend on quality of fresh water and cost of water treatment proportionally related with water quality (e.g. hardness, salinity, organic matters and biogene elements). Suspended matter concentration in water which has passed Moscow-city more then that in river higher city 2-3 times. Biogen elements concentrations increase approximately 10-fold and the degree of cooling system vegetation increases too.

Sanatory-epidemical consequences of water quality microbiological indexes are very dangerous: this consequences are determined by aerosol generated by water-cooling tower. Sources of water supply pollution (viruses and pathogenic microorganisms) gets into the cooling water for regaining water lost in circle systems, and after that in concentrated form constantly gets onto nearly territory with the process of drop-blowing.

Species composition is changing: absolute and relative content of green-blue phytoplankton having more strong adhesion to heat-exchangers' surfaces than for example green one, is increasing.

Requirements for sanitary and chemical safety of technical waters are determined by system LAC for water bodies of economic water usage because of nundevelopment of other legislative acts. But exceeding of LAC (suspended matter – 20-fold, BOD – 3-4-fold) happens before river is just in town. Down the flow this indexes getting worse.

Concentration of bacteria in water in all seasons exceeded normal level 100-fold before river is just in town. Down the maximum concentration of bacteria was 2.7 million (normal level is 100). In the river lower sites of cleared water flow from the aeration stations the concentrations of bacteria was varying between 2.5-4.7 millions.

Thus, sanitary-chemical danger of heat-energy power systems of water supply also increases with approaching this objects to the lower sites of Moscow-river.

Development of different cost of water for water consumers, situated on different sites of river, is required. Also development of requirements for quality of cooling and going-through waters, making their discharge directly into river flow, is important because this so-called normatively clear waters make the main salt burden. Increasing of sanitary-epidemic safety of open cooling equipment of Moscow thermo-electric power stations using river water is also very important problem.

RECYCLING WATER SUPPLY SYSTEM FOR CAR WASHING FACILITY PREVENTING SALINITY GROWTH

Kuznetsov O.
Russian Federal State Scientific Center NII VODGEO, Russia

The installation's technological scheme and the equipment for purifying sewage water coming out of car washing facility are designed for supplying the facility with recycled water in any season. The washing mode is manual. Two versions of the scheme were developed, for winter and for summer conditions. The winter version envisages running the cars in regions where salt containing chemicals are spilled on the roads.

The principal technological scheme of purifying and recycling sewage water is shown on the Figure below:

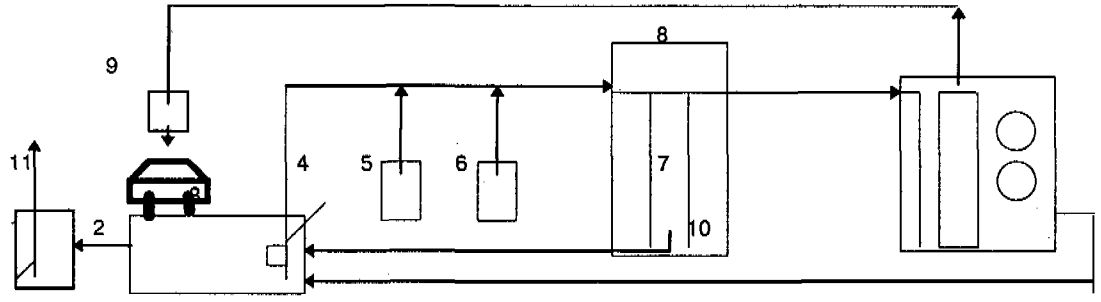

Fig.

1 - sediment tank; 2 - sewage water receiver; 3 - submersible pump; 4 - coagulant doze measurer; 5 - bactericide doze meter; 6 - compact block installation; 7 - membrane installation; 8 - purified water; 9 - high pressure purgatory; 10 - rinsing water; 11 - sediment outlet.

After washing a car, the sewage water is collected into the sewage water receiver (2), then the submersible pump (3) runs the water into the compact block installation (6). Before the purification, doze measurer (4) adds coagulant and doze measurer (5) adds bactericide chemical to the water. Purified by the block installation, the water is sent to membrane installation (7) for further and finer purification - that applies to winter season when salt containing chemicals are spilled on roads. The water so purified is then used for washing the next car. In other seasons, water is used for washing cars without additional purification. Cars are washed with water heated up to 30 ... 50 °C, high pressure purgatory (9) is used for that. The dirt detained by the block and membrane installations are carried out of the facility into the sediment tank (1) by mud carriers. Periodically the dirt is transported to utilization facilities specified by the environment protecting authorities and sanitary offices at local administration bodies. The quality of water before and after purification is shown in the Table.

Table

			Purified water	
Contaminants	Measuring unit	Dirty water		
			Summer	Winter
Suspensions	mg/l	< 2000	< 3	< 1
Petrochemicals	mg/l	< 300	< 3	~ 0.05
Salinity	mg/l	< 10000	< 1000	< 300
Coli-index	-	$< 10^6$	< 100	< 100

The compact block installation (6) assembly is a metal structure of parallelepiped shape, it sizes are 3200 by 1800 by 1800 millimeters. The installation includes sediment tank with thin layer module in the top part of it. The module's plates are situated at an angle of 60 degs with the horizon. There are also clean water tank, the pump to supply water for additional purification and for the installation's own needs, three sponge filters for secondary purification. The coagulant (4) and bactericide (5) doze measurers are standard tools operating under automatic mode. The installation occupies an area of 0.5 meter square. The dozes are calculated for constant flow, from the moment the submersible pump (3) is turned on till it is turned off. The coagulant is aluminum sulfate, the doze is 15 to 20 mg/l. The bactericide chemical is polymer Fogucid dissolvable in water, its doze is 1 mg/l. The substance is efficient when used against any Gram positive or Gram negative bacteria, fungi or weed. It is classified as moderately toxic and moderately cumulative (hazard 4^{th} class), has no latent effect on human body and provokes no allergies. Using the substance for purifying drinking water is allowed. The membrane installation (7) includes high pressure pump developing the pressure of 10 to 16 atmospheres, membrane coils in fiberglass boxes, the control panel, mechanical filter loaded with grain, washing mixture tank and rinsing pump acting periodically for removing dirt out of the membrane coils. The membrane part operates continuously round the clock. The installation is turned off automatically when there is now water consumption and starts working again once the consumption starts. The flow of sewage water with dirt to be removed is 20 to 30 percent of purified water flow. After the membrane installation, the whole sewage water flow is sent to receiver (2). Both the receiver (2) and sediment tank (1) are steel-enforced concrete reservoirs built according to the Giproavtotrans Institute standard project #TP 902249193. The high pressure purifier is a standard device too, built as an integrated wheelbarrow easy to move. Its working pressure is 105 to 135 atmospheres, the weight is 17 to 26 kg, the size is not more than 350 by 330 by 900 mm.

SWAT MODEL EVALUATION OF WATER YIELD, SEDIMENT YIELD AND NUTRIENT LOSS IN THE BLACK BROOK WATERSHEDS N.B., CANADA

Kwan-Chow Lin, Yali Yang, Joe Arbour, Tien-Lien Chow And Herb Rees
Department Of Civil Engineering University Of New Brunswick, Fredericton, N.B., Canada
Conservation & Protection IW/L, Environment Canada
Halifax. N.S. Canada
Agriculture And Agri-Food Canada. Fredericton, N.B., Canada

Potato production is one of the largest agricultural industries in the Province of New Brunswick, Canada. Intensive studies have been made on a potato belt in the 14.5 km^2 Black Brook Watershed in the Province. Excessive soil erosion in the watershed has lowered soil productivity, causing high costs of crop production and water pollution problems. The objective of this research is to study the long-term impacts of agricultural practices on water yield, sediment yield and nutrient loss in the watershed using a state-or-the-art computer model.

The PC-version of the non-point source pollution model for large ungaged basins - the Soil and Water Assessment Tool (SWAT) - developed by Arnold et al. (1995) of the United States Department of Agriculture was used in this study. It was the first time SWAT was directly applied to a watershed in Canada, and, perhaps, first in a country outside USA. Field

boundary maps, soil survey maps, contour maps and land use maps created by CARIS in DXF files were converted to MapInfo files for use in the SWAT model. The watershed was divided into 7 and 17 subbasins. Weighted averages were used for various subbasin parameters and characteristics. Weather, crop and soil databases were established in the proper input format The model was tested with field data. Statistical analyses, sensitivity analyses and various computer simulations were performed. The results are illustrated in figures and tables.

It was found that the SWAT model underestimated annual and monthly water yields and overestimated annual and monthly sediment yields and nutrient (NO_3.N and soluble P) losses in the Black Brook Watershed for the period of 1992-1994. On the whole, the simulated NO_3.N concentrations were higher in the surface runoff than in the subsurface runoff or in the percolate. The highest monthly simulated concentrations of NO_3.N and soluble P in the surface runoff and percolate occurred in early summer. The time, depth and amount of fertilizer application in the soil all had a strong influence on NO_3.N and soluble P losses in the surface runoff, subsurface run off and percolate. For good management, fertilizers should be applied after the plant canopy is established or to a deeper soil layer to reduce nutrient losses from surface runoff. However the latter practice might increase nutrient losses in the subsurface runoff and percolate. Sediment yield was found to increase in the following order of tillage practices: zero-till, spring-till and fall-till. Potato growth tended to increase sediment yield; barley growth tended to reduce sediment yield. Potato-barley rotation greatly reduced sediment yield, but slightly increased water yield compared to continuous potato growth. Surface runoff was the major pathway for NO_3.N loss at high rainfall intensities, and percolation was the major pathway for NO_3.N loss at low rainfall intensities. The annual nitrogen loss in surface runoff was nearly twice as much as that in sediment yield. However, sediment yield was found to be the major pathway for phosphorus loss.

The SWAT model has been proven to be a powerful tool for simulating long-term impacts of agricultural management practices on water quantity and quality of the watershed. However, the SWAT model cannot simulate the nutrient removal process by trees and vegetation in the riparian zones. Model calibration will improve simulation for application in Canada in view of the different climatic conditions compared to the United States where the model was developed.

SMALL WATER TREATMENT SYSTEMS USING CONVENTIONAL OR RENEWABLE ENERGY

Lamberth B.
ISET Hanau, Rodenbacher, Hanau, Germany

Introduction

Today a quarter of the world population has no drinking water which achieves the quality standards of the World Health Organisaiton (WHO). Due to the large growth of the human population the demand for drinking water is increasing. In developing countries it is often a problem to obtain the basic demand for water for domestic use and to have it in a good quality and quantity. So the mortality of babies and small children in these countries is very high because of the water problems. In Europe water shortage problems have negativ effects on the socioeconomic development of areas. Due to these reasons water treatment, water storage and water distribution and environmentally sustainable energy supplies for all these processes are very important and fields of great international interest.

complete system. One of the aims of ISET is to add all these components to an integrated system and to optimize the whole system for different kinds of usage.

There are different steps of extracting drinking water out of a groundwater or a surface water and bringing it to the consumers:

- water catchment,
- water purification,
- water storage,
- water distribution.

For the energy supply of these water treatment steps renewable energies can be used. So complete decentralized units can be realized.

Water catchment

The first step in a water supply system is the water catchment out of the wells from groundwater or a river water intake from surface waters. The pumps have to be designed depending on the depth of the well, the pumping rate and the delivery method of the water. The necessary energy for the pumps will be delivered by wind wheels or a photovoltaic system. At ISET, there are examinations being carried out at the moment to find out whether centrifugal pumps or piston pumps are better suited to this purpose. Another point of the examinations is the question whether pump arrangements in parallel are able to use the irregular energy coming from the renewables very effectively. These arrangements may even be better than battery storage systems. Figure 1 shows a pump system with energy supply by renewables.

Water purification

If any water purification (e.g. filtration for the removal of iron and manganese, membrane processes) is necessary, the pumps must be able to provide the needed pressure. Figure 2 shows a scheme for a plant to desalinate brackish water.

There are different types of membrane processes to clean water. Depending on the water treatment application (e.g. clarification, softening, removing of colour, removal of micropollutants, removal of ionic pollutants, desalination of sea and brackish water) and the concentration of the pollutants different membrane processes:

- micro, ultra and nanofiltration,
- electrodialysis,

• reverse osmosis,
• can be used.

The energy for all these treatment methods can originate from renewable sources. Some examples will be shown in the paper.

Water disinfection

Bacteria can be found in nearly every water, especially in surface waters. In the soil some millions of bacteria per mg soil will be found on the surface, some thousands of bacteria at a depth of 1 m and only some bacteria at a depth of 3 m. That is the reason why groundwater is normally a better source for drinking water than surface water.

There are different disinfection methods:
• heating,
• filtration,
• chlorination,
• ultraviolet irradiation,
• ozonation,
• silver-ion sterilisation.

In the paper an UV-system with a photovoltaic module as energy source, developed and built at the ISET will be shown (capacity 3600 l/h, costs 3.500,-- DM).

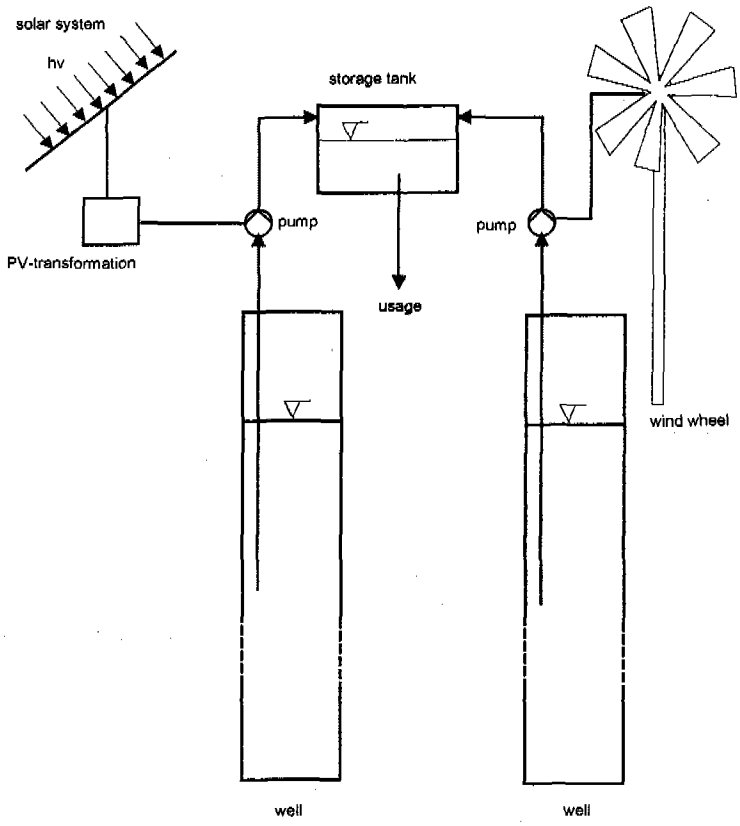

Fig. 1. Pump systems with energy supply by wind wheel and photovoltaic cells

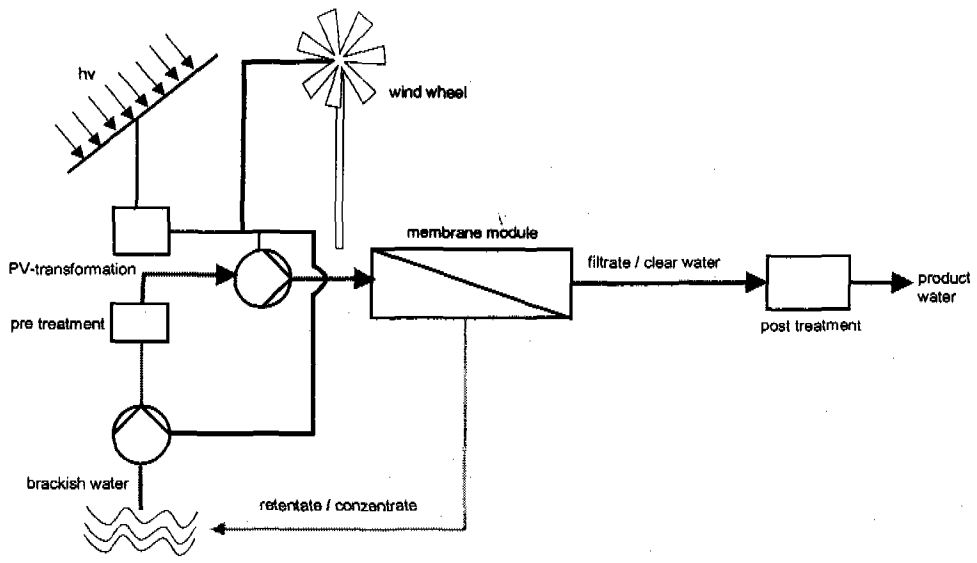

Fig 2. Desalination plant.

NON-REVENUE WATER REDUCTION. BASIC CONCEPT AND GENERAL TERMS OF REFERENCE

Liemberger R., Lutschounig K.
SEBA MESSTECHNIK)

Drinking water is becoming a rare commodity in many regions of the world. Efficient water resources management becomes indispensable in order to handle available resources with care.

Nevertheless, water supply systems do not always run as efficiently as they could. In most cases a high percentage of the water produced gets lost due to physical and non-physical losses of the distribution and the plumbing system.

Especially in former eastern block countries water companies can not meet the continuously increasing demand for safe drinking water for the growing population. Numerous nationally and internationally financed projects are implemented, aiming at an improvement of the prevailing situation.

In many cases the terms of reference for such projects are too ambitious and comprise too many measures for the whole supply system. The real problems are not of technological nature and their resolution is not a classical engineering task. Technical and institutional omissions of many decades have to be made up for.

Based on 30 years of working experience in Europe and overseas, SEBA MESSTECHNIK has worked out a Basic Concept and General Terms of Reference for the implementation of non-revenue water reduction projects. Main emphasis was given to the necessary prerequisites for project measures and their proper sequence and interdependency.

A short summary is shown on the next page. In order to achieve the best results, priorities of measures have to be observed. Technical and institutional measures of the same priority have to be implemented in parallel. Measures of different priorities could be incorporated into a comprehensive project (ideal situation) or, if available funds are not sufficient, covered by different small projects.

	TECHNICAL MEASURES			INSTITUTIONAL MEASURES
	Measures of 1st Priority			
T 1	Basic review of the existing situation and emergency repairs		I 1	Basic review of the existing situation
T 1.1	Pressure monitoring program		I 1.1	Institutional aspects
T 1.2	Flow measurement program		I 1.2	Financial aspects
T 1.3	Quantification of non-revenue water and its components		I 1.3	Socio-economic aspects
T 1.4	Review of repair statistics		I 1.4	Financial concept
T 1.5	Water quality and water related public health		I 1.5	Public relations strategy
T 1.6	Emergency repairs			
	Measures of 2nd Priority			
T 2	Mapping		I 2	Establishment of a mapping department
T 2.1	Production of base maps		I 2.1	Provision of field survey and office equipment
T 2.2	Location and check of pipes and fittings		I 2.2	Training for pipeline location and survey
T 2.3	Location of service connections		I 2.3	Training for production of network drawings
T 2.4	Geodetic field survey			
T 2.5	Production of network drawings			
T 2.6	Network data base			
	Measures of 3rd Priority			
T 3	Strengthening of the existing distribution system		I 3	Strengthening of the metering and billing system
	Transmission mains		I 3.1	Meter reading
T 3.1	Distribution network		I 3.2	Water pricing
T 3.2	Rough network analysis		I 3.3	Invoicing procedure
	Repair, replacement or installation of new distribution mains and fittings		I 3.4	Legal relationship supplier-consumer
	Pumping stations		I 3.5	Public relations campaign
T 3.3	Reservoirs			
T 3.4	Service connections			
T 3.5	Repair, replacement or installation of new service lines			
	Installation of consumer meters and meter calibration			
T 3.6	Staff training			
	Measures of 4th Priority			
T 4	Operation and maintenance		I 4	Institutional strengthening and management training
T 4.1	System operation		I 4.1	Utility organisation
T 4.2	Controlling and monitoring		I 4.2	Management information system
T 4.3	Preventive maintenance		I 4.3	Store keeping
T 4.4	Capacity building		I 4.4	Cost accounting and controlling
			I 4.5	Capacity building
	Measures of 5th Priority			
T 5	Feasibility study for system extensions		I 5	Financial planning
T 5.1	Establishment of a calibrated hydraulic model		I 5.1	Water demand forecast
T 5.2	Design of system extensions		I 5.2	Revenue forecast
			I 5.3	Financing plans

SWAT MODEL EVALUATION OF WATER YIELD, SEDIMENT YIELD AND NUTRIENT LOSS IN THE BLACK BROOK WATERSHEDS N.B., CANADA

Lin K.-Ch., Yang Y., Arbour J., Chow T.-L., Rees H.
Department of Civil Engineering University of New Brunswick, Fredericton, N.B.,
Conservation & Protection IW/L, Environment Canada. Halifax. N.S.,
Agriculture and Agri-Food Canada. Fredericton, N.B., Canada

Potato production is one of the largest agricultural industries in the Province of New Brunswick, Canada. Intensive studies have been made on a potato belt in the 14.5 km^2 Black Brook Watershed in the Province. Excessive soil erosion in the watershed has lowered soil productivity, causing high costs of crop production and water pollution problems. The objective of this research is to study the long-term impacts of agricultural practices on water yield, sediment yield and nutrient loss in the watershed using a state-or-the-art computer model.

The PC-version of the non-point source pollution model for large ungaged basins - the Soil and Water Assessment Tool (SWAT) - developed by Arnold et al. (1995) of the United States Department of Agriculture was used in this study. It was the first time SWAT was directly applied to a watershed in Canada, and, perhaps, first in a country outside USA. Field boundary maps, soil survey maps, contour maps and land use maps created by CARIS in DXF files were converted to MapInfo files for use in the SWAT model. The watershed was divided into 7 and 17 subbasins. Weighted averages were used for various subbasin parameters and characteristics. Weather, crop and soil databases were established in the proper input format The model was tested with field data. Statistical analyses, sensitivity analyses and various computer simulations were performed. The results are illustrated in figures and tables.

It was found that the SWAT model underestimated annual and monthly water yields and overestimated annual and monthly sediment yields and nutrient (NO_3.N and soluble P) losses in the Black Brook Watershed for the period of 1992-1994. On the whole, the simulated NO_3.N concentrations were higher in the surface runoff than in the subsurface runoff or in the percolate. The highest monthly simulated concentrations of NO_3.N and soluble P in the surface runoff and percolate occurred in early summer. The time, depth and amount of fertilizer application in the soil all had a strong influence on NO_3.N and soluble P losses in the surface runoff, subsurface run off and percolate. For good management, fertilizers should be applied after the plant canopy is established or to a deeper soil layer to reduce nutrient losses from surface runoff. However the latter practice might increase nutrient losses in the subsurface runoff and percolate. Sediment yield was found to increase in the following order of tillage practices: zero-till, spring-till and fall-till. Potato growth tended to increase sediment yield; barley growth tended to reduce sediment yield. Potato-barley rotation greatly reduced sediment yield, but slightly increased water yield compared to continuous potato growth. Surface runoff was the major pathway for NO_3.N loss at high rainfall intensities, and percolation was the major pathway for NO_3.N loss at low rainfall intensities. The annual nitrogen loss in surface runoff was nearly twice as much as that in sediment yield. However, sediment yield was found to be the major pathway for phosphorus loss.

The SWAT model has been proven to be a powerful tool for simulating long-term impacts of agricultural management practices on water quantity and quality of the watershed. However, the SWAT model cannot simulate the nutrient removal process by trees and vegetation in the riparian zones. Model calibration will improve simulation for application in Canada in view of the different climatic conditions compared to the United States where the model was developed.

THE ENGINEER-ECOLOGICAL PROBLEMS OF WATER SUPPLY TAKING INTO ACCOUNT THE PHYSICAL-THERMAL PROPERTIES OF WATER

Lutov A., Turutin B.

The rational use of water resources requires the detailed and comprehensive study of information about main elements of water-supply systems and their operating modes in various season. Being present thus the problems are rather diverse and owing to complexity bend of processes and insufficient known yet far from the total decision.

In regions of severe climate the maintenance not-freezing outside water-supply is difficult task, especially for pipelines of surface lining.

The development and introduction not freezing of fixture, organization of supervision for thermal regime water-supply of system, installation of reserve means for warmer of water increases the reliability of water-supply, however, as the practice shows, cases freezing of water-pipes still take place. At over-ground lining water-mains in regions of severe climate one of the most important is the task of protection of pipelines from freezing, as during normal work, as in emergencies. The measures of protection of network from freezing in emergency cases in projects, usually, are not provided, it and is explained vulnerability water-main, construction over-ground and working in severe climatic conditions Siberia and Extreme North. The absence of effective protection of networks from freezing as often as not results in heavy emergencies and drop out of operation water- main over a long period of pipelines time, that brings great damage to national economy.

The reliability of work water-pipes and water-supply of network first of all is defined by serviceability of fixture in various thermal regimes. Base of designing of fixture, working in ice conditions, prescribes the following principles:

- accommodation of source channels and lock in nucleus of section water-main,
- automatic of water from case after closing the lock,
- arrangement of source channels of fixture downwards from the lock,
- manufacturing of details, affecting thermal losses of fixture, from materials with low factor thermal conductivity or heat isolation.

The fixture, efficient in conditions frozen, is made from usual materials, condensation of details does not require the high accuracy of manufacturing, devices in not freezing performance have less the sizes and smaller weights in comparison with typical fixtures.

The technological effect from introduction of fixture, working in ice regimes, is received at the expense of prevention freezing water-supply of pipes, decrease of costs on hearing of water, decrease of building costs and working costs at transition on small-sized lining water-supplies in regions deep seasonal freezing of ground.

The fixture of new type is especially necessary for water-pipes of small diameters with non-uniform water consumption, where the cases freezing of pipes and conduits of devices are possible.

The patents of Russian Federation: №1749690, №2070632, №2070701.

PROBLEM OF A WATER-SUPPLY FOR ARCHENGEL

Malov A.
Institute for Northern Ecological Problems, Academy of Sciences Ural Division, Archengel, Russian

Now the water-supply for Archengel is carried out at the expense of surface waters r. Northern Dvina, not appropriate to the norms on bacteriological and organical to parameters, contents of petroleum, fenol, mercury, iron. Disinfection of a water intensive chlorine saturation results to formation carzenogenic chlorineorganical of connections.

In 1985 was in details prospected the Permilovo deposit of underground waters with industrial stocks 386 000 м3\days. However, too large distance it from city (120 km) and absence motor way - in conditions swampy northern taiga - make development of a deposit improbable. Besides the underground waters of the Permilovo deposit, containing in crack-carst limestones, are also subject to pollution - in view of weak cover from a surface and absence of a high-grade zone of sanitarian protection of a deposit.

In the given situation additional efforts under the decision of a problem of a water-supply of Archengel are necessary. In our opinion, first of all, they need to be applied to valuation following two perspective water deposites:

1. Underground water of alluvial adjourment r. Northern Dvina. Valuation of stocks on a category C2 in quantity 228 000 м3\days is conducted. Attraction of surface waters of the river for Artificial filling of stocks will allow essentially to increase stocks deposit. Distance of a site from city - 20-40 kms. The complexities with its development are connected with antropogenic by pollution of a water complex and increased contents of iron in underground waters. Fulfilment of researches of efficiency cleaning of a river water Is necessary at it movement to waterwells and technological valuation of expediency of construction waterwells with artificial filling of stocks.

2. Underground water of limestones of adjourment of region r. Pachuga. Valuation of natural resources of underground waters in quantity 1 mln M 53 0/ of a day is conducted. Being analogue of the Permilovo deposit on hydro-geological conditions, Pachuga the site has before it beside of advantages:

1) is in 1,5 time closer to city (70 kms),

2) costs of a structure of the water-pipe is much smaller, thanking availability motor way,

3) waters can be submitted self-those, as the marks of relief are continuously reduced,

4) conditions of organization of a zone of sanitarian protection much more better, thanking absence in region r.Pachuga of objects of economic activity and residential settlments, as well as availability of the nature reserve.

Before designing water wells on Pachuga a site fulfilment of a complex of geological work is necessary.

INFLUENCE OF WATER QUALITY ON TECHNOLOGY OF WATER TREATMENT AND WAYS OF DRINKING WATER SUPPLY TO POPULATION

Migalaty E.V., Nikiforov A.V., Brayalovsky B.S., Kuznetsov A.V., Lobukhina T.V.
Urals State Technical University, Yekaterinburg, Russia

The indicators of tap water quality fluctuate widely and often don't meet standards. Withdrawing water from the same water supply source in different points of water intake the differences in the water chemical composition were found that was caused by conditions of water transportation by pipe-lines.

It was fixed that the iron concentration in drinking water in Yekaterinburg may change from 0.3 to 0.9 mg/l (standard is 0.3 mg/l), aluminium concentration – from 0.3 to 0.8 mg/l

(standard is 0.5 mg/l), chloroform concentration – from 0.06 to 0.07 mg/l (standard is 0.06 mg/l). The water colourness fluctuates from 15 to 50-60° (standard is 20°). Water in a number of eastern areas of the Sverdlovsk Oblast and northern areas of the Tumen Oblast is characterised by heightened salt concentrations, high colourness and turbidity, significant concentrations of boron, bromine and ammonia.

The colourness of tap water from the underground water sources in Surgut town (the Tumen Oblast) is over 70°. The iron concentration is up to 2-4 mg/l, ammonia concentration – 4.3 mg/l. Under the storage of such water the yellow-brown sediment forms. For instance, the solid residual of tap water in Baikalovo (it is the settlement in the Sverdlovsk Oblast) is 1300 mg/l, including chloride-ions concentrations of 450 mg/l, boron and bromine concentrations of 3.2 mg/l and 1.7 mg/l relatively. Water oxidation susceptibility is up to 6 mgO_2/l, pH is equal to 8.5. The iron concentration in water is up to 2 mg/l. A number of metals form organometallic compounds. The latter pass through the membranes and sorbents and are not extracted by reagents. The organometallic complexes can be destroyed only in certain conditions by the oxidising methods of the water treatment. The application of single- and two-stage treatment technologies of complex composition water does not enable to acquire water of the high quality. That's why we proposed a complex multistage technology of the local treatment of tap water on the base of membrane sorption and oxidising processes, it is used in the device "Aquaros". The device was approved in conditions of the Ural region and the positive experience of its use is equal to 2 years. For instance, the selective sorbents are used for ammonia, boron and bromine removal. In order to intensify the sorption-oxidising processes the ways and modes of catalytic area extension have been worked out. Since the membranes and sorbents operate efficiently and surely only in conditions of suspended and colloid admixtures lack a great attention is paid to the methods of the preliminary mechanical water treatment. For instance, before the membrane stage of water treatment tap water of the complex phase-dispersion composition is subjected to the three-stage mechanical filtration and consequent physical-chemical treatment.

It is quite obviously that a consumer will receive drinking water which does not meet standards until the questions of water stabilisation at the centralised filtration stations and its transportation by non-corrosive pipes are not solved.

In such conditions the local systems of tap water treatment are indispensable for small settlements and individual districts of cities. For instance, over 750 local devices of common use have been introduced and maintained in Nizhny Novgorod at the expense of the investment programmes.

So the expediency of the local devices application in Yekaterinburg does not raise doubts.

IMPROVED QUALITY OF WATER TREATMENT AND INCREASED OF THE EXISTING WATER–SUPPLY SYSTEMS

Mjasnikov I.N., Potanina V.A.
G.N.C. NII VODGEO
Bukov J.B.
M.P.Vodokanal, Kaliningrad

The improvement of the water treatment technology for potable water–supply systems is the most actual problem at the present time. It is determined by contamination of natural water sources and the ever growing requirements for the quality of water treatment. Both surface and underground water is known to contain a great deal of contaminants as a result of human activities. Purification of the water under the circumstances may be achieved by means of improved–technological processes and modern facilities. Within the limits of sanitation it is necessary to remove bacterial, organic and mineral impurities containing in the initial water. The majority of the existing water treatment plants meet the required degree of treatment providing the improvement of technology and existing facilities such as; mixers, flocculation cells, settling tanks and filters.

As a rule they are the components of those water–supply systems which take water from surface water reservoirs. Flotation cells, settling tanks and filters are also used in a number of plants utilizing underground water the quality of which is characterized by the increased amount of contaminants.

The use in schemes of treatment plants some additional facilities for instance: ozonetors, coil filters and so on, usually demands substantial capital investments, besides it is not always possible to construct them due to peculiarity of the local conditions.

That is why high quality of the water treatment as well as increased output of the existing plants would be achieved by means of new more efficient reagents, contemporary materials and improved inner arrangement of settlers and filters. In this it is possible to use recirculated wash water from filters and to reduce the amount of sludge.

The abovementioned measures were realised in 1994–1997 at water–supply systems constructed as far as in 1879, 1924, 1943 and 1979. They include such components as mixers, settling tanks and filters. All those settling facilities, filters and mixers have substantial technological and constructional distinctions, that can be easily explained by the date of the plant building.

Three of the water–supply systems utilize surface water but that one which was constructed in 1943 uses an underground basin. Nowaday all the mentioned water sources contain high quantity of contamination.

A great number of laboratory and industrial tests have made it possible to define rather efficient coagulation and flocculation substances, a scheme of bringing them into the treating water as well as coagulation technology and separation of the dispersed media in the facilities with the new inner arrangement.

The treatment plants have been working for a year under above mentioned conditions and the quality of the treated water completely provide with sanitary standard specification:

- oxidation is 0,3–0,6 mg/l (standard is 5);
- colouring is up to 10 degrees (standard — 20);
- turbid is 0,3–0,6 mg/l (standard – 1,5);
- iron is 0,05 – 0,1 mg/l (standard – 0,3);
- total microbe number is up to 10–20 (standard – 50).

In this the amount of coagulant (polyaluminium chloride) is 2 – 2,5 times less than that of the previously used sulphurous aluminium.

They allow it to reduce the reagent housing up to 4–5 times. The amount of sludge was reduced to 2–5 times and filter washing water was reduced to 2–3 times. In this the operational efficiency increased up to 30–40%.

It is worth mentioning that no construction work has been made except of the inner rearrangement of the settlers and filters. Some energy saving equipment was also used. The operational costs were reduced 30–50%. Constant and stable purification of water is carried out during flood periods and periods of water blossom at those plants which utilize surface water reservoirs.

TRENCHLESS REPAIR OF WATER-CARRYING PIPELINES - AN URGENT PROBLEM OF NUNICIPAL WATER ECONOMY IN RUSSIA

Mordyasov M.A., Yanovsky Y.G.
Municipal Water Supply and Treatment Research Institute, Moscow, Russia
Kotelenetz A.A.
Cmmittee on Housing and Municipal Economy of Moscow Region Administration, Moscow, Russia

Within the structure of municipal water economy underground pipeline networks occupy up to 75 per cent of capital cost and not less than 50 per cent of operatiag cost. At present, in different regions of Russia from 25 to 50 per cent of underground water-carrying networks need urgent repair or substitution. Losses of drinking water in distribution networks approach 10 and more percent of pumpage, and power consumption in pumping water trouhg pipelines with interior incrustations exceeds by 25 per cent and more design parameters. Cases are known when drinking water effluent from treatment plants in full compliance with State Standards and Sanitary Regulations and Norms assumes worse characteristics due to secondary contamination in underg-roung pipelines with internal corrosion and incrustations.

The situation becomes more acute because at present the amount of new construction and relaying of aged networks is less than the length of the aged pipelines reaching the pre-break-down and break-down stages. Similar problems face pipelines in sewerage and heating systems.

On a scale of Russia, in is impossible and economicaly ruinous to solve the problem by using conventional schemes of relaying aged pipelines.

The solution of the problem in Russia is seen in mass implementation of methods, techniques, and equipment for trenchless renovation of worn-out pipelines by applying durable protective coating. Renovation ensures not only a substanticel decrease of expenses (about 40 per cent, as compared to new construction or up to 50 per cent as compared to relaying cost) but also a sharp decrease in the use of pipes and allows to involve worn out and aged pipelrnes in repeated and prolonged cycle of operation (not less than 50 years).

In a number of developed countries abroad this method has been employed for some years.

Renovation by stages of municipal water-carnying pipelines reguires to determine "starting" expenses. For most of the country's waterworks it is difficult to find "starting" capital. It is necessary to have social support of financing (using federal and regional budgets), as well as private investitions. It the waterworks get profit, it is feasible also to use some part of it for "starting" expenses on renovation.

The Municipal Water Supply and Treatment Research Institute, as a leding organization in the fiekd of municipal water economy, offers to implement technology and sets of native and foreign equipment for renovation of underground water-carrying pipelines in water supply and sewerage sustems. A set of renovation equipment will be supplied within 5 to 6 months. The Institute ensures training of the customers personnell in renovation work, servicing, certification and other aspects of engineering.

The Institute is ready to collaborate with waterworks in Rossia and the UIS, with their joint companies in establishing regional centres, equipped with native and foreign renovatoin equipment, including Russian TV-robots.

At present Moscow regional committee on housing and municipal economy and the Institute are working out on a problem of establishmg a regional centre of renovation of underground pipelines in Moscow region. It is plunned to have a scientific and technical as well as a training department at the Centre. It will also have several construction sections in cities of Moscow region (on the basis of city waterworks and other structural units of the housing and municipal economy of the Moscow region.

The Centre will solve by stages problems of renovatin undergroung pipelmes and ensure construction of new water carrying networks out of pipes with internal cement lining or with modern polymer or composite protective layers for a working live of over 50 years.

The question of establishing a similar Centre is on the agenda in the Samara region and in a number of other regions of Russia.

Native organizations and foreign firms ave invited for collaboration.

ECOLOGICAL AND MELIORATION CONDITION OF SOILS IN ZAVOLZJE. PROVIDING FOR QUALITY DRINKABLE WATER

Mosienko N.A., Chumakova L.N., Myazitov K.U.
S.S.A.A. named by N.I. Vavilov, *Povolzecosouz*

The main part of a complex of ecological difficulties which comes with a problem of agricultural production in Zavolzje is privation of negative consequence of irrigation.

Wide using of imgational melioration comes to serious changes of environment: raising of ground water level, secondary salinization, worsening of productivity of soils. It is characteristic for those areas, where unsatisfactory melioration doesn't meet requirements. Unfortunately this process touches upon almost all Russian's regions where melioration comes.

We can see worsening of imgational soils in typical chernozern of Northern Caucasus, Central-Chemozern region, Povolzje, and Western Siberia.

There was an irrigation in Saratov region. After the irrigation of 450 thousand hectare, only 330 thousand hectare are good conditioned (72,1 %).Ground water level is in 5m and alkalised. 13,8% of areas are unsatisfactory conditioned. 65 thousand hectare are also unsatisfactory conditioned, soils are salinizated and ground water level less than 3.0 m.

To take in to consideration, ground water level is 2,5 m we defined approximate periods of rising of ground water level to the critical norm on irrigated areas of Povolzjskaya irrational system. This periods change from 1,5 to 6.0 years, when ground water level is from 5 to 10m. and from 6 to 26 years, when ground water level is from 10 to 30m.

Irrational regime of irrigation with nonbalance combination by source of energy of agricultural chemicals comes to negative consequence.There is worsening of agro-phisical and biological characteristics of soils among them. There is accumulation of harmful elements for health in production.

Our research shows infiltrational loosing of water on irrigated areas, even if there is strict fulfilment of regimes of irrigation. Our calculations based upon facts. The creation of mathematical model shows infittrational loosing in Zavolzje's areas are from 5 to 15% of the sum of rainfall and irrigation. Filtering water provides with advancement of salinization into more deep soils and into ground water. That's why all questions of providing population with quality drinkable water are becoming more and more actual from years to years. Almost all fresh water of surface springs and subsoil one became polluted with xenobiotics.Often xenobiotics are decaying to more toxity materials than initial in the process of biotransformation.

Drinkable water scrubbing with the help of filtration or absorbation constructions doesn't allow to detain harmful elements and to preserve useful one. It is impossible to devide all harmful elements with the help of filtration and absorbation.

"Isumrud" is the machine by SPA "Ecran". It is the most interesting creation because in the machine water scrubbing based upon process of oxidation and reduction. With the help of this toxities are neutralised and destroyed. Natural process in "tsumrud" is accelerating with the help of straight electrochemical reactions and participation of reagents in this process.

In Marksovsky and Bazamo-Karabulaksky raions of Saratov region this machines are used. The level of compound of ammoniac, magnesium, calcium and other metals in drinkable water became more lower. Our practice shows that all possibilities of this machines are not used. In comparison 'Isumrud" is more effective and ecologically secure than other machines.

POTENTIAL SOURCES OF CONTAMINATION OF NATURAL WATERS OF POTABLE ASSIGNING (ON AN EXAMPLE OF THE IVANKOVSKY RESERVOIR)

Musoyan S.G., Shmidt E.L.
ENIRE joint-stock company "Interwater researching", Moscow, Russia

Main points

The quality of the Ivankovsky reservoir water - Volga source of a water-supply of Moscow - is connected to resets of industrial and household waste water, and also natural surface and underground drain. The deterioration of quality of water can happen at the expense of dangerous in sanitarian - epidemiological relation of waste water of tanning plants, wool-washing mills and other industrial firms processing cattle-breeding raw material, which drains are not sterile in the relation of microbe of siberian ulcer.

There is an actual danger of deterioration of an ecological condition of the water conservation zone of the Ivankovsky reservoir connected with possible disturbance of isolation burial grounds infested with siberian ulcer, which are situated by virtue of the historical reasons in water storage area of reservoir. Such disturbance can happen under force of both of natural factors, and intensive economic development of territory. Besides the absence now of rigid control of the safety the burial grounds does not provide reliable security of water environment from a penetration of microbe of a siberian ulcer.

In water conservation zone of the Ivankovsky reservoir at the present time the availability 185 burial grounds infested with siberian ulcer, which were built in the period from 1852 to 1979 y. More than 30 burial grounds have appeared in a zone of splashing down of reservoir. All of them are potentially dangerous centers of distribution of siberian ulcer infection. The numerous facts testify to it. For example, at extraction of sand from base adjourment of a reservoir in 1980 near to an island Uhodovo was affected burial ground

and together with sand were born on a surface of ground bones of the buried animal. Laboratory research of them has detected on a surface of the bones alive spore of a siberian ulcer saving all biological indications of this species, including ability to vegetation and contamination of animals.

At washing-out of burial grounds by water erosion or economic activity in the basin and coast zone of reservoir spores of a siberian ulcer by a water way are spreaded in a direction of flows. Thus actual there is a problem of the area of spreading of siberian ulcer spores and whether there is a danger of their hit in the sources of a potable water-supply.

Prognosed evaluation of propagation of microflora was made because of premises of analogy between motion of microorganisms and biologically of neutral suspended particles in water environment. The used method allows to find the mean and maximum concentrations of contaminant on different distances from sources of contamination. For calculations the relation is used:

$$s_m = l_0 s_0/(l_0+jL), \qquad (1)$$

Where - s_m and s_0 - accordingly mean and initial concentration of contaminating substances; l_0 - length of an initial zone of contamination, factual or specific. The size j is a function of a factor Shezy(C), which depends on hydraulic parameters of water environment. The size of initial concentration of spores of siberian ulcer in case of disturbance of isolation of a burial ground (s_0)is adopted equal 100%, initial length of a cloud of contamination (l_0) - 1000 m. The calculations are made for different segments and inflow of the Ivankovsky reservoir in several variants, taking into account probability, of extreme situations in water area and coast zone of a reservoir.

The outcomes of prognosed studies show, that the water on the different segments of reservoir located on different distances from the burial grounds of the basin and a coast zone, can contain dangerously high concentration of microbe of siberian ulcer. It can immediately attitude segments, where a scooping of a water for the water supply, in particular, the Uchinskoye water storage and on the dam site. You will acheive 15-25 % from initial concentration during 0,5-3,0 days current after opening a burial ground. The similar situation can arise in a mouth of the river Donhovka (Konakovo).

The obtained data testify that the danger of contamination of a water at destruction (washing out)of the burial ground is quite probable and, as a corollary it, the origins epizootic and epidemics of a siberian ulcer are possible.

ECONOMIC COMPARISON OF ION EXCHANGE AND REVERSE OSMOSIS FOR WATER TREATMENT

Newell P.A., Wrigley S., Sehn P.

Ion exchange (IX) and reverse osmosis (RO) can be complementary technologies for example in providing ultrapure water for microelectronics applications where each plays its particular role. However in bulk demineralisation prior to polishing they often compete.

The choice of whether to use ion exchange or reverse osmosis for water treatment is a complex and changing issue as experience with reverse osmosis grows and RO membranes develop at a much faster pace than ion exchange resins and their associated technology.

Studies in the USA in the mid 1990s compared RO with co-flow regenerated ion exchange systems and found an economical breakeven point at around 2.5-3 eq/l of total dissolved solids (TDS) in the feedwater. Below this ion exchange was judged to be more economical. Counter-flow systems, particularly using packed bed technology, were not considered and indeed many RO systems were built and installed - even upfront of existing ion exchange plants. In Europe the widespread use of more efficient, counter-flow regenerated systems and the reluctance to switch to a less proven technology has limited the use of RO for demineralisation in power plants and the chemical process industry. This is now beginning to change.

This paper will examine the advantages and disadvantages of each technology and then utilise a model to compare the costs of RO vs packed bed counter-flow regenerated ion exchange systems.

The choice on whether to use RO or ion exchange for a new water treatment plant will depend on, amongst others :

1) The source of the feed water - a highly fouling or dirty feedwater will favor IX as RO membranes are more prone to fouling and require good pretreatment. Waters with high TDS however favor RO due to the absence of regeneration chemicals

2) The cost of the feedwater - as the recovery of IX systems are typically 90-95% vs 75-85% for RO, higher cost feedwater penalises RO

3) The cost of disposal of the RO concentrate - if the concentrate can be used for example as cooling water elsewhere on the site this helps reduce the cost of RO.

On the other hand ion exchange adds more ions to the discharge water, albeit in a lower volume due to the use of regenerant chemicals

4) The availability of inexpensive power - this favors RO

5) The end user preference for one technology - today in Europe this favors ion exchange where the bulk of experience lies

6) Limitations on storage of chemicals - if there are concerns in storing acid or caustic on site then this favors RO

7) The possibility of upgrading an existing ion exchange plant from co-flow to packed bed counter-flow technology

Labor costs are deemed to be equivalent for both systems as it assumed that new plants would be automated and require a fraction of a person in a control room to supervise operations.

In order to assess the costs of the two processes a model was developed. The capital cost for plants to treat 50m3/h and 200m3/h for four levels of TDS in the feedwater, ranging from 1.6 - 9.6 eq/m3, were obtained from three suppliers of water treatment plants. Both systems included mixed bed polishers to get a treated water quality of < 1 μ S/cm and <10ppb SiO2. The operating costs of the various plants were then calculated based on typical operating costs in the UK and allowing for a 15 year capital depreciation of the plant.

The costs of buildings was not considered, just the cost of the plant including installation and the operating costs including power, chemicals and labor.

The water source was taken as river water with flocculation and sand filtration as the pretreatment for both processes.

The ion exchange plant comprised a strong acid cation - degas - layered bed anion using uniform size resins. Sulfuric acid and hydrochloric acid were both considered as regenerants in addition to caustic soda. The time between regeneration ranged from 8 - 24 hours according to the TDS of the feedwater in line with European practices.

The reverse osmosis plant had in addition 5 micron cartridge filters and used acid and antiscalant addition. Thin film composite RO membranes were used in 8" elements with 400 ft2 surface area/element in two arrays. The feed pressure was 14 bar (200psi) and the recovery 80%.

The cost to treat water with RO is rather insensitive to the TDS level in the feedwater, unlike ion exchange which incurs higher regeneration costs and outage time as the TDS increases.This leads to an economic crossover point which is dependent on the TDS of the feedwater and the size of the plant. For the 50m3/h plant the breakeven was around

8 eqTDS /m3 water ,for the 200m3/h this fell to 7 eqTDS/m3.

Next the sensitivity of the break even points were examined for the sensitivity to the varying costs of power, NaOH and feedwater. The increasing cost of power obviously adversely affects the cost of RO as does that of NaOH for ion exchange. However breakeven points were still within the 6-10 eq/m3 range. The major impact comes from the cost of feedwater : if a relatively expensive towns water is used then no breakeven can be found under 10 eqTDS/m3.

Developments with ion exchange systems have apparently reached a plateau with the use of uniform size resins in packed bed counter-flow regenerated systems. In contrast RO membranes are continuing to develop addressing three main areas of hitherto weakness :

1. Increase in salt rejection to reduce the load on downstream mixed bed polishers - this is now typically 99.5%
2. Increase in flux resulting in lower feed pressures and energy costs
3. Increase in resistance to biological fouling by special treatment of the membranes and/or lements and change in feed spacer design and thickness

These improvements will only serve to fuel the increasing trend of reverse osmosis to replace ion exchange for the demineralisation of water for industrial applications.

BIOLOGICAL METHOD FOR PROTECTION OF WATER DISTRIBUTION PIPELINE STEEL AGAINST BIOCORROSION

Noskova V.P., Mironova R.I., Kobelev V.S., Kholodenko V.P.
State Research Center for Applied Microbiology, Moscow region, Obolensk, Russia

For protection of steel water distribution pipelines against microbial corrosion, biological approaches are used along with popular chemical methods. One of the biological approaches implies the application of antagonistic cultures inhibiting the growth of highly aggressive corrosive strains.

Two strains Trichoderma D16/1 and 64/3M with low biocorrosive activities (0.0 and 0.08 g/m^2·day, respectively) were taken from a collection including about 40 steel destructive strains of different taxonomic groups. The strains acted as antagonists toward most of the biodestructors under investigation, including both micromycetes and bacteria. However, the degree of inhibition of the growth and development of destructive strains by the antagonists varied. 37 strains of micromycetes and 6 bacterial strains with biocorrosive activities (0.1 to 1.68 g/m^2·day) were tested. The results are depicted in Table.

When culturing on solid and liquid media, strain Trichoderma sp. D16/1 was found to inhibit the growth and development of 19 aggressive strains of micromycetes and 4 bacterial strains. 95% inhibition was observed for 13 micromycetes and 2 bacterial cultures, 90% for 2 strains of micromycetes and 75% for one strain. Trichoderma sp. D16/1 produced no effect on a single strain of micromycetes with marking D74/1. Only one aggressive strain Penicillium sp. B2/2 suppressed Trichoderma sp. D16/1.

Another strain under study, Trichoderma sp. 64/3M, was highly antagonistic toward micromycetes. It completely inhibited the growth of 30 degrading micromycetes and 6 bacterial steel destructors. 95% inhibition was reported for 2 strains of micromycetes, 90% for 2 strains and 75% for 2 strains of micromycetes. Two strains from the collection turned to be resistant to Trichoderma sp. 64/3M, and none of the strains tested produced a suppressing effect on Trichoderma sp. 64/3M.

Both strains Trichoderma sp. D16/1 and Trichoderma sp. 64/3M can be used as biological agents for protection water distribution pipelines against biocorrosion.

Investigations were performed in the framework of Project #119-95 of International Science and Technology Center (ISTC).

Table. Action of strains Trichoderma sp. D16/1 and Trichoderma sp. 64/3M toward steel destructive microorganisms.

NN	Biodestructors	Steel biocorrosion, $g/m^2 \cdot day$	Biodestructor growth inhibition, %	
			Trichoderma sp. D16/1	Trichoderma sp. 64/3M
1	unidentified V36	1,68	100	100
2	Penicillium sp. B4a	1,65	100	100
3	Penicillium sp. B3/2	1,29	100	100
4	Penicillium sp. 35/1	1,27	100	100
5	Aspergillus sp. 2N	0,97	100	100
6	Penicillium sp. U-1	0,94	95	100
7	Penicillium sp. V5	0,90	100	95
8	Penicillium sp. 20/1	0,87	95	100
9	unidentified V46	0,77	100	100
10	unidentified D69/1	0,76	100	100
11	Penicillium sp. S2	0,73	95	100
12	Cladosporium sp. S3	0,71	100	100
13	Aspergillus sp. V2	0,69	100	100
14	Aspergillus sp. 1N	0,68	95	100
15	Aspergillus sp. D74/2	0,65	95	95
16	Penicillium sp. N2/2	0,64	100	100
17	Penicillium sp. V1	0,64	95	100
18	unidentified D74/1	0,64	50	90
19	Aureobasidium sp. 12/8	0,64	100	100
20	Penicillium sp. B2/2	0,61	25	75
21	Penicillium sp. U2	0,60	100	100
22	Aspergillus sp. 2M/3M	0,53	95	50
23	Mucor sp. 45	0,45	95	50
24	unidentified D74/1	0,42	95	100
25	Penicillium sp. IG-1	0,39	100	100
26	unidentified D75/1	0,38	90	100
27	Aureobasidium sp. 67/5	0,34	100	100
28	Aspergillus sp. V3	0,30	100	100
29	Aspergillus sp. U3	0,30	95	100
30	Aspergillus sp. 12/9	0,29	95	100
31	Aspergillus sp. U	0,23	100	100
32	Aspergillus sp. 12/3	0,23	100	100
33	Aureobasidium sp. 3N	0,22	100	100
34	Penicillium sp. U1	0,20	85	100
35	Penicillium sp. M40	0,20	75	75
36	Aspergillus sp. V4	0,01	90	100
37	Aspergillus sp. 44	0,10	95	100
38	Flavobacterium turreni BO6	1,21	100	100
39	Keebsiella rhinosellromatis BO2	0,50	100	100
40	Ps. fluorescens G1	0,36	95	100
41	Ps. cepacia SOV4	0,32	100	100
42	M. flavescens IG1	0,23	95	100
43	Serratia marcenseus SG	0,15	100	100

WORKING OUT OF "DRINKING WATER" QUALITY NORMATIVES IN THE CONDITIONS OF THE REPUBLIC OF ARMENIA

Oganesyan K.A.
Scientific Research Institute of Water Problems and Hidrotechnics, Yerevan, Armenia

As certainment of normative demands to the "Drinking Water" quality in many countries of the world is realised on the international and national levels. The main international documents, recommendations of which are accepted as

basic at working out of national documents are "Guide on Water Quality Control", worked out by World Health Organisation (WHO) and Directives of the European Economic Council-Directive of the Council 80/778 EEC.

In Armenia till now there isn't an existing national normative document in the sphere of rate setting and control of drinking water quality.

Common tendency of the system development of normative demands to the drinking water quality is characterised by growth of the rated and controlled indices number, intensive growth of which is stimulated by increase of polluted reservoirs number and consequently number of water sources polluted by waste waters containing considerable amount of dangerous for human health components.

Physiological full value of the drinking water is defined first of all by it's salty content, which has to correspond to biological demands of organism and it's quantitatively defined in the capacity ofminimally needed values of definite indices.

Normatives of the drinking water quality, established in the Guides of WHO and directives EEC include mainly microbiological, toxicological, organoleptic indices as well as indices of radioactive pollution.

Taking into consideration the highly-cited we've begun researches on revealing now-a-days state of towns and villages sources of drinking water supply quality in the territory of the Republic. With that purpose there's been made up a list of all the sources of centralised water supply which are included in the corresponding department republic services with citing the water sources power and settlements where the water is supplied.

There's been collected material on the content of laboratory water quality analyse and frequency of conducted researches.

For the period of investigations there have been analysed 63 sources of drinking water supply designation, there have been carried out laboratory works on definition of chemical, sanitary, toxicological and radioactive content of these water quality.

In the result of further investigations there's supposed to enlarge the scope of the investigated components of the drinking water quality of the Republic with purpose of making up regulations of national documents on the normatives of drinking water quality.

THE PORTABLE SET OF REAGENT INDICATOR TOOLS FOR OPERATIVE TESTING OF THE POWER STATIONS WORKING MEDIA

Ostrovskaya V. M.
Kurnakov Institute of General and Inorganic Chemistry of the Russian, Academy of Sciences,
Company LTD "ECOTEST", Moscow, Russia
Rigenkov V.A., Nefedkin S.I.
Moscow Power Engineering Institute (Technical University), Moscow, Russia

The heat engineering equipment of power stations, e.g., steam-water lines, must be protected from atmospheric "standing" corrosion during long periods of conservation or repair works. As is known, cationic surfactants (KS) are most effective in bringing about such protection, as well as in rapid removal of corrosive-active deposits from protected surfaces.

On conservation and reconservation of the heat equipment it is necessary to conduct operative determinations of contaminants in the conservant water (steam) carrier and to control a norms of boiler feedwater regime (Nw.r.).

A portable set (the set of reactive indicator tools RIT TC 400-JE"I'18-10-96-91,

including reactive indicator paper bands (RIP), reagent indicator compositions on hard polymeric holder of strips (RIS) as well as pocket devices [1] for the sorption preconcentration of a microcomponent on reaction paper zone of test tool) for quick routine testing of the power stations working media has been developed.

The test methods are based on the color solid phase reaction of analysed substan-ces with immobilized chromogenic reagents [1,2]. Standard solutions of these substa-nces and standard buffer solutions were ready commercial standard specim-en. The procedures were done using both the immersing of strips into tested solution (i) and the concentration of the determinated substance from certain volume of exam-ined liquid probe by means of the passing 3 - 5 ml /30 s (ii) or 20 ml /6 min (iii) of the solution (for concentration ranges from 0.1 to 5 or from 0.001 to 0.1 mg/l accor-dingly) to be analyzed through the reagent 6 mm diameter paper zone of the test strip with the pocket device. The area colour transitions of paper zone were been compared visually on the reference color scales of comparators ECOTEST, which have been developed on the basis of the standard polygraph color scales TC 29.01-91-83.

The approximate limits of detection (table 1) have been evaluated on difference magnitude of two detection concentrations, which correspond to the distinction with a humen eye of two first neigboring cooler shades of color scale by DE = 10 visual convention unit [3]. The maximum relative errors of analysis sr were 33 - 100 %.

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THE DESIGN AND TECHNOLOGY OF WATER MAGNETIZING

Patrasenko V.S.
"Gradient" Research Institute

"...truth is not the one that can be convincingly proved:
it's the one that makes our world more easy."
De Sent-Exupery

When a new word appears in our every day life, sometimes it looks to be accidental, somebody said successfully and it started existing. But our language is not so simple. Almost every time behind a new word there are new phenomenon, new ideas, new psychology, even if the word is not plain and is a technical term.

Magnetotron is the word that is a little bit older than 10 years. And what it means existed before. M a g n e t o - t r o n - the first part of the word needs no commentary, the second - t r o n (analogue - electron) means a store of energy, of magnetic energy.

Before magnetotron constructions were created in science and practice there were devices and instruments called magnetofors, magnetic separators, magnetrons, magnetizers and so on.

The principle distinctive magnetic base of magnetotron is not the construction of permanent magnets but the design of magnetic fields of dispersion which have the picture and gradient similar to magnetic fields of Earth as much as possible. (Drawing 1,2).

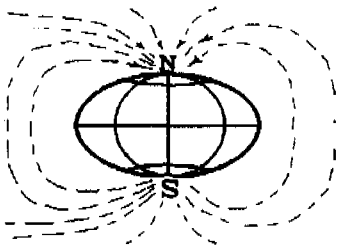

Fig. 1. Magnetic field of Earth.

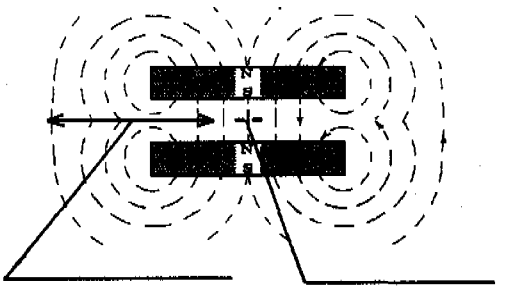

Fig. 2. Design scheme of magnetic fields of magnetotron.

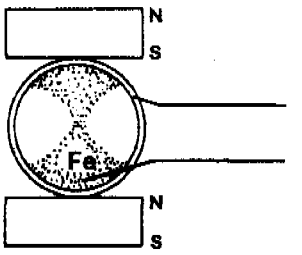

Fig. 3. Scheme of slag catching.

Magnetotrons differ from their analogues and predecessors not only with their simple design in general that gives them the distinctive stability in work. Magnetotrons are free of harmful n o n - r e p r o d u c t i o n if experiments are repeated. They are made of ferrobarium permanent magnets and don't need any source of energy, any adjustment, any special training for manpower, simplify and extend the area of their utilization.

Magnetizing effect appears immediately after substance left magnetotron. The speed of processing can be different. To get the magnetizing effect it is enough to let substance pass through a single magnetotron. In general magnetotrons for liquids and substances are based on the module principle. That makes it possible to ensure any length of magnetizing area and increase processing variations conditions.

Magnetic system of magnetotron does not let to pack the passage completely with catched ferromagnetic slag (Drawing 3).

If magnetotron is used correctly its working term is limited by the term of material of its body.

Magnetotron works reliably within the temperature range from - 50 °C to +250 °C. Initial magnetic induction in the center of magnetic clearance is from 35 to 80 mTl and retains for more than 10 years.

Besides design simplicity and low price magnetotrons demands no capital expenses for inculcation. Expenses for magnetizing are parts of copecks per ton of substance.

Elaboration, manufacturing and selling of magnetotrons are legalized by decisions Council of Ministers - government of Russian Federation dated 14.10.93, № 1058 "About development of scientific and industrial activity in the sphere of magnetology and creation of magnetotrons", by License of Minzdravmedprom of RF No. 30-03/404 and dozens of RF patents.

Design of m a g n e t o t r o n s makes it possible to magnetize water and water solutions:

1. In opened and flowing standing reservoirs.

Stimulates active coagulation of harmful admixtures;

2. During drinking water purification.

Increases productivity of water purifying equipment, increases pH factor, reduces bactericidity, pipes corrosion, prolongs terms of storing;

3. On purifying equipment.

Increases coagulation, accelerates falling of colloidal and tough sediment in the places of water escape into reservoir, reanimates flora and fauna;

4. During water preparing on systems of water heating and cooling.

Provides antiscale effect, reduces corrosion and prolongs lifetime of pipes. Magnetized water circulating in

heating systems reduces technopathogenity of rooms, in some cases excepts using of sodium chloride;

5. During irrigation and watering crops in agriculture and cattle-breeding.

Increases harvests and productivity of cattle-breeding, poultry keeping and fish-breeding making agricultural products ecologically pure, reduces water demands, chemical weed-killers and pest-killers and synthetic stimulator of growth;

6. In food industry.

During sugar manufacturing from sugar-beet biological activity and coagulation during diffusion grow, texturing and homogeneity of syrup increase, evaporation process is activated, manufactured sugar gets the stable snow white color, increased transparency during solution. Diabetic dependence reduces radically, sugar becomes the dietetic and ecologically pure product. Sugar output gets higher.

During meat products manufacturing time of minced meat ripening gets shorter, phosphate is excepted, the product output gets higher, humidity factor retains, terms of keeping get longer. Products become ecologically pure;

7. In medical magnetotherapy, in sport and veterinary science.

Cardio-vascular, psycho-physical and vestibular systems normalize. Function of blood-making organs activates during oncologist and radiation diseases;

8. In building industry.

The toxic component C-3 is excepted, thermomechanical features improve, consumption of concrete and technopatogenity of reinforced concrete constructions reduces radically;

9. During extraction, processing and transportation of oil and oil products.

The volume of water pumped into strata increases, debit of oil well and productivity of technological equipment and oil products grow, overparaffinizing reduces;

10. During utilization of fuel and lubricants.

Their consumption and toxic factor of exhaust gas reduce, efficiency and wear-resistance of frictional surfaces increase.

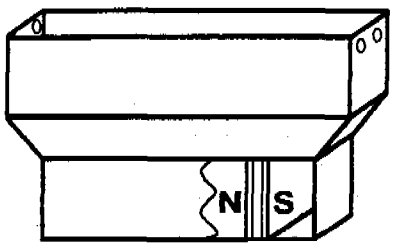

Fig. 4. Magnetotron for dry substance.

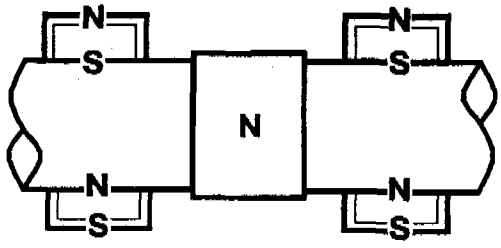

Fig. 5. Magnetotron for pipelines with diameter under 100 mm.

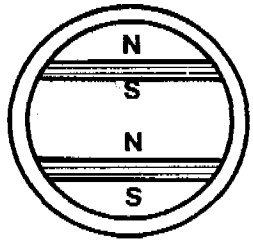

Fig. 6. Magnetotron for great diameters.

Magnetic memory of magnetized substances depends on their physical and chemical composition mode of biological activity and retains for dozens of hours, in biologically active environments - for days and some substances transfer into new mode forever.

Average effect of magnetizing of water supply reduces water consumption, increases ecology, biological activity of substance for 30% and therapeutic - for 85%.

Scientific consultant and editor, deserved inventor of USSR, academician of Academy of Medical Science, doctor of medical science Neumyvakin I.P.

FIBER GLASS PIPES FOR WATERWORK

Perminov V.P.,Goldin B.A.,Kuchin A.V.,Ryabcov Y.I.
Institute Of Chemistry, Syktyvkar, Ural Division Komi Science Centre Russian Academy Of Science, Russia
Kashin S.M.
ZAO Progress, Perm, Stc Cas Komicomposit, Syktyvkar, Russia

Institute of chemistry (Syktyvkar) Ural Division, Komi Science Centre Russian academy of Science and commercial organisations CAS PROGRESS (Perm) and STC CAS KOMICOMPOSIT (Syktyvkar) are suggest new ecology acceptable and healthy material for transportation of drink water.

There were made some activities within the development of the new waterwork pipes:

- Unification and standartization of the fiber glass pipes;
- Package of designing and engineering works to certify fiber glass pipes (including inner coating and hermetic materials);
- Estimation of fiber glass pipes life used for transportation of hot, cold, salt drink water and other various agents at normal and elevated temperatures.

Prototype pipes have been tested. A pilot lot of 25 km long has been produced and supplied to municipal water and sewage facilities of the Perm region and the Republic of Komi.

Now we have the infrastructure of manufacturing capacities to product a pilot lot of the pipes from 80 to 315 mm in diameter, pressure to 2.5 Mpa. It has been started in the Republic of Komi for cold and hot water transportation with the annual output of 50 km of pipes. Design documentation has been drawn for pipes with flange sleeves and sigot and socket joints.

A set of experimental works is to be completed; additional research and testing is be carried out; estimation of effects of various agents on the life and reliability of fiber glass pipes used for water transportation is to be done.

Introduction of economical, environment-friendly productions (fiber glass pipes with joints) based on composite materials, requiring less investments than steel pipes manufacturing. Glass fiber pipes, produced by winding of binder-saturatcd fiber, have better technical and operational characteristics than steel ones: their life is 5-8 times longer as compared to metal pipes. A fiber glass pipe weighs 6-8 times less than a steel pipe of similar design, which cuts transportation and assembling costs. The pipes do not require anticorrosive protectection.

Fiber glass pipes production can be performed in any region, in the vicinity of customer s facilities. It does not demand large investments and power resources.

TECHNICAL DIAGNOSING OF METAL CHLORODUCTS AT INTRACITY WATER-CONDUCTING STATIONS FOR INDUSTRIAL AND POTABLE WATER SUPPLY

Petrushin L.V., Shishkin A.V.
LENNIICHIMMASH Co.

The chlorine gas use for the purification and harmless rendering of the water create: the special problem of the chloroducts operation safety in the intracity water-conducting stations for the industrial and potable water supply after their long life or installed resource exhausting.

In these conditions it is necessary to evaluate the technical state of the chloroducts to take a decision about the further operation.

LENNIICHIMMASH Co. have the experience in the set problem solution by way of technical complex chloroducts diagnosing.

On the basis of the technical and operational documents examination (certificates, drawings, layouts, operational journals) the works program is drawn up taking into account the design philosophy and operation conditions prior chloroducts diagnosing.

The quality control of the basic metal and welded connections by nondestructive technique, chloroducts strength rating with regard to the control results, hydraulic and pneumatic testing, rated evaluation of the residual chloroducts safety resource according to the well-founded selected criterion of the limit condition are included into the works program for diagnosing.

The control by nondestructive technique is carried out for the exposure of inadmissible operational and processing defects by way of external inspection, color or magnetopowder defectoscopy. ultrasonic defectoscopy, thicknessmetry.

If needed, in particular during the specification of the defects nature revealed by other technique, the metallografic studies are applied with use of polystyrene replicas copied from the microsection prepared directly on the chloroduct metal and examined by optical microscope.

During the control the special attention is paid to the spots of the stresses concentration: bending, compensation elbow, underground sites of the chloroduct.

The rating of the chloroduct strength is made according to the certified program therewith the minimum permissible thickness of the wall and stressed state in the spots of the admissible defects detection are determined that can serve as stresses concentrators.

In the residual resource evaluation the wall thickness decrease as a result of the corrosion, probable change of the stressed and deformed state in the defects spots in the form of hollows or corrugations are taken in the capacity of the limit state criterion. The complex technical diagnosing allows to determine with greatest probability the real technical state and permits to issue the proved conclusion about the possibility of the further chloroduct safe operation.

The methodics is applied by LENNIICHIMMASH Co. at the water-conducting stations of the industrial and potable water supply in St.Petersburg city.

TECHNICAL DIAGNOSING OF METAL CHLORODUCTS AT INTRACITY WATER-CONDUCTING STATIONS FOR INDUSTRIAL AND POTABLE WATER SUPPLY

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PREDICTION OF AVERAGE DAILY WATER CONSUMPTION IN THE CITIES OF THE CIS DEPENDING ON NATURAL AND WEATHER CONDITIONS AND OTHER FACTORS

Petrosov V.A.
TPA "Kharkovcommunpromvod"

The natural growth of population on our planet and, naturally, in the countries of the CIS, better living conditions, bring forth the need for a higher degree of water provision, which is usually evaluated by the average daily per capita consumption (over a year). The tendency of urban water supply development is influenced by multiple factors, such as the floor-space of accommodation and the degree of equipment with modern amenities, the degree of industrial development, the capacity of water systems, the effect of the environment etc.

When developing general plans of urban water supply for a time span of 20 - 25 years, recommendations of Construction Regulations 2.04.02-84 are used, which fail to take into account the prediction methods of mathematical statistics based on the correlation analysis of water supply, depending on the number of population, the total housing floor-space, the density of urban population, natural conditions and climate, etc. This approach is, without doubt, unable to provide an adequate prediction of water supply for the purpose of town-planning, increases the risk of water supply problems occurring over long periods of the city's development, reduces the reliability of evaluating capacity of water and waste water facilities.

The approach that we propose for a long-term prediction of water supply has been developed on the basis of cybermathematical methods, involving the use of multiple factors.

A mathematical model of taking into account town-planning and natural conditions, as well as climate, is proposed. In accordance with this model, with a view to retrospectively evaluate the specific average daily consumption in the cities of CIS (over 1984), many parameters were found that influence water consumption in the cities with different geographic locations, which runs counter to instructions of the Construction Regulations 2.04.02-84 (Table 4) to consider all the cities as being alike. The research was made on the basis of the initial parameters that influence water consumption in the cities with different geographic locations. They are as follows: the annual amount of radiation (kkal/cm^2), the relative humidity (%), the geodetic elevation over the sea level (m), the average annual amount of precipitation (mm), g-factor (v/sec^2), the thermodynamic temperature (°K), the population (mln. people), the total floor-space per urban citizen (m^2), the average annual albedo (A) in %, the average annual water vapor elasticity (mb), the city pollution halo based on the data of space photography for 1984 (km^2), the geographic latitude and longitude (degrees), the number of average daily air temperatures above 0°C in the cities (degree-days), the length of period with the average daily temperature 0°C (days).

At the first phase of developing regression equation pairs, the non-linear transformation of an independent variable was postulated on the basis of the character of the factor being investigated, and taking into account the work-

ing experience in water supply industry, as well as an intuitive notion of the model structure.

The data received (with a probable error of 5.9 l/day per capita) indicate that the specific average daily water consumption (over a year) is set excessively (6% to 39.2%) high, which suggests that calculations related to urban water supply systems should be made more accurate.

An accurate prediction of demand for water, in the final count, leads to its rational use, allows to develop programs for planning the water companies' activities, to estimate the possibilities of deferring the construction of production facilities, taking into account the standard duration of construction, as well as the process of "freezing" the growing consumption of water resources. The proposed approach is one of the ways to ensure a true saving of natural and power resources, of reducing cost of materials in other branches of the economy, it is also a way of bringing-in high-tech solutions. Use of high technologies in a state is an indication not only of its economic power, but also a demonstration of the state's care of the people, of every individual and his family.

ELECTRODELESS ELECTROCHEMICAL REACTIONS INSTEAD OF OZONATION

Piskarev I.M., Sevast'yanov A.I.
MSU, Institute of Nuclear Physics, Moscow, Russia

The decomposition of chemical compounds by means of electric discharge is well known. These results don't used on wastewater treatment plants as effectiveness of these reactions are not so high as desirable. In this work the first attempt was made to investigate a chemical reactions of decomposition at small discharge current: 0.05 - 0.1 mA (corona discharge), 0.5 - I mA (spark discharge) and at high strength of electric field in electrode-liquid gap (2 - 3 kV/mm). The goal of these exploration was to find a conditions for which the effectiveness of chemicals decomposition by electric discharge would be close to that by radiation-chemical reactions. Authors of previous works seems don't assumed the abruptly decreasing of discharge current will caused the increasing of reaction yield, therefore they don't investigated an electric discharge by current less then 10 mA.

It was stated the discussed reactions take place in surface layer of liquid having thickness 0.1 mm between active particles (H, OH, HO_2, O_2 , O3, H_2O_2), created in gas phase, and chemicals dissolved in water. The intermixing of treated liquid layer with thickness 20 mm was realized under action of pulsed electric field, having strength about 2 kV/mm, applying to liquid during the breakdown of discharge gap by electric discharge. The highest efficiency was obtained by negative polarity of voltage on discharge electrode, discharge current 0.1 mA (corona discharge) and for the case gas phase was pure oxygen. The yield of decomposition the chemicals, investigated by us (phenol, chlorbenzol, dichlorethane, cyanides, oil in water, gemiceHulose) were about 10 equiv/F or so.

The electrodeless reactions can be used for wastewater purification instead of ozonation. In this case an electric discharge must be immediately above the treated liquid surface (not in different modulus). Many active particles are created by ozone generation process in usual ozonator (for instance, excited states of oxygen molecules), however in the course of transportation of ozone-air mixture to ozonation tank many active particles were lost. In the case of electric discharge between liquid surface and electrode above it these particles would interact with chemicals, dissolved in water. The decreasing of ozone yield owing to presence of water steam and leading to OH radicals production will increase the effectiveness of decomposition as reactivity of OH radicals is essentially higher then that for ozone.

There are possibility to create a new advanced oxidizing technology, using the electrodeless electrochemical reactions.

CRITERIA AND PRINCIPLES OF CONTROL OVER DRINKING WATER QUALITY (ACCORDING TO THE METHODOLOGICAL GUIDELINES ON THE IMPLEMENTATION OF SANPIN "DRINKING WATER")

Plitman S.I., Zholdakova Z.I., Rogovets A.I.
Research Institute of Occupational Medicine RAMS,
A.N.Sysin Research Institute of Human Ecology and Environmental Health RAMS,
Department of State Sanitary and Epidemiological Surveillance of Public Health Ministry RF, Moscow, Russia

The following principles served as the base for the development of new documents SanPin- Sanitary Rules and Norms, (V.T.Mazaev et al.) and Methodological Guidelines on Hygienic Requirements to Quality of Water in District Systems of Drinking Water Supply:

the necessity for harmonization of Russian standards with WHO recommendations,

use of new scientific knowledge on drinking water health effects;

acknowledgement of the fact that the water quality of surface and underground water sources has deteriorated everywhere, while the water treatment technologies used often do not meet the requirements.

SanPiNs have preserved the requirements contained in GOST "Drinking Water", but also have incorporated a

number of new statements, in particular, a strategy of development of a work program for water quality cintrol based on findings of extended studies is given.

A number of contradictions hampering practical implementation of SanPiNs were removed or specified in the process of development of Methodological Guidelines (MG) based on WHO principles:

- the need to meet the interests of safety and health protection of the population as a priority;
- impossibility to waste money on determination of indices of relatively low hygienic significance in the process of water quality monitoring;
- mandatory taking into consideration local peculiarities.
- The following aspects are covered in the document:
- principles of development of work programs for drinking water quality control are considered;
- recommendations on the choice of methods of control over contaminations content in the water source and in drinking water, metrological requirements to them, control over levels of chemicals not specified in SanPiNs, taking decisions on changing the procedure of water preparation and of other elements of water supply are given;
- situations when locally it is regional standards that should be adhered to are described;
- a number of technical and organizational activities aimed at implementation of SanPiNs, including set up of laboratories maintaining current water quality control, are presented.

A principally new statement on differentiation of the list of indicators in extended studies depending on the object – be it a source, treated water, water from the distribution system, is introduced.

Criteria for the choice of chemical and microbiological indicators with an account for local peculiarities are presented. According to MG local sanitary and epidemiological surveillance agencies can assess danger and health risk from consumption of water not meeting hygienic requirements. Criteria for the assessment of the degree of MAC exceeding and class of danger of a chemical, types of negative effects (carcinogenic, mutagenic etc.), "dose-response" relationship, "dose-status" relationship in time are given; restrictions to the use of the summation principle are presented. For that summarized data on the toxicity and danger of more than 60 most common for drinking water chemicals is given.

MG present hygienic criteria for taking immediate and long-term decisions.

THE RESULT OF FUNCTIONING THE SERTIFICATION SYSTEM OF POTABLE WATER AND ITS TRENDS OF DEVELOPMENT

Podlepa S.A., Taktastov V.A.
All-Russion Scientific and research institute of standartization Moscow, Russia

The vertification system of potable water, materialy, production processes and equipment, used in economic potable water supply" developed by specialists of Gosstandart, Goskomsanepidnadzor, RAMS and Minstroy and introduced in the state in 1995 the joint resolution of Gosstandart and Goskomsanepidnadzor, specified the principles of conducting the certification of conformity of objects of the state social and producting economy sphere. At the same time the basic strategic direction of the system formation and management, its subject-object constituent, organization structure, methodical principles of the certification of conformity of object, normative and methodical base, informative, personnel and economic provision.This resolution specified also the principles of scientific and technical policy of the certification system, the essence of which is to provide its major objectiveusing methods and means of standartization and certification to contribute to complex decision of the tasks of improving potable water quality, the effectiveness of the equipment used,the materials reagents and production processes of water purification and treatment.

The certification system of potable water functions within GOST R certification system and has both legally regulated (obligatory) and voluntary sphere of the certification of comformity. Owing to this, the urgent task is futher development of its legil base and achievement of stability interrelation with already made and newly established systems of obligatory and voluntary certification, including the certification system of food products and food raw materials, the certification system of power facilities for conformity to safety standards, the certification system of chemical products, the accreditation system of metering laboratories ("Analytics") the ecology certification system.

The nomenclature and object base of the certification system covers the following groups of objects including various types of drinking.

Water, water treatment equipment and devices materials substances used in economic potable water supply. Futher expension of the certification system field of application is carried out during developmentand introduction of domestic technological legistation, preparation of state standards as normative base for the purposes of certification as well as the results of practical approbation of methodological principles of certification of verious groups of the system. Formalization of the system nomenclature objects was realized by specifying the system documents as well as by expanding the list and nomenclature of the products, subject to obligatory certification, confirmed by Russia Federation Goverment and Russian Gosstandart respectively.

The system organization and functional structure includes the Central body (VNIIstandard), 6 regional bodies for certification (in Central,East-Siberian, Far East, Ural, Volgo-vyatskom and Nord-West Russian regions), as well as 14 test laboratories,accredited by Russia Gosstandard

acording to the certification system rules. The system infrastructure development shall be carried out by establishing a series of regional bodies, by including separate objects (mainly bottled drinking water) into the field of certification bodies accreditation "The certification system of food products and food raw materials" as well as accreditation of the test base available (about 300 testing laboratories) according to the rules of the certification system of potable water. The criteria of accrediting bodies for certification and testing laboratories according to the rules of the certification system of potable water were regulated by state standards, prepared for affirmation.

The system normative base is formed by two major directions: specification to certification objects and then test methods. The first one is the national standards for potable water of centralized systems of economic potable water supply (replaces GOST 2874 on Russian Federation territory), interconnected with SanPin 2.1.4.559-96 and the standards for prepacked drinking water, home water treatment devices and materials (reagents), used in economic potable water supply. The urgency of these documents development was noted by the participants of the Federation Council Parliament hearings " Provision of Russia Federation population with potable water" of December 2,1997. The second one is the development of national standards for test methods accounting for and based on international standards ISO/TC 147 with their metrological certification. At present there are 26 state standards for control and test methods valid, 8 standards are being prepared. The state standartization plan for 1998 covers 19 standards. This work is carried out accounting for the resolution of Russia Gosstandart Boads of 1996-03-06 in view of Metrological provision of the certification system.

Normative and methodological provision of the certification system was formalized in the form of 4 documents affirmed by Gosstandart Board Resolution and Goskomsanepidnadzor Resolution of April 28,1995. As a result of studies made and practical aprobation of methodological approaches to the certification of comformity of objects, more accurate version of the certification rules was developed and presented for registration to Minust of Russia. For the period of the system functioning more than 600 object were certified half of which relate to the sphere of obligatory certification, a third of them- production imported to Russia.

Personal provision of the system is formed upon the principles, established by the system of experts certification. Taking them into account the qualification requirements to experts on certification and their specialization and the programs of training and periods of probabation were developed and affirmed. At present certification of drinking water and water treatment plants in the system is conducted by 35 experts on certification enlisted in Gosstandart catalogue. The primery aim of the personal provision in preparation of experts on equipment, materials and reagents certification.

The basis of personal provision of the system comporises state catalogues which are conducted by Central body of the certification system, including: catalogue of certification objects, catalogue of accredited bodies on certification and test laboratories expert catalogue.

Therefore, the introduction and functioning of the certification system of potable water has provide time-lines and urgency of its creation, practical ability and functional effectiveness, made it possible to determine new stages of its further development.

APPRAISAL OF IONIZING TECHNOLOGIES APPLICATION IN WATER TREATMENT

Popov G.P., Kosenkova I.L., YBaranova u.G., Tikhonov G.P., VSaveliev.G., Minaeva I.A.
State Academy of Water Transport, Moscow, Russia

Some papers [1, 2] elaborates on an assumption of oxidizing capacity of water connecting it with formation of OH radicals and oxygen atoms - O. Presence of these particles is believed to facilitate spontaneous self-purification and self-disinfection of water. In this context the appraisal of likelihood of formation of these active particles (AP) in water is very important. AP can appear in sewage or drinking water as well as in chemically pure water as a result of ionization of water molecules.

It is assumed that AP formation can be appraised by a row of energy characteristics the values of which are given in the Table using data from [3]. The Table gives heterolytic reactions with ion formation (Group I) and homolytic reactions with radical formation (Group II). It is seen that homolytic reactions, taking into account their energy effect (ionization energy or affinity to electron, in eV) — E_i are more likely than heterolytic because, according to (3) E_i is less than the energy of OH radical atomization. Besides, it should be assumed that OH is stable because E_i, according to (10) is less than 4 eV. Transfer of OH radical into ion OH^- (13) requires little energy and, thus, formation of OH and OH^- is very likely. In energy terms formation of molecular ions (11, 12) and other AP (11, 14 and 16) are most preferable, too. Hydration according to (7, 8) and (17, 19) is energetically very beneficial. These processes give a high exoeffect that is indicative of a homolytic mechanism with formation of aqua-complexes both on a proton (7, 8) and hydroxyl (17), and not simply a hydrogen bond. Therefore, it can be concluded that homolytic reactions is energetically more preferable when proceeding in water because here not migration of ions occurs, but redistribution of electron density.

It should be said that reactions (19 or 20) reflect a process of water dissociation and here $[H^+] = [OH^-] = 10^{-7}$ g ion/l, and it is proved that 1 molecule of H_2O of 556×10^6 ("A" condition) is subject to decomposition. Consequently, even in the course of electrolysis discharges of H^+ and OH^- ions are unlikely and one should take into account somehow proceeding discharge of water because even in interaction of Zn with acids the process $H^+ + H^- = H_2$ is assumed [3].

Let us analyse appearance of atomic hydrogen. Heat of atomization of water and OH^- (2,3 and 10) requires energy capacity. Discharge of OH^- into OH (13) and then its atomization (3) is also difficult in energy terms. Therefore, appearance of O atoms without a discharge effect in an electric field is unlikely, especially if to take into account "A" condition. Probably it is in a double electric layer affected by a potential difference conditions are created for oxidation of OH- — ion and more so of $H_3O_2^-$ (17) with formation of oxygen atoms — O and follow-on process $2O = O_2$.

Atomic oxygen probably appears only in a near-anode space. As O_2 and O are still generated in water, then the appearance of oxygen atoms is connected with decomposition of hydrogen peroxide H_2O_2 (20). But appearance of H_2O_2 in water is observed when subjected to irradiation, electric discharge and even cavitation. Therefore irradiation of water leads in principle to appearance of oxygen atoms and their recombination: $2O = O_2$. It can be concluded that it is radicals - molecular ions that make up a group (AP) that, being valency unsaturated, energetically excited, are capable of binding chemical pollutants in water and deforming cells of micro-organisms. Conclusions on likelihood of processes only by Ei values can be not convincing enough, especially for processes with endoeffects. One should take into consideration kinetic regularities determining output. However, if to keep in mind that processes given in the Table are initiated by irradiation with various energies, then it can be assumed that a thermodynamic factor — E_i will agree with kinetic characteristics. This is the more so because if to take into consideration functional bonds between H, $\bar{k}T$ and $T\Delta S$, then the entropic factor turns out sufficient to determine progress of endothermal processes exposed to irradiation. Therefore, it is assumed that when water is exposed to irradiation the quants of which possess energy exceeding an average energy of chemical bonds in water (~ 4,2 eV) irradiations are capable of generating AP ensuring water purification and disinfection. Consequently, development of ionizing technologies as a new method of water treatment is very advisable.

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Table

Group I			Group II		
Reaction	E_i эВ	№	Reaction	E_i эВ	№
$H_2O=H^++OH^-$	-16.6	(1)	$H_2O=H_2+0,5O_2$	-2.97	(9)
$H_2O=H+H+O$	-9.58	(2)	$H_2O=0,5H_2+OH$	-2.95	(10)
$OH=H+O$	-4.47	(3)	$H_2O+e=H_2O^{-1}$	+0.91	(11)
$H_2-e=H_2^{+1}$	-15.5	(4)	$H_2O-e=H_2O^{+1}$	-0.55	(12)
$H_2=2H$	-4.51	(5)	$OH+e=OH^{-1}$	+2.82	(13)
$H-e=H^{+1}$	-13.7	(6)	$OH-e=OH^{+1}$	-0.58	(14)
$H^{+1}+H_2O=H_3O^{+1}$	+11.5	(7)	$H+e=H^{-1}$	+0.78	(15)
$H_3O^{+1}+H_2O=(H_5O_2)^{+1}$	+4.16	(8)	$H_2+H^{+1}=H_3^{+1}$	+3.04	(16)
			$OH^{-1}+H_2O=(H_3O_2)^{-1}$	+4.99	(17)
			$H_2O=H^{+1}+OH^{-1}$	-0.59	(18)
			$3H_2O=H_3O^{+1}+H_3O_2^{-1}$	-0.59	(19)
			$H_2O_2=H_2+O_2$	-1.95	(20)
			$2OH=H_2O_2$		(21)
			$2H+O_2=H_2O_2$		(22)
			$2H_2O+h\nu=H_2O_2+H_2$		(23)

THE KARELIA WATER SUPPLY DEVELOPMENT PROGRAMME PROJECT DESCRIPTION

Porttikivi R., Sarkioja A.

North Savo Regional Environment Centre, Finland

A water supply study has been convicted by the Finnish and Karelian specialists. The work consists of three reports in Russian and Finnish: Karelia Water Simply Development Programme (January 1997), General Plan for Water Supply in the District of Suojarvi (January 1997) and Guidelines for Water Simply in the Rural Areas (September 1997). The work provides for the use of clear drinking water to be taken from underground sources which are of the same glacial origin in both countries. The joint effort which was initiated in 1993 is continueing by ground water mapping, detail planning and implementing pilot projects.

The project forms a part of the co-operation between

Finland and Eastern Europe, and has been financed by the Finnish Ministry of Environment, Finnish Ministry of Agriculture and Forestry, and by the government of the Republic of Karelia. The following organisations have participated in the realisation of the project: On behalf of the Republic of Karelia: The Karelian Committee of Housing and Municipal Economy, the Karelian Water Institute of the Russian Academy of Sciences, the Geological Expedition of Karelia, the Institute of Hygienic Control and the Karelian Ministry of Ecology. On behalf of Finland: The Finnish Environment Institute, the North Savo Regional Environment Centre and the consulting company Soil and Water Ltd.

Cuircnt State of Water Supply

The water supplied in Karelian towns is currently satisfactory in a quantitative sense. Surface water, which is abundantly available, is used as the sources of raw water almost without exception. However, quality-wise the situation is poor: the present treatment processes are insufficient considering the low quality of the raw water sources. The distribution network usually does not cover the entire area, and a rapid amelioration is unlikely due to the current unfavourable economic conditions.

Geneial Principles of the Water Supply Development Pkogianmie

Improving the quality of the water is the primary goal of the Karelia water supply programme. Expanding the coverage of the distribution network to reach a larger part of the population is a secondary goal which will be implemented at a later stage. The programme has sought to create a plan according to which easily financed, effective measures can be implemented quickly. The goal is to provide the population with safe potable water. For example, springs will be restored and more effective chemicals will be utilised at the existing waterworks.

The long-term objective of the Karelia water supply development programme is to achieve European quality standards for potable water in the year 2010. Therefore, there must either be a change to the use of better raw water sources (mainly ground water), or a significant improvement in the effectiveness of the treatment process. These developments will simultaneously require additional training for the personnel of the waterworks.

Quality of the FbtaMe Wrier

When judged by European quality standards the greatest problems regarding *tap* water in Karehan are the high colour value (counts even higher than 100, humus) high levels of chemical oxygen demand (organic substances, mainly humus), low pH-levels (often under 7), softness, and high concentrations of iron as well as manganese. The quality is, when measured by European standards, unacceptably poor.

Healt Hazards

The consumption of tap water in Karelia can in some instances be considered a health hazard. The water often contains unhealthy inorganic and organic substances, as well as microbes which cause diseases. The spread ofwaterbome diseases has several times been reparted in the area covered by the water supply programme. For example in November 1996 a Hepatitis A epidemic raged in Suoj'arvi and 150 people were affected. The epidemic was due to the contamination of a spring (from which potable water was transparted to the community by car) by the seepage of sewage.

Carcinogens

High levels of mutagenity have been detected in Karelian tap water during studies performed for the water supply development programme. Samples taken from tap water showed a variation between 1 500 and 16 000 as measured by the AMES test. The reason is to be found in the high humus content of the water, in combination the addition of substantial amounts of chlorine for disinfection. The high levels of carcinogens clearly lead to an increase in the susceptibility to cancer by the population. Puudos, Karhumaki, Kern and Kostamuksa suffer from the highest levels of mutagens. The tests performed in the municipalities all showed levels of 8 000 or higher.

In Finland, where the humus content of the surface water is very high as in Karelia, the levels of carcinogens have decreased by two thirds since the 1970s (when the levels were at their highest, ca 3 000 on average). The changes have resulted from the development of more sophisticated treatment techniques.

Solutions Raw Water

There is a need for better raw water in the republic of Karelia. Water from the large, mainly unpolluted lakes can still be used, as long as the raw water intake is situated (or moved) to an area not too close to the population centre where pollution levels are higher. However, usually ground water provides the best source of raw water, either natural, artificial or abstracted from boreholes.

Treatment

Improving the treatment processes will be necessary where high quality raw water is unavailable. Initially the treatment processes can be upgraded through the use of additional chemicals. In addition to intensifying the chemical treatment, waterworks still under construction should be examined and finished where deemed appropriate. The following step would include the installation of new partial processes in the existing facilities.

Distribution Network

The condition of the distribution networks are estimated to be weak. The networks should be studies and the extent of the necessary rehabilitation assessed on a network by network basis. According to local estimates, 10- 80 % of the distribution networks need to be rehabihtated. Befare the new, high quality water is utilised it is important that the existing network is thoroughly rinsed. If not, there is a risk that the water from the improved waterworks or a new raw water source would become contaminated in the network.

Groundwater Protection

In some areas the ground water has already been contaminated. Therefore, as the general ground water survey is carried out, special care should be taken to *map* ground water quality, especially in areas where the risk of pollution is high. Areas of importance in terms of water supply should in particular be mapped and protected.

Rural Areas

There seems to be a lack of knowledge in the villages and rural areas as to where and how to construct a good well. It is recommended that information on the construction, use and maintenance of wells is distributed both to authorities and the

local populations in Kareha.

Measures for All of Karelia Statistical Records

There are some good local statistics on water simply in the Republic of Kareha as a whole. However, the statistics are not yet complete; for example, the statistics of water supply and distribution systems owned by industries have not always been reported. Furthermore, there is some conflicting information in the statistics due to inadequacies of the data collected as well as differences in the way the recards are kept between the districts.

Measuring and Monitoring

Currently water quantities are measured only seldom in the Republic of Karelia. However, it would be important to measure the water taken into, distributed, as well as the amount consumed, in order fo follow up on the functioning of the water supply system. Furthermore such a follow up will add to the rehabihty of the billing system, provide the consumers with incentives to conserve water and add to the level of detail of the statistics. Precise knowledge about a water simply system is important when new investments are planned; there should be neither under nor overproduction of water.

Mapping of Ground Water Formations

At the time being information regarding ground water is lacking in the Repubhc of Karelia. The available information exists in conjunction with surveys made for the purpose of extracting gravel and sand. There has been no uniform mapping of the ground water resources. This should be done for the Republic of Karelia in its entirety. It is an important precondition for the use of ground water.

Water Supply Industry

As long as the investments proposed by the programme are even pardally made, water *supply* will be a prosperous sector of economic activity in the Republic of Karelia. Pipes, vents, wells, waterposts etc. will be needed for the construction work, and these can to a large extent be produced locally. The necessary investments will thus vitalise and strengthen the Karelian economy. A new industrial branch can prosper due to all the investments.

THE BASIC TRENDS OF THE SOLUTION OF THE ECOLOGICAL PROBLEMS OF THE WATER ECONOMY OF THE CITY OF MOSCOW

Poupyrev E.I., Ishtchenko I.G.
MOSVODOKANALNIIPROJECT Moscow Institute for Water & Wastewater Research & Design, Moscow, Russia

Taking into account the main principles of the Concept of stable development and reforming of the housing and communal services, MOSVODOKANALNIIPROJECT Institute organizes its activity in the field of the water economy ecological problems solution according to the following principles:

- the economic and rational usage of the water resources,
- the evaluation, prediction and control of drinking water quality in the City,
- the monitoring of the maintenance and improvement of the water objects.

The solution of the problems of the economic and rational usage of the water resources includes the development of the prescriptive and legal documents, the analysis and adjustment of complex ecological programs, the development of the documents containing the information concerning the methods of rational water usage.

The main trends of the development of the system for the evaluation, prediction and control of drinking water quality in the City include the protection of the water supply sources, the improvement of the barrier function of the facilities and the reduction of water abstraction from the surface sources.

The well-developed system of the ecological monitoring of the water supply sources and the adjacent territories is the obligatory condition for water quality improvement. The monitoring envisages the solution of the following problems:

- the establishing of the data bases concerning the ecological condition of the water supply sources;
- the certification of the polluting objects;
- the study of pollutants transformation in atmosphere, river water and surface run-off;
- the calculation of the pollutants balance in a water supply source;
- the prediction of the possibilities of water quality deterioration in a water supply source, as well as the long-term prediction of a water source water quality changing tendencies.

A possibility of emergency situations occurrence within the water catchment areas still exists during the recent years, that is why the water treatment plants must have the relevant information at their disposal and, having the relevant package of algorithms and programs, they are to provide the prompt prediction of water quality sharp changes at the water intakes of the treatment plants as well as to make adequate decisions concerning the treatment mode changes.

Based on the long-term data concerning the condition of the water supply sources of the City of Moscow and the trends of environmental water quality changes, MOSVODOKANALNIIPROJECT Institute in collaboration with the other leading institutes has developed the modern technologies for environmental water treatment based on the application of flocculation, ozonation and sorption methods. The specialists of the Institute have carried out the Project of Roublevskaya Water Treatment Plant Reconstruction which meets all the modern requirements for the water treatment technology. The similar project developments are carried out for the other three Water Treatment Plants of the City of Moscow. At present one of the most important problems in the field of project development is the selection of the

optimum variant that would provide the maximum speed of the transition to the new technology with some minimum reconstruction expenditures.

At present the Institute in collaboration with MOSVODOKANAL Moscow State Enterprise carries out the study aimed at the improvement of the reliability of the operation of the networks of the drinking water supply system of the City of Moscow with the identification of the required scope of the preventive maintenance and rehabilitation work concerning the pipeworks and the equipment of the water supply network of the City of Moscow for the required reliability level stabilization.

The necessity of the work in the field of the monitoring of the maintenance and improvement of the water objects is caused by the fact that the ecology of the City of Moscow is considerably determined by the condition of the water objects. That is why within the framework of the Water Monitoring General Concept the Institute develops in detail the system of monitoring and management of the water quality of the water bodies and the waterways located at the territory of the City. This task is in full accordance with the complex ecological program of the City which is under development at present.

The regulations concerning the status of the water objects of the City and the water use order have been developed based on the Water Code of the Russian Federation. The document is the juridical basis which secures the right of the City of Moscow (as a subject of the Russian Federation) to use and protect the water fund of the City; this document also determines the status of the water objects and the main trends of their usage and their condition monitoring.

There have been made the inventory and the classification of the natural waterways (including the waterways subject to anthropogenic transformation) and the riverside territories of the City of Moscow; there have also been developed the measures concerning the improvement of their ecological condition. The condition of the hydrographic network of the City has been evaluated and the prediction of its further technogenic transformation has been made. All the information concerning the parameters of the waterways are included into the computer data base which is connected to the numerical map of «The Hydronetwork of Moscow» Geoinformational System developed by the Institute on its own initiative.

In accordance with the main concept of the water bodies complex usage for various types of water use, the Institute and PRIMA-M Closed Joint Stock Company develop the monitoring system taking into account its existing federal, municipal and departmental subsystems. The application and the adaptation of the existing systems will provide the possibility to establish a more efficient system of the City's water objects complex monitoring.

Within the framework of the general scheme of surface run-off disposal from the territory of the City, the Institute in collaboration with the Research and Design Institute of GENPLAN, MOSINSHPROJECT and MOSVODOKANAL MSE takes part in the establishing of the treatment facilities system as well as in the reconstruction and development of the waterways networks taking into account the water economy balance and the balance of the pollutants from the territory of the City. In order to regulate the operation of the run-off disposal system the Institute initiated the development of the Regulations for surface run-off reception into the drainage system taking into account the specific nature of the pollutants from industrial, residential and other territories of the City.

Within the framework of the realization of the Water Code concept concerning the mutual responsibility of the subjects of the Russian Federation for the condition of the water objects in their joint use, the Institute designs the treatment facilities for municipal wastewater, industrial wastewater, surface run-off and communal wastewater at the level that provides the possibility to establish the interrelations with the downstream water users on the basis of equality and partnership in the field of water use.

CRITERIA FOR SELECTION OF NANOFILTRATION MEMBRANES FOR DRINKING WATER PRODUCTION

Povorov A.A., Dubyaga V.P., Platonov K., Kornilova N.V.
CJSC "Membranes", Vladimir, Russia

Many of nanofiltration (NF) membranes used for drinking water productions are characterized by great difference in mono- and polyvalent selectivity which results in unstable permeate producing calcium carbonate sediment while boiled.Criterion for selecting NF membranes is as follows: membranes should produce stable permeate containing mineral salts in compliance with physiological norms.

According to World Health Organization (WHO) recommendations minimum required and optimum water ratings for organism are the following: hardness - min. 1.5 mg•equiv./l; alkalinity - 0.5 mg•equiv./l; TDS - min. 100 mg/l (optimum TDS totals - 250-500 mg/l).

Composite polyamide and cellulose acetate membranes manufactured at CJSC "Membranes" and having standardized test solution selectivity of 20 to 80% at p = 0.5 MPa were tested using tap water of the city of Vladimir and the standardized test solution (0.15%w NaCl) in order to determine their transport characteristics and permeates stability.

Fig. 1, 2 shows the dependence of hardness and HCO_3^- selectivities with water of the following content: Ca^{2+} - 4.7 mg•equiv./l, alkalinity 5 mg•eguiv/l, TDS - 330 mg/l, p = 0.3 MPa on the standardized test solution selectivity.

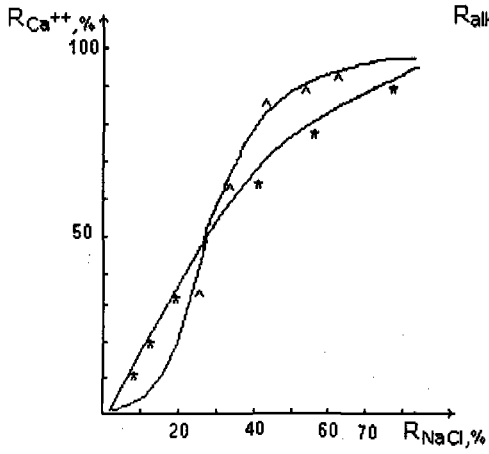

Fig. 1.

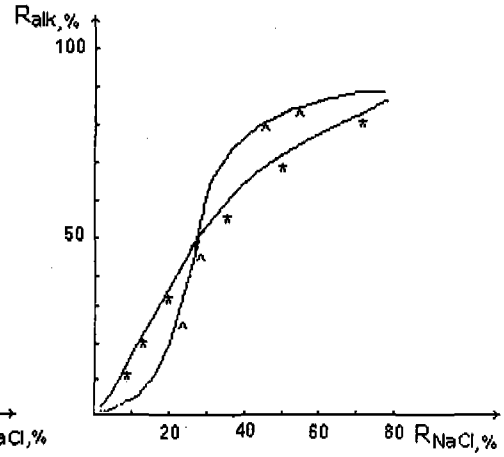

Fig.2.

Fig.1. Ca^{2+} selectivity against NaCl selectivity

* - cellulose acetate membranes of MGA series

Fig.2. HCO_3^- selectivity against NaCl selectivity

^ - composite polyamide membranes

NF membrane permeate stability depends basically on hydrocarbonate (alkalinity) and calcium-ions selectivities therefore cellulose acetate membranes permeate stability with 0.15 NaCl solution selectivity less than 25% is higher than that of composite polyamide membranes.

Based on the test results optimum NF membranes characteristics and criteria for their selection for drinking water production with total dissolved solids (TDS) have been determined: less than 500 ppm - NaCl selectivity = 30-50%; 500 - 1000 ppm - NaCl selectivity should be - 40-80%; 1000-3000 ppm - selectivity - min. 90%.

PURE WATER MEMBRANE HOME UNITS FOR DRINKING WATER PRODUCTION

Povorov A.A., Smirnova N.V., Kadykina G.A.
CJSC "Membranes", Vladimir, Russia

Today many water sources are contaminated and poisoned due to the inemense scale of industrial development and it places the problem of pure, safe water among the world's most urgent. The Russian Federation Government federal special-purpose program "Russia's Population water supply" (N 573-p) enumerates the main measures for our country population supply with ecologically safe drinking water. Such measures include large scale commercialization of the technological processes developed during the last years by scientific-research firms:

- high molecular weight flocculants structures and apparatuses;
- new filtering materials;
- double layer carbon-sand filters;
- bactericide irradiation units;
- mixing machines;
- flocculation chambers;
- thin layer blocks;
- floatating filters;
- membrane units.

The program also provides both the reconstruction of the present day and the development of new advanced technologies and structures for drinking water pre-treatment at the centralized water supply systems and the commercialization of the compact domestic units for individual water consumers.

In this connection the development and use of the small scale home and public services units with their autonomous service, always ready to be used and their small overall dimensions and weight which allow to obtain high quality drinking water seem to be a promising trend in solving the problem of the population supply with high quality drinking water.

Nanofiltration and low pressure driven reverse osmosis membranes based technologies used in home units which allow to obtain high quality physiologically full value drinking water, i. e. having salt content necessary to satisfy the biological requirements of a man are considered highly promising at the moment.

Nanofiltration and reverse osmosis processes low operating pressure (16 bar, max.) of the nanofiltration and reverse osmosis membranes based technologies makes their usage economically beneficial. Moreover, because of low reagents consumption used for membranes cleaning and disinfection the mentioned processes are environmentally friendly.

At the present time the membrane home units with 3-14 l/h and public services units with 50 - 10000 l/h outputs have

been developed and produced serially at CJSC "Membranes".

Ultrafiltration membrane equipped membrane home units "Ручеек 1 с" and nanofiltration membrane equipped " Ручеек 2 С" new derivative have been developed. A single housing unit combines compactly four stages of water treatment: tap water pre-filtration to remove suspended particles, spiral wound membrane element treatment to remove heavy metals and other highly toxic contaminants, activated carbon additional treatment to remove organic and chlorine-containing contaminants and to improve taste and to decontaminate water with biocide solution.

To improve the ergonomics the membrane home unit "Ручеек 2С/10-Комфорт" integrated improved derivative has been developed and produced at CJSC "Membranes" to obtain high quality drinking water with 60 l/d output for your house. The operating principle is based on the integration of the membrane technology (nanofiltration) and conventional water treatment methods.

Improved product water taste is obtained through the use of granulated mineral additions and due to design modifications. The unit is installed under a sink and has a prefilter, a storage container for product water (12-24 l) and a distributing faucet.

The units have been certified by the sanitary-epidemiological inspectors state Committee and by the Standard Committee of the Russian Federation.

ACTIVITY OF THE SERTIFICATION BODY OF POTABLE WATER AND WATER TREATMENT UNITS

Prilipko L.A.
VNIIstandard, Moscow, Russia

With a view of adopting effective meaqures to mevent selling in Russia of home water treatment units and bottled potable water of domestic and import production of bad quality which can cause damage to population heath, by decision of Gosstandart and Goskomsanepidnadzor of March 1994 VNIIstandart was entrusted with the functions of head organization on scientific and methodological questions in the field of standardization and sertification of potable water and also the function of the sertification body, accredited in 1995 according to the rules of the sertification system of potable water, materials, production processes and equipment potable water supply (accreditation sertificate № РОСС RU. 0001.11ПВ01).

At the initial stage the sertification body participated in the development and carried out pilot approbation of fundamental documents of the sertification system of potable water, materials, production processes and equipment, used in economic and potable water supply. The activity of the sertification body is carried out in accordance with the requirement of Russian Federation Laws. "Sertification of product, and services", "Sanitary and epidemiological population prosperity", "Production of consumers rights, as well as on the basis of valid documents of the sertification system of potable water, organizational-methodical and normative documents of Russian Gosstandarart".

For the period of functioning the sertification body issued about 600 sertificates of conformity, including for: potable water, packed in reservoirs water treatment units, mineral water alcohol free and alcohol drinks, distilled water and ofter production.

Among them 50% sertificates of conformity were given to the domestic production with preliminary production estimation is carried out involving the specialists of the sertification body of quality systems (VNIIstandart).

The sertification body performs cooperation with Russia Gossanepidnadzor bodies , ensures impartial evaluation of sertification bodies in accordance with the rules of the sertification system of potable water. Besides , the body cooperates with accredited sertification bodies in legally regulated sphere, in particular with VNIINmachment, VNICMSV - on sertification of materials and reagents. The testing base for sertification purposes in liaison with the sertification body comprises 8 independent laboratories.

At the same time the sertification body has permanent scientific and technical contacts with recently established sertification bodies of the sertification system of potable water in other region of Russia (North-West, Ural, Fare-East itc.), renders them methodical aid in organized sertification activity.

Specialists of the sertification body take direct part in standardization activities in the field. In particular a Gosstaddart was developed for portable water packed reservoirs in 1997.

The specialists participated in prepar ng a draft national standard instead of GOST 2874, the catalogue of sertified hater treatment units was prepared be used, a series of the specifications for water treatment units and potable.

Water, packed in reservoirs was developed, permanent scientific and methodical aid to plants-manufacturers is being rendered.

The leading specialists of the sertification body take an active part in theoretical training of candidates to experts of potable water sertification of water treatment units as well as their practical probation on the body base. The sertification bodies are given also methodical support in preparing and accrediting sertification bodies and test laboratories of the sertification system of potable water, materials, production processes and equipment, used in economic potable water supply.

In its activity the sertification body cooperates with the Central body of the sertification system of potable water, with Technical committee TC 343 "Water quality", with scientific and research institutes of Russian Minzdrav and regional bodies of Russia Gossanepidnadzor, NII of municipal water supply, NIIVODGEO, NII of water problems, with plants of water supply and manufacture of water treatment equipment and other organizations.

WATER TREATMENT DEVICES-CONDITIONERS – A PROMISING FUTURE IN THE DEVELOPMENT OF PORTABLE DEVICES FOR DEEP FINAL TREATMENT AND TREATMENT OF DRINKING WATER

Rakhmanin Yu.A., Mikhailova R.I., Kirianova L.F., Sevostianova E.M., Solntseva D.P., Krasnov M.S.
A.N.Sysin Research Institute of Human Ecology and Environmental Health RAMS,
G.S.Petrov Research Institute of Plastic Materials, Moscow, Russia

Because of the ever increasing technogenic contamination of water sources a problem of supplying the population with good quality drinking water is very urgent. A great number of water process devices providing final treatment of drinking water from different types of technogenic pollution have appeared on market. However, all existing process devices do not solve such a vital problem as providing the water with biologically essential microelements, such as calcium, magnesium, fluoride, iodine, selenium etc. Quantitative disturbances in the administration of microelements into the organism and their being nonbalanced in the environment are pathogenetic factors of endemic diseases, and they also decrease general resistance of the organism to infectious diseases. With an account of results of studies of the biological effects of microelements a new additional criterion of drinking water quality assessment is substantiated --a criterion of its physiological adequacy, based on the need of regulating not only maximal allowable, but also minimal essential and optimal levels for a number of biogenic elements and indicators adequately reflecting the compliance of macro- and microelement drinking water composition.

The water obtained from the existing house-hold and collective water treatment membrane devices is significantly demineralized and does not meet the requirements of its physiological adequacy. Besides, in Northern regions of Russia low-mineralized water sources are used, which demands the necessity of enriching the water with mineral salts, biologically essential, in the first place: calcium and magnesium compounds. A promising technique of enriching water with minerals by their direct dosing when the water is in contact with composition polymeric granulated materials containing mineral compounds of calcium and magnesium.

The biological effects of one of the most common elements fluorine are qualitatively different depending on its water concentration. It is common knowledge that fluorine is a biologically essential element in case of a daily uptake of 2.9 mg (for adolescents and young people). Fluorine deficiency in diet has a significant effect on dental caries development. The water factor bears utmost importance in caries prevention.

According to WHO experts data drinking water fluorination is the most money consuming and most available method of caries prevention, its anticaries efficacy being high (50-60%).

One of the most reliable ways of drinking water fluorination program is fluorination of the limited amounts of drinking water – using house-hold treatment devices. Since water fluorination is not the only problem with respect to improving its quality (the presence of chemical and microbic contamination) scientists from the A.N.Sysin Research Institute of Human Ecology and Environmental Health together with other organizations were the first to develop house-hold fluorinators-treatment devices of the «Barrier» and «Topaz» type and collective process devices functioning in a highly dynamic regime of filtration with changable fluorination blocks. House-hold fluorinators-treatment devices provide not only the improvement of organoleptic properties (taste, odour, turbidity, colour), but also deep final treatment of the limited volumes of water from various chemical pollutants, including chlorine-containing hydrocarbons, and also saturation of the treated water with fluorine in optimal levels without a risk of overdosing.

OPENED PLASMA SOURCE OF ULTRAVIOLET OF RADIATION FOR WATER CLEANING TECHNOLOGY

Rakhimov A.T., Rulev G.B., Saenko V.B.
Institut of Nuclear Physics of Moscow State University, Moscow, Russia

The intensive ultraviolet (UV) sources, which spectrum of radiation provided maximum bactericidal effect, present the significant interest for water cleaning technology [1,2].

As usual, the UV-technology of water clearing and sterilization is based on using the low pressure mercury lamps [2]. The 90% of their irradiation is concentrated in a spectral line 254 nm. Due to their high power efficiency, the bactericidal mercury lamps are left out the practically unique UV source, which finds the wide application in a water cleaning technology. At the same time, the intensity of this UV sources is limited by self-absorption in a mercury vapor, so the UV light intensity is strongly depends from the working temperature of a lamp. Besides this UV source radiation spectra is not optimal for the bactericidical application. It is well known, that the photoabsorbtion spectra of the nuclein acids is a broadband (170-300 nm) and has two maximumes: on a wavelength of 265 nm, which is optimal for absorbtion the mercury lamps irradiation (254), and the more intensive photoabsorbtion peak near the 200 nm [3]. The serious problem is a salvaging of ecologically dangerous mercury lamps.

We developed the pulsed discharge UV source, which is opened and can work in the enviroment atmosphere. This UV source heavily radiates in the spectral range 180-300 nm during 1-2 mks pulses with frequency up to 10^4 Hz, (Fig.1). A UV source represents the line or the grid of plasma

microdischarges with density of about 10 sm^{-2}. Their parameters are adjusted over a wide range for reception of necessary intensity of radiation in a preset spectral range. The method of discharge organization permits easily to pack an UV source with any other devices for water cleaning. The intensity of an UV source in a spectral range 180-300 nm is determined by a power supply and can be presetted in a wide range. There of the bactericidal effect can be achieved during the time of 1-10 seconds. Unlike from known bactericidal lamps the offered UV sourse is ecologically safe unit. Besides the offered UV source provides the instant availability for service and its parameters do not depend on enviroment temperature. The expensive UV optical materials are not used in a design of the UV source. The microbiology tests of the UV sourse are conducted and positive recalls are received [4]. The experimental device for cleaning and disinfection of a water is developed.

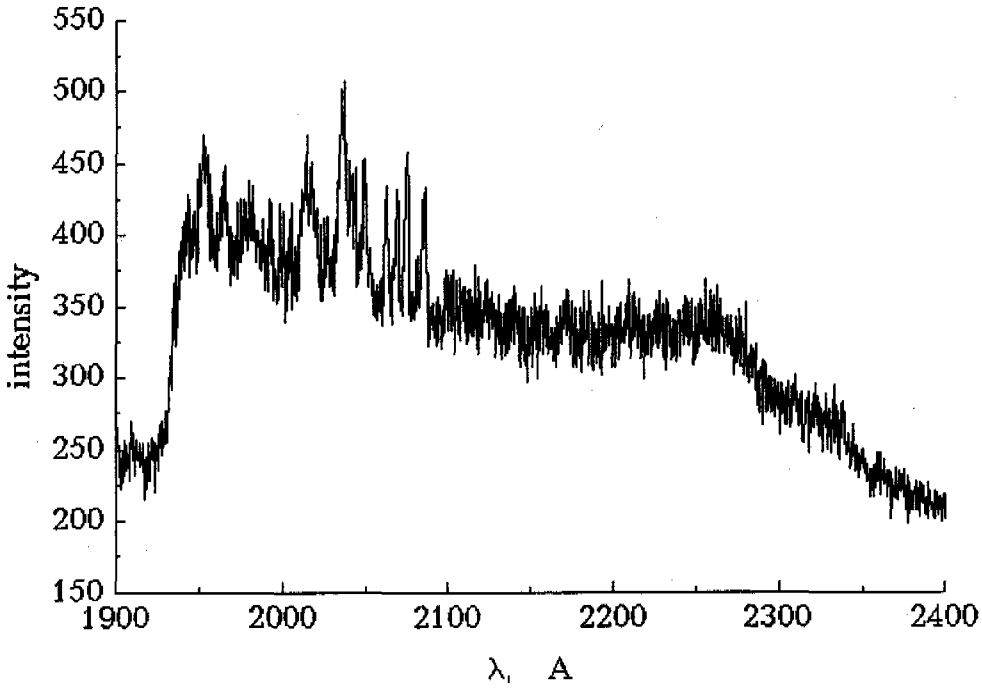

Fig. 1 The radiation spectra of an air plasma UV source.

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SEARCH FOR EFFECTIVE BIOCIDAL COMBINATIONS TO PROTECT WATER DISTRIBUTION PIPELINES AGAINST BIODAMAGE

Rodin V.B., Kobelev V.S., Akimova N.A., Kholodenko V.P.
State Research Center for Applied Microbiology, Moscow region Obolensk, Russia

Biocides are the most common agents used to combat biocorrosion of metals as well as pipeline biofouling. Despite that biocides applied in high concentrations kill microorganisms, some of them often result in corrosion and environmental contamination. The use of synergetic biocidal combinations may help in overcoming this problem.

The following biocidal combinations were tested: tributyltin acetate (TBA) + katone, TBA + CTAB, TBA + baccide, TBA + K_2CrO_4, TBA + carbamol, TBA + cuprum sulphate, katone + CTAB, katone + cuprum sulphate, CTAB + baccide, CTAB + cuprum sulphate, baccide + cuprum sulphate, K_2CrO_4 + cuprum sulphate, and carbamol, + cuprum sulphate.

Serratia marcescens SG, a steel destructor, was used as a test-culture. Biocides were diluted and introduced then into 0.05% peptone-added glucose-mineral medium to study

their effects. The biocidal action was measured by the following parameters:

- MIC - minimum inhibiting concentration of medium-introduced biocides, at which the culture does not grow when plated in concentration of 500CFU;
- MIC_{90} - biocidal concentration decreasing tenfold the number of CFU;
- K_{75} - biocidal concentration reducing the maximum specific rate of the growth by 25%.

The direction and value of the synergetic effect was determined by the parameter *N* as follows:

$N = A/P_{x+y}$, where: *x* and *y* – biocides, P_{x+y} - value of a biocidal mixture under research, *A* – theoretical value of evaluation parameters at the additive effect. Value *A* was calculated by the following expression: $A = P_x + P_y = P_x + aP_x$, where P – value of any evaluation parameter, $a = P_y/P_x$.

In the first series of experiments, a semi-quantitation analysis of the combined action of indicated biocidal paires was made, with MIC being used as an evaluation parameter. In a combination baccide + cuprum sulphate, biocides were found to suppress each other by 1.6 time. The combinations such as katone + cuprum sulphate and CTAB + cuprum sulphate were synergetic, while the other combinations turned to be additive.

A quantitative analysis of the combination katone + cuprum sulphate was performed using a mixture, in which the concentration of katone was tenfold higher than that of cuprum sulphate. Values MIC_{90} and K_{75} were applied as evaluation parameters. Data are depicted in Table. The parameters were calculated by empiric equations derived by the method of the least squares on the basis of data obtained. As seen from the Table, the synergetic effect increased by 1.3±0.1 for K_{75} compared to the expected additive effect and by 3.9± 0.9 for MIC_{90}.

Table. Quantitative characterization of katone + cuprum sulphate synergetic effect.

Biocide	K_{75}	MIC_{90}
$CuSO_4 \cdot 5H_2O$	0,0015±0,0001	0.0049±0,0001
Katone	0.027±0,004	0.036±0,002
Biocidal mixture ($CuSO_4 \cdot 5H_2O$,% = 0.1 katone) Experimental data	0.0077±0,001	0.0058±0,0013
Biocidal mixture ($CuSO_4 \cdot 5H_2O$,% = 0.1 katone) Calculation (parameter A)	0.0965	0.0229
Parameter N	12.5±1,4	3.9±0,9

The offered approach can be applied to search and quantitate synergetic biocidal combinations. The synergetic combination katone + cuprum sulphate promotes efforts in combating water distribution pipeline biodamage.

Investigations were performed in the framework of Project #119-95 of International Science and Technology Center (ISTC).

THE EVALUATION OF THE QUALITY OF THE SPRING WATER USED BY THE POPULATION OF THE CITY OF MOSCOW FOR DRINKING PURPOSES

Romanova G. I., Kouzmina N. P.
MOSVODOKANALNIIPROJECT Moscow Institute for Water & Wastewater Research & Design, Moscow, Russia

There are several dozens of springs in Moscow replenished from various water bearing strata. The water of these springs is traditionally used by the population for drinking purposes.

These springs are mostly located in the valley of the Moskva River with its tributaries. According to B. M. Danshin's data, 140 wells and springs were studied in the twenties and almost all the water samples taken from them were recognized to be more or less polluted judging by the results of chemical analyses. In the author's opinion at that time pure springs could be found as an exception only in the entire area of the City of Moscow.

The bowels of Moscow consist in places from glacial sands and cleaved carboniferous limestones of relatively high water permeability. The hydrogeological materials collected and worked in detail by B. M. Danshin in 1920 - 1928 reveal that the 4th post-Jurassic aquiferous stratum and the 7th Upper Carboniferous (the 1st artesian) aquiferous stratum are not protected from surface water penetration well enough. The complex and heterogeneous geological composition of the territory of the City of Moscow, the long period of intensive technogenic influence, as well as the process of underflooding that exerts adverse influence on the communications and building foundations may result in industrial and bacterial pollution of the water bearing strata.

Numerous factors influence the obvious destroying of the ground water budget as a result of technogenic influence.

At present the spring water of the City of Moscow is under constant control of the Sanitary Inspection of Moscow within the framework of brief sanitary analyses.

Taking into account the high level of technogenic loading within the City boundaries and insufficient protection of the water bearing strata that replenish the springs as well as the necessity to evaluate the possibility of spring water usage as

an additional water supply source under the conditions of increasing shortage of water from the surface sources, the Water Supply Sources Laboratory of MOSVODOKANALNIIPROJECT Institute (the Laboratory has been accredited by GOSSTANDARD) performed in 1995 - 1996 a detailed inspection of the springs, checking out the complete list of indices in accordance with the requirements of the relevant Standards.

24 springs were seasonally inspected in the following areas: Pokrovskoye-Streshnevo, Phyli-Davidkovo, Borisovsky Ponds, Kouzminsky Forest Park, Kolomenskoye, Shepylovsky Proyezd, the flood-lands of the Yauza River and the Lykhoborka River, Bytsevsky Forest Park, Yasenevo, Teply Stan, Krylatskoye and South Bootovo.

It should be mentioned that as a result of the City infrastructure development all the wells have disappeared in Moscow during the period from the twenties up to the present; the number of the springs has dramatically decreased (approximately 5 times) and by the end of the inspection period some springs located in the flood lands of the Yauza River and the Lykhoborka River as well as in South Bootovo and Shepylovsky Proyezd have failed.

85 indices were determined in every water sample taken.

The analysis of the data obtained revealed that the formation of the spring water hydrochemical character depended on the conditions of the water exchange during various seasons between the groundwater and the surface water as well as on the proximity of pollution anthropogenic source.

Compared to the other springs, the purest water was the water from Krylatskoye and Teply Stan; only a single case of the allowable standard value exceeding (bacterial contamination - coliform index) was noted during the inspection period. The exceeding of the permissible standard values for petroleum products, iron, manganese, cadmium, aluminium, hardness and organic phosphorus pesticides was less frequent.

Nitrates and bacterial contamination (coliform index) were the most common indices concerning which the increased content or the exceeding of the permissible standard values were noted in the water of the springs examined during the inspection period.

The content of some organoleptic indices (colour, for example), organic substances (oxidizability, synthetic surface active substances, aromatic hydrocarbons, haloid methanes, etc.), biogenous compounds (nitrites, ammonium, phosphates), toxic metals (strontium, lithium, copper, barium, nickel, zinc, lead, chromium, etc. - 17 denominations altogether), sodium, potassium, chlorides as well as radio-activity value in spring water comprised the values 5 - 10 times lower the permissible standard values.

The content of chlorophenols (six derivatives), m, p, o - xylols and some nitrogen -, phosphorus - and organic chlorine pesticides (for the 17 preparations identified) was under the detection limits which were 0.02; 0.04 and 0.01 micrograms per dm^3 for each group of the compounds correspondingly.

In conclusion it should be mentioned that judging by the results of the inspection, the springs in Krylatskoye, Teply Stan and a spring in Pokrovskoye-Streshnevo are the safest ones from the point of view of using their water for drinking purposes. The rest of the springs for several indices during certain seasons are not safe and can not be recommended to be used by the population for drinking purposes without preliminary treatment.

EXPERIENCE OF THE URAL REGIONAL BODY ON DRINKING WATER CERTIFICATION

Rosental O.M., Kardashina L.F.
The Ural centre of standardization and metrology, Yekaterinburg, Russia

Bottled up drinking water and water-purifying equipment are widely spread products. There is high demand for them in different regions of the world irrespective of tap water quality. These products cost more to Muscovites than to those who live in the Urals, which shows an abnormal distribution of consumer demand especially because water quality in the Urals is much lower than in Moscow. For wider spreading of these products in the Urals it is necessary to improve their quality which will win back consumers' trust.

Characteristics of a number of water-purifying equipment offered to the Ural consumer are unsatisfactory, notwithstanding that the enclosed documents testify to the opposite. Besides some equipment which is effectively used in Moscow can be economically inacceptable in the Urals due to short operation period guaranteed. All the above mentioned factors reduce consumer demand.

This report deals with compulsory certification as a product quality improving instrument.

Quality of bottled up water is determined by characteristics of water sources, water intakes, bottling lines and reservoirs used, and also by control trustworthiness. The necessary condition of getting a certificate of conformity is providing that all above mentioned characteristics are satisfactory and all terms and conditions of transportation are strictly kept. It is known that part of bottled up drinking water is put on the market with no documents guaranteeing its conformity to the existing requirements. Producers make ample use of self-advertisement /inappropriate information on the labels, confusion of drinking water and remedy characteristics etc./. The main disadvantages of water-purifying equipment are its short operation period guaranteed, especially with bad quality waters, and insufficient quantity of water indices at which water characteristics improve. The Ural regional "Body on certification of drinking water, materials, technological processes and equipment used in economic drinking water supply" wants all these technical characteristics to be mentioned in enclosing documents truly. Only in this case it is possible to win back consumers' trust, because consumers have right to know what they are paying for.

There are positive changes due to the chosen policy in the field of certification. Producers tend to improve consumer characteristics of their products, they work out and

inculcate new solutions of the problem of quality and therefore raise production and competitiveness of products and services. We expect an increase in assortment of drinking water and water-purifying equipment bearing the mark of conformity, as more and more producers apply to the body on certification. This is hopeful as consumers can now have easier access to standard quality drinking water.

DRINKING WATER CERTIFICATION IN STATE CERTIFICATION SYSTEM

Rosental O.M., Kardashina L.F., Ageyev V.P., Sursyakov V.N., Mekhontsev E.A.
Ural centre of standardization and metrology, Department of Education of Sverdlovsk region, Yekaterinburg, Russia

State certification system is created as an instrument to protect consumer from bad quality products. Drinking water, materials, technological processes and equipment certification in particular aims at providing an access to standard quality drinking water. This report gives a summary of work which has been done to solve this problem in child educational institutions of Sverdlovsk region. It was necessary to create a network of effective water purifying equipment in child educational institutions with the highest level of microbiological and chemical pollution of water and therefore to reduce morbidity rate /general, catching and digestive diseases/.

The following aspects were taken into account:

- health hazard degree of certain drinking water polluting components;
- presence of these components in tap water of local child institutions;
- efficiency of water purifying process using the offered equipment and perspectives of inculcating the latter into existing hydroeconomic systems of educational institutions.

Certification tests made it possible to forecast the effect of the work and plan immediate expences.

According to the medical statistics data analysis and chemical and technological tests of the certified water-purifying equipment it is recommended to use low-pressure reverse osmosis systems in child institutions of Yekaterinburg, Irbit, Alapayevsk, Tavda, Ivdel, Kachkanar, etc. This will reduce microbe pollution of drinking water, improve its organoleptic indices, reduce to safety level percentage of metals, salts, halomorphic compounds generated in the process of water disinfection.

In 1996 the planned amount of water-purifying equipment was assembled and put into operation. At present efficiency of its work in hydroeconomic systems of educational institutions is subject to supervision and is determined by the changing number of acute and chronic diseases. This report gives the first results of the supervision showing that the undertaken steps enable to improve health indices and reduce, and sometimes eliminate the difference in morbidity rates in institutions with different water quality.

The report also gives data on efficiency of state certification system to provide further solution of the problem of access to standard quality drinking water in educational institutions.

BIOCORROSION AS A MAIN FACTOR OF THE INNER DAMEGE OF HEAT PIPE LINES AND STRUGGLE PROBLEMS

Rozanova E.P., Dubinina G.A., Lebedeva E.V., Entaltseva L.A.
Institute of Microbiology, Rassian Academy of Sciences. Moscow, Russia

1. Under investigation were the water and inner corrosive deposits of the heat pipe lines of Moscow city (closed system) and one of the Moscow - region colony (opened system). Tubes were made from steel-3. The heat pipe lines was characterised by high temperature ranges of water (from 70 to 110° C for the move in type magistral and from 40 to 70° C for the recirculating type), alkaline pH value (8,6 - 9,6), large quantity of supplementary water and low oxygen concentration (about 500 mkg/l). The inner corrosion of tubes and metal demage reached 60 - 100% from external.

2. It was discovered that thermophilic microorganisms of corrosion - dangerous groups (suspended in water and fixed on deposit) were spread in the investigated magistrals, namely microaerobic iron - oxidative and thionic bacteria, anaerobic iron - reducing and sulfate - reducing bacteria (SRB). These were neutrophilic and alkaliphilic microorganisms. In open system pipe lines hydrodgen - cation exchange was used. In this system autotrophic SRB utilizing hydrogen were the most predominant forms.

3. We carried out laboratory experiments to clear up the steel-3 plates corrosion factors. In the experimental series microorganisms isolated from the heat pipe lines (or contaminated deposits) were cultivated in the media with steel-3 plates. In the control series microorganisms were absent. As a result of these research it was shown that the microorganisms play the main role in the steel-3 corrosion and demage.

4. Elemental and mineralogical analisyses have demonstrated a similarity of corrosive deposits of the plates in laboratory experiments with those ones that were formed in the heat pipe lines. It was concluded that different corrosive deposits were in connection with metabolism of microorganisms of different physiological groups. Oxides and suboxides

of iron compounds were predominant among the corrosive deposits, namely goetite, lepidocrocite, magnetite, siderite. Elemental sulfur and roentgeno - amorphous phase of iron compounds were also revealed. The first one was found essentially in opened heat pipe lines system with water enriched by sulfate.

5. Increase of the water pH value from 8,6 to 9,6 did not prevent of the microbial metabolism, but influenced the direction and the rate of bacterial processes, and as a result corrosive conditions were changed.

6. The reason of periodic hydrogen-sulfide appearence in the pipe lines water containing high concentration of sulfate was cleared up. It was result of biogenic processes (sulfate - reduction) and abiogenic reactions and took place while the rapid temperature rising to 90^0 - 110^0 C.

7. Taking into account the biogenic factor is the main corrosion agent we have proposed to exchange a present heat water preparaition technology for a new one

EXPERT EXAMINATION OF UTILITIES IN THE CONTEXT OF REFORMING THE HOUSING AND COMMUNAL SECTOR OF ECONOMY

Schegolev A. V.
Fund "Institute for Urban Economics"

The only way how to overcome the crises in housing and communal sector is to change the system of its finance which implies transition from budgetary subsidizing to users' full coverage of housing and utility services providing that low income households are socially secured and utilities have economic indices to upgrade the quality of their services.

Throughout 1994 - 1995 the sharp growth in housing and utility rates made it possible to keep them in pace with inflation, with residents' coverage of operation costs of the utilities at the same time running up from 2-3% to 20-40%.

Since increase in utility costs outpaced the rate of inflation, municipalities keep subsidizing maintenance of the housing stock and compensating the difference in heating prices at the same level.

The next stage of reforming the communal sector invites to focus all efforts on minimizing utilities' costs and making them more reasonable since there are strong grounds to believe that steady growth of the cost of housing and utility services exceeding the rate of inflation may be explained by existing monopoly of utilities.

Expert analyses of utilities performances may prove to be useful for establishing control over them.

Currently inadequate legislation fails to provide opportunities for conducting regular examination of utilities.

RF Law "On Competitiveness and Limitation of Monopolies' Activities on Commodity Market" fails to provide for the State Anti-Trust Committee opportunities to influence the utilities when they sell their services at controlled rates. Besides the majority of utilities are not subject to RF Law "On Natural Monopolies".

Pursuant to RF Government Resolution "On Straightening Out the System of Housing and Utility Payments" local self-governments shall approve rates of use of housing and utility services, as well as rates and tariffs of payment for them (except electric power and gas tariffs). This Regulation provides to local administrations a real opportunity to limit the monopoly of utilities, first of all, of heat suppliers. But it appears next to impossible to check the process of costs estimation which serve as the basis for establishing rates and tariffs, especially when utility services are produced by a non-municipal enterprise.

Very often in some regions work of local Power Resources Committees appear to be ineffective. Rather examination than auditing.

According to effective legislation standard auditing procedures includes two stages:

- to check the correspondence of bookkeeping and accounting statements and reports to RF effective standards;
- to state auditor's opinion on reliability and consistency of bookkeeping and accounting of a business entity.

To examine utilities' performances it is required to carry out a complex of actions including:

1. auditing of records and accounts
2. organization auditing
3. legal expert examination
4. management auditing
5. process and technology examination

Complex expert examination is the most preferable but it is hard to be done due to the lack of professional companies ready to fulfill such work.

Binding force of expert examination

Effective legislation fails to provide an obligation of compulsory auditing of utilities - natural monopolies, to say nothing of complex expert analysis.

But still local administrations stand a good chance to make such auditing compulsory through issuing a regulation on tariff-setting procedures. The regulation may call for mandatory expert examination of utilities when rates and tariffs are under review.

Complex expert examination will contribute to:

- the process f establishing control over utilities;
- reduction of local budgetary expenditures;
- easement of social tension provoked by the increase of residents' coverage of housing and utility costs;
- making the image of enterprises - natural monopolies more agreeable.

POLYALUMINIUMCHLORSULPHATES - EFFECTIVE COAGULANTS FOR HIGH-TURBID AND HIGH-COLOUR SURFACE WATERS PURIFICATION

Shabanov M.V., Canda S.
National Technical University of Ukraine, "Kiev Polytechnical Institute", Kiev, Ukraine

The main source of drinkable water supply on the african continent are mountain rivers with rapid current. The lowest parts of these river- beds are situated on soft soil of the plains which tend to washing away the banks. Besides that a great amount of humus, poisonous chemicals used in agriculture and household wastes are washed down in the rivers by atmospheric precipitation annually. It's due to absence of purification constructions on most regions. Qualitative indices of water, including turbid, colour, content of pathogenic microorganisms, do not correspond to the recommendations of the All-World Health Protection Organization. And this fact affects the health of the population in the most unfavourable way.

Annually in the result of mulnutrition and infections diseases about 11 mln children under 5 years die in the countries of the "third world". 55% are connected with diarea, caused by the bowels function disorder because of unsatisfactory quality of drinking water. More than 80% of tropical diseases are transmited with water and their outbreaks can be explained by absence or insufficient effectiveness of municipal and household flows treatment systems and shortage of drinking water safe for usage.

In literary sources [1-3 and others] there are references that polyaluminiumchlorides (PAC) posess bactericidal properties, and using PAC in combination with Sulphate of Aluminium (SA) in coagulation purification of water gives high effectiveness of processes on suspended substances and colour [4 and others].

We have synthesized coagulants of complicated composition polyaluminium-chloridsulphates on the basis of raw materials from Angola and investigated their composition and properties. Spectral, derivatographical and chemical methods of investigation determined that PACS are substances of variable composition, which is expressed by the general formula $Al_n(OH)_{3n-m-2k}Cl_m(SO_4)_k$, basis of which is a function of media acidity in which they appear and live. It has been also established that at concentration more than 2 mol/dm^3(on Al_2O_3) PACS are transformed in condition of crystallohydrate, molecule content of crystallization water in crystallohydrate composition being different, depending on the basis.

Investigations of coagulation ability PACS on model water cotaining suspended substances 20 mg/gm^3,(colour 70°, coli-index 20 intestinal bacillus/gm^3 preparation station of Kiev) containing suspended substances 10 mg/gm^3, coli-index 20 intestinal bacillus/gm^3 and on drinking quality water (on Desna water preparation station of Kiev) containing suspended substances 10 mg/gm^3, color 30°, oxidizing 10,2 mg O_2/gm^3 at 5°C, pH 8,1 were conducted. The objects for comparison were solutios PAC and SA identical in Al_2O_3 concentration. Obtained results show that the best indices on such waters can be achieved by using PACS of composition $Al_2(0H)_2Cl_2SO_3$: turbid decrease for 98,5 -97,5%, colour - 91-97%, coli-index - for 60-70%, oxiding - 86-90%. PACS and SA showed the following results correspondingly: turbid decrease for 92 and 71%, colour - for 82 and 75,5% coli-index for 70 and 15%, oxidizing - for 66 and 37%.

We have worked out technological parameters of processes of achieving PACS from mineral raw materials from Angola and from wastes of metal aluminium.

The conducted work showed possibility of real improvement of ecological situation on the African continent in the shortest terms by realizing in practice the results of the obtained scientific research.

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SELECTIVE INORGANIC SORBENTS USED IN DRINKING WATER DECONTAMINATION TECHNOLOGY

Sharygin L.M., Poluyachtov A.I., Galkin V.M., Teterin D.M.
PRC "Termoxid", Zarechny, Sverdlovsk region, Russia

Physico-chemical and sorption properties of inorganic sorbents (ion-exchangers) of the "Termoxid"-brand (T-3A, T-3, T-5) were investigated and practiced with water decontamination technology. The sorbents show high ion-exchange capacity and higher selectivity to iron, heavy toxic metals (Pb, Cu, Zn, Be, Cd, Mn, Si, NH_3 etc.), radionuclides, transuranium elements and other impurities.

The Research and Production Company "Termoxid" manufactures the sorption materials by low-tonnage quantities and water chemistry facilities 0.04-5.0 m^3/h production capacity for drinking water purification. Filters used in the facilities provide decontamination, complying with the state standard requirements "GOST 2874-82. Potable Water" even when the content of Fe, Mn, Cr, Zn, Si heavy metals salts, ammonia, F, active Cl, chlorine organic impurities in initial water is 3-5 times higher than normal. These sorbents are

very effective for Co, Cs, Sr radionuclides decontamination as well.

The manufactured inorganic sorbents have Hygienic Certificate and "GosSanApidNadzor" Licence for their application for drinking water purification. At the end of the sorption lifetime the inorganic sorbents are regenerated and used in a repeated cycle.

The Termoxid sorbents used in a combination with other sorption materials and disinfection blocks are very effective for potable drinking water preparation.

THE PRINCIPAL RESEARCH EFFORTS OF NDKTI MG IN THE FIELD OF WATER SUPPLY AND DRAINAGE

Shcherbina G. P.
NDKTI MG, Kyiv, Ukraine

The global pollution of natural water resources caused by the powerful technical and anthropogenic influences requires the persistent improvement of the water treatment technologies, using the last achievements in chemistry, physics, biology, ecology and other sciences.

The specialists of the Research and Development Institute for Municipal Facilities and Services (NDKTI MG) develop or improve the existing technological process both for potable and drainage waters.

Our collaborators are solving the problems of deironisation, demanganisation, defluoridisation in ground waters; those of coagulation, ozonisation, slow filtration and removing of phytoplancton in surface waters as well as complex technologies for ground waters treatment in the northern oil-and-gas bearing regions, containing considerable amounts of unhealthy components (gumus substances, ferric and manganese organometallic complexes, ammonium ions, oil products, methane).

The filtration processes and consequently the filtration materials set the central place in the modern water treatment technological processes. The role of loading material at the filtration facilities, according to the developed technologies, is played by the natural zeolite-clinoptilolite, corresponding all the requirements (including the license of the State sanitary organs) to materials applicated in domestic and potable water treatment systems.

The unique characteristics of clinoptilolite (absorbic, cation-exchanging, molecular-sieving, catalytic) are making possible not only the intensification of the traditional water-treatment methods but also the creating of new original technologies (in particular, the technological process of natural waters conditioning).

Having used the specific characteristics of zeolite by means of their modification, we have received the composing material, active to the fluorine ions which became the base for ground waters defluoridisation technology.

The following criteria were taken as the principal: technological effectiveness of all the stages of process realization; the efficiency concerning all the costs; the ecological and the final quality effectiveness.

In order to solve the problems of surface waters treatment, the technological process of contact and volumetric coagulation, as well as the process of filtration through zeolite-clinoptilolite or its combination with other efficient sorbents have been developed.

The application of oxidizing and sorption methods based on the preliminary water oxidation by ozone with the following filtration through zeolite filters is the efficient way of surface waters conditioning.

The effective method of solving problems concerned with the supply of high quality potable water is the application of ray water intakes instead of surface facilities.

In order to secure the fast and efficient realization of the above-mentioned technologies, the special equipment of the technological module units has been created . Each of the standard water treatment units consists of the modules of degassing, coagulation, filtration (pressure and non-ramming versions). The pump compressor unit with corresponding capacity, reagent units and decontamination unit are the supplementary modules. Such system permits to choose the necessary modules of units for every object.

Nowadays the sewerage system of Ukraine meets two main problems of the maintenance and improving of sewage water treatment facilities.

During last years the Institute carries out the research and experimental works connected with the problem of rising efficiency of existing water treatment facilities in cities and towns and the creation of new efficient facilities.

The Institute elaborated the guidelines for management of process of removing and oxidizing contaminations in the traditional biological treatment systems with aid of corridor aeration tanks-clarifiers and secondary sumps which make possible the improving not only of organic contaminations treatment but also of nitrogen and phosphorus compounds treatment.

One of the most efficient modifications of such equipment are the aeration tanks-clarifiers with two-level area of clarification which have been put into operation at the Yalta wastewater treatment plant. It permitted to rise the transmissive capacity of the plant.

The next modification of aeration equipment are the aeration tanks-clarifiers of column type which have been put into operation at the Uzin wastewater treatment plant in Kiev region. The construction of such facilities is being completed in the towns of Saky and Stary Crym. Their introduction will allow to reduce significantly the area of structure and to reduce almost to 25% the energy consumption simultaneously with improving of water treatment quality.

For small-sized water treatment plants the biological treatment facilities of module units construction with capacity of 25; 100; 400 m^3/day have been created. The operation of aeration tanks clarifiers performing in the complete oxidizing mode is taken for a base.

The characteristic feature of these facilities consists in the replacement of pneumatic aeration system with the jet

one. This allowed to rise considerably the reliability of equipment operation and simplified its setting.

During the last years the Institute initiated the research and experimental work on creation of physicochemical treatment facilities. In the frames of the complex interfield program "The Provision of Ukrainian Municipal Economy with the communal equipment" the technical project of typical physicochemical facilities with capacity of 100 - 700 m^3/day has been elaborated.

In the course of realization of the State complex program "Organization of the new efficient coagulants and flocculants manufactured with the further development of technologies of their introduction in systems of natural and sewage waters treatment" elaborated in 1996, the basis for application of the above-mentioned progressive sewage water treatment technology in Ukraine. This will allow to reduce the investments up to 20 - 30% and to accelerate the terms of putting into operation of objects of canalization. This direction of works becomes very important because of the necessity of sewer systems introduction in the considerable number of the cities and towns where it exists already the centralized water supply system but there is no the centralized sewage system (consequently, these cities are the real sources of the environment pollution).

The considerable volume of research and experimental works is carried out by the Institute in the field of improving the methods of treatment of sediments and sludge, creating as a result of the sewage water treatment process, including the technologies of aerobic sludge stabilization, mechanical dewatering with application of the new types of coagulants and flocculants made both in our country and abroad, sludge dewatering and drying on highloading sludge beds with mechanical cleaning of the dried sludge etc.

In the frames of above-mentioned complex interfield programme a number of facilities for sewage treatment plants is being developed, including: bar screens of rod type; waste water percolators, units for dewatering of solid wastes, submerged pumps, square sand traps with mechanical sand removing; aeration equipment etc.

The Institute fulfills the Program of water supply and sewage facilities development, adopted according to the decree of Cabinet of Ministers of November 17, 1997.

THE IONS OF HEAVY METALS IN WATER MASS OF WELLS AND DRILL HOLES USED FOR DRINKING WATER SUPPLY

Sheinerman N.A., Sergeev S.M., Slepyan E.J.
International Centre "Bioecological control", St.-Petersburg, Russia

The problem of water-supply and drinking water is one of the most urgent problems of the XX century. With the lack of water-supplly the main source of drinking water are wells and artesian chinks, the quality of water in which is not fixed. The objects of analysis chosen as the models for comperative inves-tigations are wells and chinks of 5 settlemens in St.-Petersburg suburbs, also reservoirs used for agricultural crops watering. It is defined that the quantity of calcium ions and ions of heavy metals is more then enough in all water objects. The less quantity was observed in wells of Sablino and Gatchina suburbs. In Djuny and Cobralovo wells the quantity of marganese and ferrum ions exceed.

In Martishkino settlement on the territory used for gadering in the time of the Great Patriotic War used as an aerodrome, in the water the marganese ions exceeds high leveled limited (admissible) in 38 times, ferrum ions exceeds in 87 times, cobalt ions exceeds in 1,8 times. The quantity of other ions of heavy metals doesn't exceed high leveled limited (admissible).

RESEARCHES OF THE NATURAL REASONS OF WATER-SUPPLY NETWORKS RUPTURES

Shikin A.S., Kapochkin B.B., Isakova J.V., Kucherenko N.V., Nagrebetsky V.S.
JSC "Odessavodokanal", TSB, ORAN, OHMI, Odessa, Ukraine

The city water-supply systems are influenced by various processes, leading to wear-out, corrosion, and final destruction. The study of the named processes allows to figure out the measures directed on increase of reliability of the water-supply and drainage networks, that lead to less number of breakdowns. In the report there are observed the two interconnected types of breakdowns. The first are the breakdowns caused by periodical variations of ground temperature, the second are those, stipulated by geodynamic movements of the terrestrial crust.

Since 1993, the geodynamic activity in the Black Sea coast region of Ukraine has been extremely active. It was expressed in avalanche-like growth of the number of underground network breakages, crashes of industrial and residential buildings, activation of land-slope processes.

With the purpose of losses minimization in new geodynamic conditions, it is advisable to review the strategy of monitoring, control, design, construction and operation of the underground networks.

DIAGNOSTICS AND REPAIR OF REINFORCED CONCRETE STRUCTURES IN POTABLE WATER SYSTEMS AND SEWERS

Shilin A.
ZAO "Triada-Holding", Moscow State Mining University, Moscow, Russia

The report contains data on the state of reinforced concrete in structures being under operation, including concrete strength, porosity, permeability, quality of reinforcement, common types of damage.

The data has been obtained in the course of both destructive and non-destructive investigations as well as laboratory testing using the equipment of the leading world companies.

On the basis of investigation results the company offers particular technical and technological solutions, carries out works on construction, repair, reconstruction and rehabilitation of structures, sealing leakages and stopping water filtration.

The author touches upon the problem of planning the investments for maintenance based on the actual state of structures.

The report provides references on repair and protection of potable water reservoirs, aerotanks, pump stations, tunnels etc. implemented by the company.

NATURAL COALS IN THE PROCESS OF WATER PREPARATION

Sidorov A. I., Bekassova V. N., Ogolikhin A. S.
South Ural State University, Chelyabinskm Russia

The process flow diagrams of water preparation based on the sorption cleaning methods are the most reliable and simple in operation, as they allow to extract impurities from water solutions without any transformation of organic substances and chemical compounds. It is especially expedient to use these methods when there is no possibility to receive quickly the exact and full data related to the nature and concentration of impurities present in water. But most of good artificial sorbents are rather expensive by their cost price, and therefore they don't find wide application at water lines.

Our examinations and laboratory tests of some natural anthracitic coals showed that it's possible to use them in most cases instead of expensive artificial sorbents (such as activated charcoals, for example) without reducing the quality of drinking water obtained. As for the natural coals we suggest any pre-processing is not provided (to raise their operating characteristics), their application in the process of water preparation will result in considerable economic effect, according to our preliminary calculations.

Our scientific-research work conducted since 1994 covers several interdependent stages:

- study of anthracite and super-anthracite physical-chemical characteristics with the aim to use them as sorbents and filter materials;
- definition of anthracite and super-anthracite mechanical strength and chemical stability;
- estimation of anthracite and super-anthracite sorption activity as related to;
  - heavy metals compounds,
  - phenol and chlororganic compounds.
- estimation of anthracite and super-anthracite deodorization ability;
- investigation of absorption mechanisms on anthracite and super-anthracite patterns;
- development of anthracite and super-anthracite technological classification in view of their absorption properties;
- economic effect estimation of anthracite and super-anthracite application in water purification technology.

While analyzing all the investigations carried out, we came to a conclusion that the tested natural coals can be applied for purification of:

- underground waters with high Fe and Cu contents, as well as with dissolved gases H_2S, NH_3 and the like;
- surface waters in the periods of water plants and microorganisms season-peaks development;
- waters with exceeding sanitary limits of phenol content.

It is evident that before recommendations for improving the water line quality, the preliminary analysis of all the conditions for a concrete case of water scooping should be carried out. And then, according to the water quality in a water source and to the enterprise production capacity funds, the optimum methods and process flow diagrams may be chosen, taking into consideration the users' sanitary technological requirements as well as the technic and economic reasons.

SALOONS OF CLEARING WATER INSTALLATIONS

Skvortsov L.S., Varshavsky V.Y., Rachinanin U.A.

To supply the population of Russia by conditioning drinking water it is necessary to create the concept allowing to solve this task in view of real economic conditions. Such concept is developed by Association "Water -Medicine - Ecology" together with the Moscow Centre for promoting of scientific and technical achievements "Moskva" of Moscow

Government. In its basis is planned both rising efficiency of clearing of natural water and using of individual drinking water clearing installations.

The analysis of the such installations market has allowed to make a conclusion about it disorganisation, that does not allow the consumer to objectively choose installation, essential for it. An output from the situation one can see in creation of a furcal network of special saloons of such installations. These saloons should consist:

- Laboratory of express analysis of water,
- Trading hall for clearing water installations of collective and individual usage and spare cartridges to them,
- Hall with the legislative and help literature on water supply and water purification,
- Service installation group.

Centre "Moskva" and Association have carried out for the last year series of practical steps directed on creation of such saloons. First of all for the most effective water clearing it is necessary to know consumer water pollution.

As the first stage of realisation of the developed concept on the basis of domestic and import devices it has been created a laboratory of express analysis of drinking water pollution. The express analysis laboratory devices allow within 2 hours to analyse water on 26 basic parameters - biological, organoleptic, chemical, etc. All devices - small-sized, have an independent energy supply and the analyses do not demand high qualification.

The Association has united the main domestic manufacturers of installations for drinking water clearing. It is well known, the modern domestic industry is supplied with all essential, including by unique, conversion materials and technical decisions allowing to clear practically any natural water up to the drinking water demands. Our materials and technology have allowed to the domestic manufacturers to create installations, surpassing any foreign devices. We do not mean our design.

The pilot survey carried out on the Moscow area water has shown, that it contains the quite certain pollution. First of all it contains the salts of ferrous, fluoride, strontium, manganese and calcium. To clear such kind of water pollution it was developed special reagent free collective type installations "Favorit", and ferrous cleaning installation OUVG. The greatest interest represents the individual filters installations of a type «Topaz -02». They have advantage not only to clear and decontaminate water, but also to dose strictly quantity fluoride into the water, that provides the most effective protection of teeth against caries.

To simple a choice of installation according to the water analysis, the second directory edition "Drinking water clearing installations (filters)" is issued. Besides the description about 100 kinds of filters individual and collective using one can find there some information about rules of water cleaning devices certification, about a condition and prospects of improvement of drinking water supply in Russian Federation, about influence of drinking water quality on the population health, general characteristic of installations and information about their manufacturers.

Saloon work will include regular advises and conversations of the experts on water quality, technology, medicine and so on.

Centre "Moskva" the Government of Moscow, Association "Water - Medicine - Ecology"

QUALITY MANAGEMENT DRINKING WATER CERTIFICATION TESTS AS ECOLOGICAL SAFETY

Sokolov S.A., Ignatov V.I.
Water Certification Center, Ltd

Certified water analysis laboratories have quality guidance where described procedures and algorithms quality control measurement (test) sample water results. Approach in laboratory quality guidance sometimes is inadequate in comparison with last international organizations documents [1-9] peculiarly in conditions chemical, ecological and other safety threat. As drinking water is a priority factor in population safety as problem its tests management quality is very essential.

Data quality is objective factor. For using data to estimate drinking water safety they must be significant and reliable. Also data quality in a large extent depended on experience of staff many of quality parameters may be estimated or measured objectively and hence may be systematically entire.

Quality enhancement is a management task. Quality assurance is a process using various approaches for this task solution.

Quality assurance included independent tests monitoring and secure for laboratory management and data customers that laboratory rooms, equipment, staff, methods and procedures, recorders and supervision adequate control quality principles. Efficacious control quality system bring assurance that present tests satisfy determined criteria of precision, authenticity, records complete and comprehension. Quality assurance must be a part of general test process for secure results reliability and them accurate records. It's necessary treatment and conducting of quality assurance programs (QAP) [3].

Important QAP instrument is quality control (QC). This is qualitative estimation oe routine quantitative laboratory tests. Sometimes many procedures are inadequate for this purpose

On the base of documents [1 - 5, 7] and our investigations developed some approaches to treatment quality control water test system suitable for any water-ecological investigations included ecological monitoring of water objects.

Basic principles and organization quality management are:

1. Organization and functionalities (laboratory management, investigation leaders, group QAC, subsidiary departments).
2. Program quality assurance (independence, quality control, organization and staff, inspections and audit,

documentation and reporting, working procedures of program).
3. Laboratory rooms and equipment.
4. Investigation plan (aim, preparation, form and maintainance, using).
5. Standard routine laboratory procedures (form and contents, using and suitability, adequacy, updating).
6. Test, control and reference samples.
7. Quality control (level, preceding control, analytical contrrrrrol, statistical control, quality control test fulfilling, working instructions).
8. Documentation storage include manual and computer recorders.
9. Reporting
10. Data archive storage (responsibility, index, identification, systematization, saving, search, access control).

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TESTING OF POTABLE WATER AND WATER TREATMENT DEVICES FOR CERTIFICATION. THE EXPERIENCE OF THE FIRST YEARS OF ACTIVITY

Sokolov S.A.
Centre of water certification, Moscow, Russia

The questions of certification of potable water and devices for its treatment acquired actual significance practically from the time of establishing the system of certification GOST R, i.e. since 1991-1992. At the same time it was established the Centre of water certification (CWC), which was the first in Russia to be accredited by Gosstandart in the field of potable water tests. Below is a brief account of the first years of activity.

The problems facing us have methodical, metrological and normative technical aspects.

There are the most important of them and practical ways of their solution.

1. Many methodics of measuring content of substances in water were not attested and some bore general normative character and did not meet the requirements of GOST 8.010 "Methodics of measurements performance".

ISO standards for water quality could not be used under Russian conditions because of absence of reagents recommended. Therefore the chromatographic procedures of determining organic substances in water (chlorophenols, phosphorus - and chlororganic pesticides, petroleum products, halohydrocarbons, monohydric phenols and phthalates) were formed as normative documents according to GOST 8.010 in CWC and also metrologically attested. Besides the procedures of determining more thean 30 inorganic substances including BPK and HPK Were metrologically attested. During attestation the indices of reproducibility (convergence), correctness and accuracy of measurements were determined, which amounted to an average of 4-12, 2-10 and 8-20% respectively on all indices.

2. The procedures of water treatment devices certification tests were absent, there fore the following approach was adopted as a basis. The devices were considered as "black box" with varying input and output parameters:

Under various modes of operation a model solution was fed with different concentrations (from 1 to 10 and more PDK) of those substances from which the device purifies water according to specifications (TU) and the concentration of there substances was determined before and after the solution passes through the filter. The efficiency of a device operation was determined by the ratio of input and output concentrations and if the efficiency was not less than that given in specifications under the whole modes of operation then the test result was positive since 1997 on the proposal of the certification body of potable water and water treatment devices of VNIIstandart the test program comprises determination of input and output concentration at the initial middle and final stages of operation stated. Furthermore, additional in dices (mainly metals) were determined which may possibly pollute water when using this method and the technology of water purification. The test results showed that domestic filters operate with the effectiveness, set in specifications but some imported filters considerably decrease the effectiveness to the middle of the operation term stated.

3. The procedures and methods of inter laboratory control of certification tests quality were not regulated and the running available bore general character. We have devel-

oped the following decision in co-operation with Gosstandart metrological institutes. As a result of a metrologic attestation of methodics the norms of accuracy control of measurements results were determined: assumed discordance between two parallel determinations and assumed discordance between attested and actually found concentration values. The operation quality of a test laboratory was checked with given periodicity (depending on the member of analyses) by these norms. The operation was considered satisfactory, if in less than 90% of cases these norms were observed (actually the norms were not increased in 95-100%). In 1997 on the basis of methodical developments of Ural NII of metrology (RD 2335) CWC made up the instruction of interlaboratory operative and statistic quality control. The instruction uses the indices of convergence, correctness and accuracy of measuring results, obtained during metrological attestation of methodic as criteria of test results quality with respective coefficients.

The most important tasks which face us in the hearer future are as follows:

- expansion of normative base (from normative-legal on obligatory and voluntary water certification to normative-technical on test methods of water treatment devices accounting for their consumer characteristics; of material's, production processes and equipment, used in economic potable water supply and also on the basis of valid international standards, e.g. NSF 53-1994 "Water treatment devices for potable water- effectiveness with reference to health protection";
- establishing the system of test quality management in the field of water certification accounting for documents and recommendations of such international organisations, as WHO, WNEP, ISO, IEC, ILAC as well as OECD, which developed " Principles of proper laboratory practice", and AOAC, which developed "Principles of ensuring quality for analytical laboratories";
- expansion of international co-operation with some of the above listed organisations as well as with IAWQ, IWSA and with similar foreign laboratories and centres;
- development and introduction of intercalibration measurements system (ribying tests) among laboratories and centres for test of water and water treatment devices with a view to set real accuracy and reproducibility results.

MODIFIED MACROPOROUS ION EXCHANGERS FOR DRINKING WATER TREATMENT AND CONDITIONING

Solntseva D.P., Kalinina R.N., Krasnov M.S., Kirianova L.F., Rakhmanin Yu.A., Kiseliova O.Yu.
G.S.Petrov Research Institute of Polymeric Materials
A.N.Sysin Research Institute of Human Ecology and Environmental Health RAMS, Moscow, Russia

Use of macroporous ion exchange materials for water treatment provides removal of not only inorganic, but also of organic impurities. At the same time, a variety of existing quantitative and qualitative compositions of contaminants requires availability of a wide range of sorption materials.

Modification of the surface of a polymer by chemically active compounds or substances enriching water with physiologically vital for human health components is one of the promising means of producing polymeric sorbents with a specific (selective) action with respect to a certain type of substances.

A principally new anion exchanger has been developed, modified by iron oxides (AM-Fe), meant for water purification from hydrogen sulphide. As compared to an anion exchanger-carrier AM-Fe has a selective action with respect to hydrogen sulphide in water with a varying anion composition, and its dynamic capacitance as far as the mentioned above pollutant is concerned is 3-4 times greater compared to the initial anion exchanger. Besides, the material is also functioning as a «conditioner», since it enriches water with hydrocarbonate anion exchangers, thus improving its taste.

In contrast to a catalitically active manganese zeolite MZ-10 ('PUROLIGHT', Great Britain) the developed modified anion exchanger mainly produces a sorption effect. In studies that were carried out MZ-10 oxidized hydrogen sulphide to sulphur, and the process was accompanied by water opalescence and increase of the pressure loss of the material layer.

The modified anion exchanger is promissing for use in portable water treatment and conditioning devices.

A macroporous cation exchanger (CM-F) capable of removing heavy metals cations from water and at the same time enriching it with fluorine ions in physiologically vital concentrations has also been developed.

At present hygienic properties of the modified ion exchangers are being tested.

USE OF LOCAL RAW SOURCES FOR MANUFACTURES OF COAGULANTS

Sporsheva T.M.
Institute of chemistry, Komi Scientific Centre, Russian Academy of Sciences, Syktyvkar, Russia

In practice of water supply the greatest spread was received by a method of processing of water of coagulants because it provides removal of particles of various sizes, and also of colloidal particles, practically can not sedimentation and being in a suspension condition.

In connection with development of a municipal services of northern cities and orientation of industrial manufacture to a closed cycle of water consumption requirement in sulphate salts of aluminium, traditionally used for clearance of water has much increased. In conditions of stable demand on

coagulants the world manufacture is aimed at creation of small installations on processing natural raw material with the purpose of maintenance of the nearest consumers. In this connection there is the necessity of inclusion of kinds of widespread raw material, such as low quality bauxites, caolins, alynites, aluminium waste. Aluminium raw material of Komi Republic can form the basis for the decision of a regional problem of water preparation in conditions of the north.

Caolin clays, low quality bauxites and also metallurgical slags are the most interesting materials.

Compositions of tested raw material, weigh. %:

Clay of deposit Pyzla: 35-38 Al_2O_3; 50-52 SiO_2; 1,4-2,4 TiO_2; 0,4-1,9 Fe_2O_3; clay of deposit Loimsky: 32-35 Al_2O_3; 47-50 SiO_2; 1,7-2,0 TiO_2; 1,1-1,5 Fe_2O_3; reduction fusion slags : 27-30 Al_2O_3; 25-28 SiO_2; 8-10 TiO_2; 0,8-1,0 Fe_2O_3.

The basic stages of processing clays included preliminary preparation, destruction calcination, acid processing, division of suspension, crystallization of of aluminium sulphate.

The reduction fusion slags represented products of processing of a waste of manufacture of alumina - red mud. The slags are easily decomposed by a sulphuric acid, sulphuric acid solutions are exposed evaporation and crystallization.

The products of crystallization were analysed and their conformity to the requirements that the Official standart 12966-85 is established.

With use of the coagulants, received from local raw material, tests to processing of water from r.Vychegda are spent. Results of the analyses of quality of water and time of sedimentation of colloidal particles at different dozes entered of coagulant have allowed to give the practical recommendations at water preparation of colour water with prevalence of colloidal factions.

NEW HIGHLY EFFICIENT COAGULANT ON THE BASIS OF TITANIUM COMPOUNDS FOR NATURAL AND WASTE WATER PURIFICATION

Stremilova N. N.
Saint-Petersburg Scientific Research Centre for Ecological Safety, Russian Academy of Sciences, Russia

Permanently growing anthropogenic influence upon environment, including natural water pollution, gives rise to the especially actual problem: elaboration of new highly efficient reagents for the water purification and new technologies for water treatment and waste waters purification. Improvement of traditional water treatment technologies by means of further complication of apparatus-technological schemes, improvement of coagulants based on aluminium compounds, and application of different organic floculants is limited by the secondary pollution with aluminium, chlorine, chloroorganic compounds, etc.

We have elaborated the technology of non-traditional inorganic complexing titanium compounds and synthesized several series of unique coagulants, which effectively purify natural water.

The efficiency of the coagulants under consideration is conditioned by the formation of developed colloidal structures with a wide range of absorption centres and consists in the following processes: treated water microfiltration, sorption onto adsorption centres and in micropores of organic and inorganic compounds, and mechanical capture of suspended particles, phyto- and zoo-plankton.

The new coagulant displays the following unique properties at natural and waste water purification from harmful admixtures:

- high rate of flakes formation - about 10-30 seconds at water temperature 0.6 0C;
- ability to form large flakes, which pass into dense compact large-grain sediment, as both sorption and admixtures capture occur (therewith the rate of sedimentation is high and formed sediment may be easily filtered off);
- ability to decrease turbidity of natural water by 80-90% (up to 0-0.3 mg/l) and purify completely (for 95-100%) stable highly-dispersed suspensions of natural and industrial origin by the cost of microfiltration;
- ability to absorb organic and inorganic compounds and heavy metals (Hg, Mn, Cd, Sn, V et al.) due to the formation of developed specific surface, containing a wide range of adsorption centers and micropores;
- effective work at low temperature of treated water (0.6-10 0C) in contrast with today used aluminium salts, which can work only if temperature is not lower than 10 0C;
- deep purification of water from pathogenic bacteria without preliminary chlorination (total microbe number decreases by 20 times and more) with prolonged disinfecting effect during 4 hours;
- ability to sorb high-molecular organic compounds of sophisticated composition;
- ecological safety and absence of secondary water pollution with coagulant components (their residual content does not exceed 10% from maximum permissible concentration);
- decrease of the secondary sediment volume by 2-6 times and increase in the rate of filtration due to the formation of a dense compact sediment.

The coagulant on the basis of titanium compounds is developed for the first time and has no analogs in the world practice.

The high efficiency of the new coagulant possesses to simplify and to reduce the price of technological scheme for water treatment by the cost of decrease in a number of operations and appropriate equipment, decrease in a number of the reagents used (including chlorine), and decrease of amount of sediments, which can be recycled.

Technology of new coagulant production demands standard equipment, consumes not much power, produces not much waste, and may be completely automated. Necessary raw materials are traditional for industrially-developed countries.

DOMESTIC WATER PURIFICATION FILTERS WITH CHANGEABLE CARTRIDGES FOR THEM

Taganrog plant "PRIBOY"

Main principle - the chemical purification of the water, sorption of harmful and toxical chemical impurities, filtering of mechanical particles by usage of modern materials, allowed for the contacts with drinking water.

FILTERS provides high-quality disinfection of water, purification from iron, free and fixed chlorine, oil products, phenols, mechanical impurities.

FILTERS are produced in double: wall-table versions. Filter consists of the polymeric body with changeable filtering cartridge Inside. Cartridge is filled with inflates; filtering, disinfecting an4 sorbing.

Domestic electronic cold-hot water counters with distance and stationary control of indications and automatic regulation of "zero" error in the effective range, (from Qmin to Qmax).

The counters are interference resistant and can be easily repaired at home.

Plastic spare parts for the filters and presitional equipment.

POTABLE WATER SUPPLY STANDARDIZATION IN THE FIELD OF WATER QUALITY CONTROL

Taktashev B.A., Borisov N.P., Hasrovyanz I.L., Makarov S.N.
All-Russia scientific and researd institute of standardisation, Head test centre of potable water, Moscow, Russia

The basis of normative provision of the problem of water quality increase its harmlessness and safety for man and environment in foreign practice are national standard, relying on international documents for water quality such as Guide on potable water quality control (WHO), Directives for potable water quality (EC) international standards and national legislation.

Technical Committee on standardization TC 147 "Water quality" of International Organization for standardization (ISO) developed 143 international standards and 43 draft standards, the analysis of which was organised and carried out by TC-343 "Water quality" (VNIIstandart), the international standards cover issues of terminology, sampling, physical, chemical, biological and radiation test methods, as well as evaluation of the accuracy of results obtained.

Interstate (countries of CIS) standards and other normative documents for water quality test methods valid at present on the Russian territory do not meet fully international requirement on this problem and do not provide normative support to the existing Russian legislation. The national technical committee TC-343 "Potable water" faces the task to complete development and revision of the whole complex of standards in the heave future.

The program of complex standardization, developed by VNIIstandart (TC-343) in co-operation with leading NIIs of the country was included as one of the sections of normative-legal provision of FCP draft "Provision of Russian population with drinking water".

Accounting for the priority of sanitary legislation and Ministry of heals regulation (Gossanepidnadzor) of norms, ensuring safety of drinking water for the health of man (SanPiN 2.1.4.559), the interdepartmental decision was made about developing Russian state standard for potable water, which specifies requirements for quality control. It was recommended to speed up development of this standard by Parliament hearings "Provision of Russian population with drinking water" at Federation Council of December 2, 1997.

While assuring Russian Federation law "Consumers rights protection" the standards for drinking water, prepacked in reservoirs for individual, home and local water treatment devices are being developed.

At the same time special requirements for prepacked drinking water, stated in a recent version of WHO norms are taken into consideration.

Special significance is attached to the development of a national standard specifying requirements for potable water, produced by mobile facilities for short-term provisions of the population needs under conditions of emergency. There works are interconnected with the revision of GOST 2761 provisions for the requirements to sources for centralized economic potable water supply, which together with SanPiN 2.1.4. 027-95 specify the rules of choosing such sources and requirements for there zones of sanitary protection and guard of water pipe-lines of economic - drinking purpose.

The second strategic direction of standardization development is the regulation of organizational and technical issues of the quality control systems in the sphere of economic potable water supply, including (specified by Russian Federation Law " Provision of measurements unity") questions of metrological provision and standardization of methods of water quality control covering the whole list of indices normalized and subject to measurement control or state control or state supervision.

When developing standards for test methods the task is set to bring them closer to valid international standards ac-

counting for our possibilities, equipment of testing laboratories and accumulated experience.

The standards for methods of determining content of mercury, boron, chromium, benzopyrene, cadmium, chlororganic pesticides, PAV, halogenorganic compounds.

Broad application of international standards should be commenced with samples standards complex. Direct use of international standards will allow to solve a lot of problems, associated with the absence of reliable metrologically certified procedures.

Thus, the realisation of complex standardisation program in the field of potable water supply will ensure the technical support of formed legislation in Russia, harmonization of domestic normative base with international norms and rules, will contribute to increase the quality of potable water in Russia and to scientific and technical progress in this field.

DEVELOPMENT OF THE NATIONAL STANDARD FOR POTABLE WATER, PACKED IN RESERVOIRS

Taktashov V.A., Prilipko L.A., Morina M.V.
VNIIstandard, Moscow, Russia
Rachmanin U.A.
NIIACH & GOS after Sysin A.N. , Moscow, Russia

Increasing population demands for qualitative potable water, changing economic conditions, expansion of export-import conditions operations brought about the appearance of potable water, packed in different reservoirs . Mass production and manufacture in the country of packed drinking water by specification and other intrafirm documents of plants with various forms of property and with various level and culture of production stipulated the necessity to prepare at national level a state standard ,ensuring protection of the population interests.

Realization by VNIIstandart together with VNIIACH&GOS after Sysin A.N. of examination of various kinds of drinking water, packed in reservoirs when developing and coordinating specifications, its testing and sertification made it possible to draft GOST R "Possible water in reservoirs. General specifications".

When developing the draft standard the nomenclature and value of potable water indices of safety and harmlessness were analyzed and adopted as basic requirements, established by international (Luide of WHO and Derective of ES) and domestic (SanPiN 2.1.4.559-96 and draft of GOST R «Possible water. Requirements and water quality control of centralized system of water supply») documents.

According to the provisions of the prepared standard the water from underground water supply sources of 1 and 2 class should be used for industrial bottling in conformity with GOST 2761-86 and from centralized systems of water supply. This water has passed water treatment.

Depending upon chemical composition and method of water treatment potable water is subdivided 4 categories: the water from underground sources in natural state, the water from underground sources of from centralized systems of water supply, "corrected" on separate indexes; this water, passed tertiary treatment from chemical and microbiological contamination. The waters, passed deep tertiary treatment with general mineralization below permitted level The standard comprises normative values of indices (organoleptic, microbiological, radiation and toxicological) and normatives for the indices affecting water organoleptic indices and harmful chemical substances, added to water or formed during water treatment.

The standard specifics the rules of acceptance and method of control over whole nomenclature of requirements as well as the requirement to packing, marking (accounting for GOST 51074), transportation and storage of potable water.

DEVELOPMENT OF A STATE STANDARD IN THE FIELD OF POTABLE WATER QUALITY CONTROL

Taktashov V.A., Borisov N.P., Hasrovyanz I.L.
All-Russia Sientific and reseach institute of standartization, Moscow, Russia

Development of knowledge about various potable water contaminants effect on diseases stimulation and also continuous expension of the number of pollutants found in water supply sources impart special urgency to the preparation of legal and normative documents reflecting the requirements to potable water quality to the order and rules of monitoring when producing drinking water, as well as to the control methods ensuring the unify of masurements on all objects of the country.

Specifying such requirments in world practice is carried out at international and national levels. Such international documents are "Guide for potable water quality control (WHO) and Directive 80/778 on potable water (EC).

Then international documents were adopted as the basis for preparation of national standards in the whole world. When developing national standards all European Countries took EC Directive as a guide. Acccording to the materials of XY111 International congress on water supply the recomendations of WHO leaders were taken as the basis by the states with total population of more than 500 millions of people all over the world. A number of countries such as Japan, South African Republic use normative of the

Environment Protection Agency of the USA (EPA normatives) as base documents when preparing national standards.

However, some countries including Russia did not yet fully bring their national standards on potable water in comformity with base international documents.

Till 1997 in Russia and in CIS the basic document regulating requirements to potable water quality and monitoring was GOST 2874-82 validated in 1982. As compared with basic international documents GOST 2874-82 comprises Milder requirements to potable water: less number of normative and monitoring indices of water quality (total 28). Primarily it relates to the number of normalization requirements for limiting products of interaction of organic agents in potable water with disinfectanty used in the process of water disinfection. GOST 2874-82 also has substantially less list of normalized and controlled indice of water quality on organic compounds including pesticides and herbicides. Nevertheless, the standard has the indication on the possibility to extend the nomenclature of controlled water content components, which can emerge in any water supply source. In these cases for water quality indicer not included in GOST 2874-82 it should be recomended to be guided by normative requirements specified in the document SanPin 4630-88. Putting this directive into practice causes great difficulties due to the lack of equipping laboratories for potable water quality control, which have as a rule, control facilities only on indices specified in GOST 2874-82.

Unlike forein practice the domestic practice of standartization,supported by Russian laws "Sanitary and epidemiological population well-being","Standartization" and " Provision of measurements unity", envisages availability of two basic types of documents of the state level: sanitary rules and state standards. The first one have the priority establish norms, ensuring Moduction Safety for man health (criteria of safety and harmlessness of drinking water). At the same time drinking water is a product of interbranch importance and multifunctional use (code OKP-013100 dy all -Russia classifier of industrial production OK-005) and in accordance with valid legislation · in the fielc' of standartization and measurements unity the technical norms and test methods should be regulated by state standards.

Owing to this SanPin 2.1.4.559 normalizes maximum acceptable values of safety indices and harmlessness of potable water, and the standards being prepared instead of GOST 2874 on the Russian Federation territory, specifies united nomenclature of basic indices of potable water quality as well as other requirements, neccessary for water production by water supply plants and use by its population.

Particularly, the standard specifies the methods of testing (measuring) on 56 basic controlled indices of potable water quality the requirements to production stability and production inspection system of water supply plants, the requirements to input control of the quality of water taken for water treatment from water supply source, of consumed materials, reagents and equipment for water treatment and water purification as well as the requirement to proccess monitoring at various stages o water treatment process and water feed to supply line.

At present GOST draft, developed by TC 343 "Water quality" at VNIIstandart, was circulated for discussion in the interested authorities and organization.

ACCREDITATION OF TEST LABORATORIES AND BODIES FOR CERTIFICATION IN THE CERTIFICATION SYSTEM OF POTABLE WATER

Taktashev B.A., Borisov N.P., Kotova L.P.
All-Russia scientific and research institute of standardization, Moscow, Russia

In Russian accreditation system the order of official recognition of organizations competence for the right to conducts works on products testing and certification, in general, was specified by GOST R 50 000.3-GOST R 50 000.6.

The formation of infrastructure "The certification system of potable water, materials, production processes and equipment, used in economic potable water supply", assigned by Gosstandart and Goskomsanepidnadzor on VNIIstandart, stipulated the urgency of developing and regulating the united complex of fundamental requirements (criteria), necessary to evaluate conformity of test laboratories and certification bodies exercising threir actively according to the system rules.

The development of requirements was carried out accounting for Russian Gosstandart experience of accrediting test laboratories and bodies for certification for the period of 1995-1998, practical approbation of the provisions of organisational and methodical document of the certification system of potable water Central body, and also accounting for the provisions of ISO/IEC Directives, European standards and ILAK documents in the field of certification and accreditation. The results of work are arranged in the from of 2 draft state standards, prepared for affirmation.

Draft standards specify requirements for the field of laboratories and bodies accreditation; objects of accreditation; nomenclature of determined indices of objects, subject to certification; the products of normative documentation, used for tests and certification; specify the procedure of including other objects in the field of accreditation (entering into the competence of other federal bodies of executive power), having joint normative base with the system objects (methods of control).

GOST R draft, specifying criteria to the accreditation of testing laboratories, clarifies the requirements to laboratories rooms (including storehouses and warehouses of reagents), carrying out chemical and analytical microbiological and radiological tests. The draft standard regulates requirements to the equipment (with reference to test types). Special attention is paid to the requirements for laboratories personnel qualification, formation and conduct of documentation fund which the accreditated laboratory has to possess. The draft specifies the requirements to the system of ensuring tests

quality; the draft envisages main procedures, subject to document registration and control for their observation (inclucing algorithm of carrying on operational control of testing quality; it comprises forms of test reports, certificates of sampling etc.

At the same time all requirements of the draft standard are co-ordinated with certification rules of objects of potable water certification system, which establishes conditions for co-operation of testing laboratories and bodies. Besides the draft specifies the criteria of mutual recognition of laboratories accreditation results in other accreditation systems (accreditation system of analytical laboratories accreditation system of Gossanepidsluzhba laboratories).

GOST R draft specifying criteria to the bodies accreditation in the certification system of potable water determines the spheres of activity of certification bodies in regions; the requirements, ensuring theirs independence and competence; co-operation with executive power bodies, supervising bodies and other organizations interested. The draft clarifies functions rights, responsibility and obligations of executive services of the body, which relate to its structure and their functionael ties; it establishes the fields of experts certification. The draft standard compresses the main directions and elements of a body technical policy, including the system of quality assurance system of works made. The draft gives the list of documents which an accreditation certification body has to possess; the lest should have report forms and the rules of their filling in.

The development and introduction of mentioned documents will contribute to the formation and development of territorially dispersed network of test laboratories and certification system of potable water bodies will allow to set stable system infrastructure, will ensure strengthening of confidence to its structural formations.

REQUIREMENTS TO THE EXPERTS OF THE CERTIFICATION SYSTEM OF POTABLE WATER AND THE ORDER OF THEIR ATTESTATION

Taktashov V.A., Kotova L.P.
All-Russian scientificant and research unstitute of standartization, Moscow, Russia

One of the most important actions, directed to the establishment and stable functioning of the certification system of potable water is preparation of experts whose activity is closely connected with evaluation of conformity of the system object: potable water supplied to a consumer in the systems of centralized and decentralized economic potable water supply and potable water pre-packed in reservoirs; assessment of water treatment equipment efficiency; disinfection and water treatment of potable water; check of production processes of water treatment stability ; assessment of water treating units conduct, materials and equipment used in economic potable water supply. The level of the expert preparation affects directly the results of technical policy realization , which is carried out by the certification body in the field of quality works done, impartiality and reability of information about the real state of certified products conformity.

The rules and order of preparing experts, conducting products certification relating to the system objects number, processes and quality systems are regulated by organizational and methodical document of the system, PNOZOSPVR-008 "The certification system GOST R" The certification system of potable water, materials, production processes and equipment, used in economic potable water supply. Requirements to experts and the order of their attestation".

The document was prepared on the base of PR 50.3.001-94 "The certification system of GOST R. Requirements to experts and order of their attestation" in order to clarify requirements to experts on certi-fication of the system objects with reference to the field of their attestation: basic aducation, functions, rights and responsibilities; preperation for attestation. Experts should be attested in the following fields:potable water certification; certification of equipment for water treatment and purification (tertiarry treatment, disinfection) and economic potable water supply; certification of materials for water treatment.

Depending upon the attestation field a condidate to expert should have higher education on one of the profile profession, water supply, canalization, radional use and protection of water resources; public construction and utilities; hygiene, sanitary and epidemiology; chemistry, chemical technology; technology of electrochemical processes; biology, biotechnology; chemical technology; environment protection and rational use of natural resource; maching and instruments for chemical production; at that the length of service on professon, as a rule, should be not less than 5 years.

The organization of experts preparation should be carried out by the scientific and methodical center of the certification system of potable water head body at VNIIstandart.

Training of experts organization is carried out by scientific and methodic center of the central body of certificatin system of potable water at VNIIstandart. Instruction of experts should carried out by the chair "Standartization problem" of Academy of standartization of Russian Gosstandart on the base of specially developped programs. The programs envisage examination by expert candidates of legal, organizational and methodological bases of the certification system of potable water, analysis and evaluation of the system objects conformity to the requirements of normative documents. Besides, the programs include examination of general technical questions of products certification in Russian Federation and abroad.

During training an expert candidate gets possibility to study procedures and rules of products certification in accordance with the field of his attestation, to get skills of competent use of the legal, organizational- methodical and

normative documentation, to study in detail his functions, rights, obligators and responsibility.

The ability to use the skills obtained during training is confirmed by the results of practical probational period, carried out in the body of certification, accredited according to the system rules. The probational period, as a rule, ensures trainees with maximum possible coverage of situations spring up buring products certification with reference to select optimal decision according to the certification scheme the nomenclature of indices determined, recognition of earlier tests conducted. Since the number of an expert obligations comprises the ability to make up the program of production testing to carry out the analysis of test results and, if necessary, to realise the tests quality control the program of training include practical lessons in the accredited testing laboratory.

The document envisages also the reguirements to periodic report of an expert and his re-attestation after expiry of an expert certificate.

FORMATION OF NOMENCLATURE OF THE SERTIFICATION SYSTEM OF POTABLE WATER OBJECT

Taktashov V.A., Prilipko L.A., Morina M.V.
VNIIstandard, Moscow, Russia

The basis of forming the sertiflcation systems of potable water , materials, production, processes and equipment, used in economic potable water supply is the principle of classifying object by subject - functional character, ensuring complexity of their effect on ultimate result - potable water of normative quality.

The nomenclature of the sertification system of potable water objects is given in in Table 1.

Table 1.

Description of product (service)	Code of OKP
1. Potable water packed in reservoirs	013
2. Equipment and devices for water treatment	130,140,224,311,346,361,363,369,485,492, 495, 499,644,791
3. Reservoirs for potable water	141,229,249,598
4. Materials and substances used for water treatment and disinfection	191,211,212,213,214,215,216,221,222, 249, 260, 261,262,485,571,574,919

In accordance with valid Law of Russian Federation "Sertification of products and services" the sertification objects in any sertification systems are differentiated into the groups: objects subjects to obligatory sertification in legislative-regulated sphere and objects of voluntary sertification.

The first group covers such objects as potable water, packed in reservoirs home water treating devices, which are subject to obligatory sertification of Conformity according to Russian Federation Law "Protection of consumer rights".

The second group at present covers: water of centralized systems of water supply, materials, reagents and equipment for water purification and treatment, production processes- Obligation of their sertification is determined by consideration and introduction of Russian Federation draft Law "Provision of population with potable water".

When forming the nomenclature of the sertification system object special attention should be paid to the problem of intersecting various properties (characteristics) of the same objects involved in the sphere of action of different sertification systems, including legislate sphere . For instance ,home water treatment units operating on the principle of electrochemical cleaning or ultraviolet radiation processing, industrial equipment is subject to obligatory sertification in the sertification systems of GOST R according to the parameters of electric safety etc. Materials and reagents are also subjects to obligatory sertification in the systems of SEPROHIM.

In this connection the examination carried out in VNIIstandart allow to establish within the sertification systems rules the united basis for conduction sertification of conformity in totality of sertified parameters and for ensuring complexity of sertified objects properties, used in potable water supply proceeding from their functional purpose in production processes of water treatment and purification in the interests of reaching the final result-obtaining the potable water of normative quality .The integral stage of sertification according to the sertification systems rules is hygienic estimation (sertification) of objects with reference to the water purification effectiveness, absence of harmful substances migration when water contacts with used materials. Hygienic studies of mentioned factors should be carried out at the stage of development and manufacture of production. However when conduction the sertification of conformity hygienic examination may be confirmed by hygienic sertificate.

Therefore , VNIIstandart carries out regular activity in developing the nomenclature and list of products, subject to obligatory sertification and improvement of the nomenclature of objects, sertified according to the rules of objects systems in voluntary sphere.

INFORMATION DATABASE OF WATER TREATMENT UNITS, EQUIPMENT AND SPARE PARTS

Tereshchenko A.G., Tereshchenko O.V.
High Voltage Research Institute, Tomsk Polytechnic University, Russia
Suchev O.F.
Water system commitee of Tomsk region, Russia

The automatic information and analitycal system "Rusalka" ("Mermade") that is being elaborated in the High Voltage Research institute at Tomsk Politechnical University provides the possibilities of optimal choise of water treatment methods depending on the wasted water contents and the requirements to the purified water. The specialized database upon water units, equipment and spare parts "Rusalka" became the independent database within the system. The main purpose of "Rusalka" DB is the accumulation, classification and systematic renewal of the data upon the technical characteristics of water treatment systems and spare parts.

The structure of the database is represented in two parts: the first part contains information about the units (constructions) of water treatment(UDB). The second part contains the information about the apparatuses, equipment and spare parts, used in water treatment systems (ADB). Each part of the database contains the main table and several connected tables. The total number of fields in each part is about 50.

The main table contains the following information: The name of the unit, its type, OK.P code, water productivity, energy consumption and two text fields (25 page MEMO-field and 255 character common text field.).

The connected tables contain data upon the effectiveness of the water treatment, gabarite size and mass of the units, producer adresses (developer companies and providers). The effectiveness of treatment is expressed in persent and (or) in concentration units before and after treatment. Thanks to using the connected tables one can describe not just the size and mass of the unit itself, but the characteristics of its spare parts and also provide the references about the adresses and phone numbers of all the companies concerned about the unit. The related tables of UDB contain classification of the quality of input water (artesian water, wastage water etc.) and output purified water (the application of the output water: for use as potable water for sewage system etc.). Important charachteristic of a unit is the method used in water treatment(for complex units it is the sequence of methods. This is the base for attachment of UDB to the "Rusalka" system.

ADB has its own internal classification: the highest is the section level (main aparatuses, auxiliary equipment, pumps, pipe-line reinforcement, control and measurement units and spare parts for water treatment systems). The second level contains groups, the third - types of equipment, e.g., the section for a unit is "pumps", the group is "for pure water", the pype is "D". The classification structure of units, equipment and spare parts is formed by the user in the beginning of work with ADB and it is kept in the separate system of connected tables.

The main table of ADB also contains the unit or equipment name, type and OKP code text field and MEMO-field. In the ADB connected tables ane can find the data upon the producing companies, mass and size parameters of units, ways of treatment and types of treated water.

One peculiarity of ADB, wich makes the DB universal, is the absence of the fixed set of tecnnical parametes in ADB. This means that each type of unit and part is described using the individual set of parameters from the list. The technical characteristics of units, equipment and spare parts are concentrated in three types of the connected tables. The first type is the table with the text description of the parameter, the second part contains the numerical description of the parameter, the third part is the numerical range of values. When information is being written in DB, the system of the connected classification tables arranges the necessary data according to the parts, groups and types, that helps to reduce the probability of error while adding new information to the DB.

"Rusalka" database provides search and selection of the units and equipment through typical and special inquiries. The special inquiries are intended to search the units and equipment within any field of DB classifying the contents of the field according to the value of desired parameter or in alphabetical order. One can also make standard reports (e.g. equipment specification) or special reports with any desired set of fields. Grouping and sorting the found data according to given criteria is also possible.

"Rusalka" DB is being elaborated for future use in intrested design organizations, municipal housing departments, water consuming companies etc.

BIOLOGICAL ASPECTS OF USING POTABLE WATER IN BUTTER AND CHEESE PRODUCTION

Tetereva L.I., Tolkachev A.N., Vitushkina L.P., Norkina A.P.
All-Russian Scientific Research Institute for Butter- and Cheesemaking

Potable water is used in dairy industry for partial substitution of whey, preparation of calcium-chloride solutions and rennet preparations, brine for cheese brining, butter grains washing. The transfer of harmful substances including toxic elements cannot be excluded from potable water into butter and cheese.

We have used the atomic absorption method for carrying out the determination of toxic elements in potable water coming out from artesian well to the experimental laboratory

of the Institute. Their contents have been (mg/kg) : copper - 0.0120 ± 0.0004; iron - 0.68 ± 0.08; lead - 0.002 ± 0.001; cadmium - 0.0011 ± 0.0002; zinc - 0.011 ± 0.001; mercury and arsenic have not been detected; the contents being by 2-3 orders , with the exception of iron and cadmium, lower than maximum permissible concentrations (MPC) of toxic elements' contents in potable water. The last ones are equal to MPC in milk for zinc, copper and arsenic, but are lower 3.3 times for mercury, 30 times - for cadmium than in milk.

When partially substituting whey (15%) by water with the concentration of elements at the level of MPC there will be added 37.5 mg of copper, 1.13 mg of lead, 0.04mg of cadmium, 0.02 mg of mercury, 187.5 mg of zinc, 1.9 mg of arsenic into the cheese-vat of 300 l capacity, that may result in the additional contamination of the final product and secondary products with toxic elements.

As far as iron is concerned, its MPC in potable water has been exceeded by 2.2 times. High iron quantities may lead to the appearance of "spotting" on cheese body. When studying a number of these cheeses, the iron concentration in the area of "spots" has been three times more than outside of them. High contents of iron and copper in water used for butter grains washing may become one of the reasons of butter contamination with these elements and result in defects of "oxidized flavour", "oily and fishy flavours" during its storage.

APPLICATION OF ELECTROMEMBRANE TECHNOLOGY IN WATER SUPPLY AND ELECTROLYTE SOLUTIONS PROCESSING

Tskhay A., Tolmachev L.
JSC "Membrane Technologies"

Electrodialysis is based on transfer of ions of salts dissolved in water through selectively permeable polymer membranes under direct electrical current. Electrodialysis has certain advantages, such as simplicity of the technology, low power consumption, and reagent free process.

When developing industrial electrodialyzers, we have done comparative assessment of hydrodynamic and polarization characteristics of different kinds of inter-membrane chambers and designed unique electrodialyzers with labyrinth-type spacers. Basing on this new technology we have developed EDU, EDU-1, and EDU-2 desalination plants with the capacity of 25-600 m^3 per day. These plants are commercially manufactured at the base factory of our company and extensively used in different fields of industry and agriculture in CIS. We also manufacture spacer-type electrodialyzers of big capacity for different applications. In the past 10 years (year 1986 through 1996) more than 500 electrodialysis apparatuses and plants of different capacity have been manufactured and put into operation.

Long term usage of desalination plants of EDU series showed its high degree of efficiency and reliability. Specific power consumption is 1.0-1.2 kWh per 1 m3 deep-desalted water for heat power industry, and 2.0-2.4 kWh per 1 m3 desalinated water for drinking purposes.

In the present time "Membrane Technologies" has developed wholly automated desalination plants of low capacity: 10- 200 l/hour for private consumers.

Desalination of saline water is not the only application of electrodialysis. First in CIS, we have developed the new electromembrane technology to concentrate natural saline water and tested it under production conditions in the oil fields of Western Siberia. The offered technology enables to obtain high-concentrated brines (180-200g/l), potable water, and extraction of valuable components from brines.

Moreover, we have developed an industrial electrodialyzer with bipolar membranes, intended to produce acid and alkaline solutions from salt solutions. This plant will allow widening the areas of application of membrane technologies in new technological processes.

Our another development is an electrodialysis plant for separation and purification of solutions in chemical industry. Low-molecular electrolyte is extracted from organic phase with minimum losses of the useful product and is used over again in the main process.

Electrodialysis plants EDU and EDU-1 are implemented to improve characteristics of wine and fruit juices and to desalt whey.

The fields of application of electrodialysis technology are so extensive, that they need special research that is being done by our specialists.

"Membrane Technologies" is a research-and-industrial company with a full range of work including research, development, pilot-scale production, testing, commercial production, sale and service.

The company incorporates research and testing laboratories, engineering department, design studio, department of automatic control systems and production and service facilities that are situated in Lithuania and Kazakstan. We also have a trade mission in Russia.

The company is staffed with professional researchers, product and process engineers, designers and high-qualified workers. The leading members of the staff work in the field of research, development, production, delivery and operation of electrodialysis plants for more than 30 years. The equipment produced is successfully implemented for many years in the areas of water desalination, waste water treatment, agriculture and different branches of industry, including power, chemical and oil-producing complexes, food processing.

PREPARATION OF DRINKING WATER FROM UNDERGROUND SOURCES IN THE SETTLEMENT ZELENOGORSK

Usoltsev V. A., Sokolov V. D., Skolubovitch U. L.

Nowadays the problem of preparation of drinking water from underground sources is one of the most urgent in Kuzbass. The river Tom, that is the main surface source of water supply, is contaminated by various organic and inorganic compounds as a result of human activity. Purification of surface water is rather expensive. Underground water is an alternative source of water supply: it is not influenced by the industrial activity and has good quality characteristics. Nevertheless in most cases underground waters in Kuzbass are characterized by high concentration of ferrum, manganese, phenol, and have smell and smack. Small settlements in Kemerovo Region mostly have no special water purification plants, in some cases these plants do not meet present-day requirements. It makes population use water that doesn't meet existing standards.

Administration of Kemerovo Region made OJSC "KemVod" a request to solve the problem of preparation of drinking water from wells in the settlement Zelenogorsk, Krapivinsky district, Kemerovo Region. The only source of water supply in the settlement is underground water (the depth of wells is 25 meters in most cases). Water tests during the three last years have shown that the water contains ferrum (up to 0,8 mg./l.), phenol (up to 0,003 mg./l.) and some organic impurities.

The results of the tests allowed to determine preliminarily the methods of water preparation, but the effectiveness of the methods chosen should have been confirmed by research in natural conditions. To work out a technology of water preparation on the basis of pumping station of the 2nd grade an experimental plant was built. It included aeration-ozonization block created in Tomsk Research Institute of High Tension, transfer tank, pump, tank with constant flow rate and head, two quartz filters and granulated active carbon filter (rank АГ- ОВ).

Data of the experiments allowed to work out a technology that included simplified aeration, crushed quartz filtering and active carbon filtering. For water disinfection a technology based on the usage of sodium hypochlorite was used. Taking into account that contaminating agents appear periodically the technology provides various operation modes: simplified aeration - quartz filtering - active carbon filtering - chlorination; simplified aeration - quartz filtering - chlorination; active carbon filtering - chlorination; chlorination.

Field adjustment at water preparation plant has shown that on condition of keeping the technology the quality of water meets the requirements of All-Union State Standard 2874 - 82 "Drinking water". High quality and intensity of research, building and assembly work and of field adjustment should also be mentioned. All the period, including research and turnkey construction, took less than six months. All projects, building and assembly work was done by OJSC "KemVod".

Thus, working out and introduction of the technology of purification of underground water confirmed once again that OJSC "KemVod" has high research-engineering and industrial potential, it is ready to solve various problems concerning water supply in small settlements of Kuzbass.

PRODUCTION OF ECOLOGICALLY PURE WATER

Usoltsev V. A., Sokolov V. D., Skolubovitch U. L.

The river Tom, the main source of water supply in Kemerovo , is polluted as a result of human activity by phenols, oil products, chlorine - organic matters etc. Existing systems of water supply and water purification plants were built and reconstructed on the basis of traditional technologies. These technologies allow to purify water only if source of water supply falls under the category of pollution not higher than the 2nd one (mild degree of pollution). Existing technologies do not function as a barrier with respect to chemicals and dissolved organic matters.

One of the methods of improving sanitary effectiveness of the systems of public and drinking water supply is using of underground water. Waters from underground sources are highly pellucid, have good taste characteristics and minimal bacterial contamination. On the other hand they often contain specific impurities, such as ferruginuous and manganiferous compounds; they are of high hardness, etc.

Bottling of drinking water is a perspective method of providing urban population with pure drinking water, meeting the requirements of EEC and recommendations of World Health Organization concerning physiological needs of people. It allows to solve both the problem of quality and the problem of water delivery without losses and in necessary quantity.

In February 1997 OJSC "KemVod" built and put into operation a plant for preparation and bottling of ecologically pure water "Khrustalnaja". Source water, taken from wells up to 180 meters depth, is characterized by low sediment concentration and chromacity, high hardness (up to 9 mg.-equivalent/l.), considerable concentration of carbon dioxide (up to 80 mg./l.), high concentration of ferrum (up to 2 mg./l.). It also contains phenol (up to 0,002 mg./l.) and has mild bacterial contamination. Besides, underground water contains fluorine (up to 0,5 mg./l.)

In order to bring the water up to the norms defined by All-Union State Standard, in natural conditions research on the plant including aeration block, ozonization block, block of filtering and active carbon sorption block were carried out. On the basis of the research a technology of preparation of water for bottling was worked out. The technology included aeration, ozonization, fast quartz filtering, two-stage active

carbon filtering (using specially selected ranks), ultraviolet disinfection.

Quality tests of purified and bottled water, undertaken by International Medical Research Center, Kemerovo epidemiological sanitation center and by the laboratory of OJSC "KemVod", that included more than 80 parameters, have shown that the water meets not only the requirements of the standards accepted in Russia, but also the recommendations of World Health Organization and international standards.

Nowadays production of ecologically pure drinking water, aerated, fluorinated, iodinated, mineral water and of a number of soft drinks on the basis of water "Khrustalnaja" has been mastered. Usage of modern equipment for blowing of bottles and for bottling excludes secondary contamination. This fact as well as usage of ecologically pure source water allows to assert that water "Khrustalnaja" is ecologically pure.

Thus, the population of the city of Kemerovo and of the other cities has an opportunity to use ecologically pure water. Nowadays realization of the water in twenty - liter bottles is mastered. It can also be mentioned that the disbursing price of water "Khrustalnaja" is much lower then the price of water and soft drinks that are sold in Kuzbass and some cities of Siberia. It allows people of practically all strata of society to buy it.

THE EXPEDIENCY AND TECHNICAL OPPORTUNITIES OF FOUR-INCH PUMPS APPLICATION

Vasiukov V.
Waterequipment company "Spetsvodmontazh"
Grishin A.
Firm "ATE" Agrotechelectro

In economy of the former Union, including water construction spending-gross gear of management of worked.

For example, when boring bore hols on water the pipes of petroleum bill of rating, possessing walls of greater thickness, and consequently greater weight and cost were applied. The cost of the pump was 10 % of the cost of bore holl against 2 ..3 % for today. The pricing in pump building was formed bythe weight factor.

That is why two pumps ЭЦВ4-4-70 and ЭЦВ6-10-80, which had the weights 33 and 88 kg costed 80 and 185 rubles. As a result, the large usage of the second pump brought to stopping of producing of the first one. The other situation was in market economy countries. As АО "Гидротехника" means, 63% of all producing pumps in the country are six-inch pumps and only 2,3% are four-inch ones. Meantime, the share of four-inch pumps in the world market is 77%. Today the great choice of four-inch pumps is offered.

At the same time, four-inch bore holes are practical away, and six-inch ones among all ones. These circumstances require the consideration of the problem about expediency and technical opportunities of the usage of pumps in bore holes of large diameters.

First of all it is necessary abide distinctions of parameters and characteristics of four-inch and six-inch pumps. The least diameter of a pump, influences the regime of electric motor cooling in bore hole of a greater diameter owing to increase of section between of the electric motors surface and internal wall of casing and decrease of the speed cooling flow of water in this section. It is degraded the conditions of heat transfer from the motor surface, that causes its overheat. If overheat is high enough, the pump inevitably breaks down.

The majority of agricultural consumers of water uses the tower water system of water-supply, where the water consumption is ranged from 22,5 to 67,5 $м^3$ daily, that at continious work of the pump the hour is provided with its submission up to 3 $м^3$/h. From here, when designing of system of water-supply systems, the settlement significances debit of a bore hole, nominal submission of a pump, and the other elements of system are defined. However, than larger bore hole and it debit, theme is more possible to be supplied investments in constructions of system of water-supply as a whole. As a result, little-debit bore holes were considered waterless, and all systems of water-supply were provided, with as the minimum six-inch bore holes and appropriate pumps with submissions from 6 to 25 $м^3$ / h, pipelines, designed for such submissions and appropriate delivery-regulating capacities, plumbingware and other elements with repeated stock of productivity. The contradiction between the required charges of water and their maintenance from the positions of the large costs should find the allowance today. The expediency of the delivered task is contained.

In tower water system the pump works in regime of repeatedly - short-term loads, when the time of next start-up after cooling of electric motor is strict is regulated of its frequency of inclusion. Such operating mode of the pump is characterized by operating time and pause time. The sum of operating time and pause time gives the duration of cycle, the return size of which will be the frequency of inclusion of the pump. So the pumps of dimension 4`` produced by the Slovak firm SIMA or Italian Friulana Pompe have the frequency up to 20 inclusions per houг, against 3 time at six-inch ones. The maximum frequency of inclusions defines the minimum regulating volume , which in case of application of four-inch pumps can be reduced more, than ten times. The reduction of size of regulating volume, in its turn, allows to lower the specific consumption of materials water towers , and in case of preservation of their volumes - to increase the unconsumable stock of water.

ON APPLICATION OF SORPTION METHODS TO DRINKING WATER TREATMENT PROCESSES

Vasiljev A.L., Vasiljev L.A.
N.Novgorod State University of Architecture and Civil Engineering, N.Novgorod, Russia

Recently, much attention has been given at all levels of administration to environmental problems and to providing health public water supply. In spi e of economic recession and, therefore, reduced wastewater discharge there has been no improvement in water quality in the sources of water supply. Thus, in major streams in the European part of Russia, the Volga and Oka rivers, considerable concentration of oil, phenols, surfactants have recently been detected. Total organic carbon could reach as high as 30000 m|dm^3. Present in water are aromatic hydroca (bensene, toluene), diethyl ether, tetrahydrofuran, aliphatic hydrocarbons C_6H_{14}-$C_{10}H_{22}$. The typical water treatment plants used to obtain drinking water from surface water supplies are represented most often by preliminary chlorination, chemical treatment followed by sedimentation or flock blanked clarification, sand filtration and secondary chlorination. These technologies were developed in 1930-40-ies and were not designed for application to water sources heavily polluted with man-made contaminants. Most water treatment plants fail to perform their principle function of a barrier to detain and remove pollutants of both natural and anthropogenic character. Moreover, water chlorination process produces THM ($CHCl_3$, $CHBrCl_2$, $CHBr_2Cl$, $CHBr_3$) in concentrations far above concentrations of other organic compounds present. Organic chlorine compounds in water intended for drinking purposes, particularly chloroform, is of great danger to public health.

Taking this into consideration many water treatment facilities have been reconstructed, primary chlorination being replaced by primary ozonization. This is obviously a step forward.

However, in view of complex organic compounds present in water. We think it expedient to add another stage of powdered activated carbon treatment, besides ozonization, to the drinking water treatment process. Compared to tertiary treatment on sorbtion filters this solution is relatively cheap being applied water treatment in special cases.

Studies conducted at the department of water supply and sewerage of the University on the raw water taken right from the have shown that the point of introducing activated carbon into the process, in the most common two-stage system consisting of horizontal sedimentation tanks and rapid filters, is flocculation chamber (carbon was introduced at three points: raw water, flocculation chamber, before filters).

The activated carbon dose should be in the range of 15-25 mg/dm^3 depending on raw water quality.

Of great interest is the installation for generation and feeding powdered activated carbon by German firm MANNESMAN. It is compact and power consuming. Motor car tyres are used raw material for production of activated carbon. Negotiations are presently under way about application of these installations in Nizhny Novgorod Region.

A STUDY OF COMBINED METHODS OF DRINKING WATER TREATMENT

Vasiljev A.L., Vasiljev L.A.
N.Novgorod State University of Architecture and Civil Engineering, N.Novgorod, Russia

In view of deteriorating environmental situation studies have been on in search of more efficient methods of raw water treatment it to drinking water standards. Water is a basic ingredient of food, therefore, potable water quality is directly related to public health.

During the last ten years there were many publication about possible intensification of ozone water treatment. The so called "peroxon" process is considered as the most efficient technique of drinking water treatment combining ozone, ultraviolet radiation and hydrogen peroxide. However, the analysis of literature has revealed contradictory character of these reports. There are serious difficulties in application of the method on industrial scale for the lack of equipment manufactured commercially.

Recommendations issued by some organizations which do not specialize in water treatment calling for introduction of this method into general practice as a means of reliable quality potable water supply are open to question. The literary data have shown that there are three directions in this issue.

1.Treatment process is conducted on surface water supplies carrying 18-20 mg O_2/dm^3 of organic matter determined by oxidation capacity. These data refer to laboratory-scale investigations. It is concluded that the process is not effective or that the effect is too low, and there is no point in applying the method even if it gives some effect.

2.They treat water (without specifying whether it is surface or ground water) and establish treatment effect. The study is also supported only laboratory tests aimed at possible detection of by-products.

3.They use a combination of ultraviolet radiation, followed by oxidation with ozone and hydrogen peroxide to treat ground water with high concentration of refrectory compounds (bensene, toluene, atrazene). High effect of the method is indicated. This technology has been applied in the USA, FRG, France. How there is information, which requires identification of possible by-products.

Considering all this it became necessary to give an objective estimate to this method and to get the results to support or denounce the reconstruction projects suggested

recently. The study was undertaken by the laboratory of water supply department of the University.

The results obtained were as follows:

1.In case toxic organic matter, in concentrations by far exceeding the MAC figure, is not found in raw water, the most efficient process consists ozone treatment alone. The use of UV-radiation and hydrogen peroxide gives an effect.

2.When raw water is contaminated with specific organic matter exceeding the MAC level 5-10 fold, the combined treatment with ozone, UV-radiation positive effect in spite of increased permanganate oxidation capacity.

3.Introduction of peroxide stage in the treatment system complicates water quality control in permanganate oxidation capacity which is the most common indicator of water pollution with organic matter.

4.To find a complete solution concerning water treatment with hydrogen it is necessary to continue the study to define oxidation products and establish their influence on drinking water quality.

"PRACTICAL EXPERIENCE OF POLYALUMINIUM CHLORIDE IMPLEMENTATION AT POWER PLANTS"

Vasina L.G., Boglovsky A.V., Menshikova V.L., Kazanceva T.N., Shipilova O.V.

In lab as well as industrial investigations of polyaluminium chloride (PAC) as coagulating substance for power plants were carried out. During the in laboratory investigations the influence of main factors such as dose of coagulant and OH /(OH +Cl) relation on the efficiency of natural waters purification were investigated. Was established that the best coagulation efficiency has the PAC with OH /(OH +Cl) relation equals 5/6 and with the polymerisation factor about 70-85 %, produced using the pure aluminium. At all other conditions been equal the efficiency of all PAC (OH /(OH +Cl) relation 1/3, 2/3, 5/6) are much higher comparing with aluminium sulphate.

Industrial tests were carried out at CHP-23 plant and at the CHP plant in Tobosk. Both of them showed the positive results. At CHP-23 plant the switching from aluminium sulphate to polyaluminium chloride improved the coagulation process and the reliability of the regime. This allowed to rise the production of the precipitator from 150 t/h up to 250-270 t/h.

The quality of treated water was improved by all the parameters at Tobolsk CHP in case of polyaluminium chloride usage as the coagulating substance and as the result it started meeting practically all requirements. The Fe-reduction due to the water treatment reached 85-87%, the reduction of organic contaminants was 40-50% , the reduction of colority was 85-90% and the reduction of turbidity was 90%. The residual aluminium content was at the level 60-80 ppb, production of the precipitator increased from 240 up to 350 t/h. The significant improvements were reached in the labour conditions in case of polyaluminium chloride usage.

Therefore in laboratory investigations and industrial tests showed the obvious advantages of polyaluminium chloride comparing with the aluminium sulphate. This allows to recommend the polyaluminium chloride as coagulant for water treatment at power plants and for industrial energy production.

TECHNOLOGIES OF FILTERING WATER INTAKING IN WATER SUPPLY SYSTEMS

Vdovin Y.I., Lushkin I.A.
The Penza State Architectural and Building Academy, Penza, Russia

In Russian Federation by present time 72 % of water is taken from the surface springs (85,6 cu km). The treatment of ingoing water does not meet the necessary requirements because of the lack and absolete technologies, overload and absolete water treatment plants. The filtering techniques of water intaking give the opportunity to increase considerably reliability of water intaking from surface springs and to improve the quality of water taken directly at the water supply stations. Filtering water intaking is the most expedient technique from the technological point of view. It is economically advantageous and ecologically admissible decision of water intaking in any natural, climatic and hydrological conditions.

Filtering elements (filters of various types), being the base of structural and functional realisations, protect intake, drainage systems and overflow structures of intaking from various obstacles and unfavourable manifestations of water springs regime during the process of water selection.

The wide range of structural and technological decisions of intaking by means of filtering water intaking foresees water intaking out of springs through filtering elements of various types and structures made of different natural and artificial materials, having various capacity, size and structure. The carring capacity of filtering elements of intake being obstructed with rubbish and sludge ice during the work of the pumps is being restored when it is necessary. Technological, functional, structural and operational advantages of filtering water intaking are oriented as much as possible to the adaptation to any differences of water springs regime and provide the increase of water quality.

Different modifications of filtering water intaking structures are successfully used providing water supply in difficult sludge ice conditions in small water springs depth as well as during water freezing or drying up, with water-plants abundance, during natural and technical obstructions and while

changing the courses of the rivers. Valuable experience of construction and maintenance of stationary water intaking structures (filtering buckets, dams, slopes, water intaking structures, mines, columns, drainage systems, galleries, wells and etc.) is accumulated as well as the use of light-weight (floating, suspended, funicular and others) and seasonal intakes, having filtering elements of serial production.

It is possible to vary in wide rages watershed, speed of water intaking and water quality indices depending upon functional and technological requirements to water intaking, water springs capacity and water intaking volume.

Type of intake (filtering, infiltration-filtering and combined), structure and regimes of maintenance is defined by the conditions of water quality being set beforehand and depending upon the ecological requirements (fish protection).

Filtering elements of water intaking structures are located directly in water spring above the level, at the level or below the level of bottom, under the watercourse in bank and watercourse structures, having various directions of water intaking.

Filtering water intakings having large sized porous materials are usually designed to intake large expenditures (more than 1,0 cu m/sec) out of large rivers and water basins during intakes washing when they are obstructed. Its filtration as a rule takes place in turbulent or transitional regimes. Water intaking through small grain filters having the speeds of water intaking of 0,01...0,001 m/sec (laminar filtration regime) gives the decrease of suspension content in 100-150 times, colour decrease in 6...60 times; the problem of fish protection is solved radically as well as the protection from water-plants abundance and alluvium. These types of water intaking structures work in the regime of regulated infiltration. While water intaking from small springs (freezing, drying and others), the most expedient and advantageous way is combined water intaking (of both surface and under watercourse flow).

To get high quality water intaking, extract or considerably simplify and cheapen further treatment of water intaking, new structures of water intaking equipment are designed. They have new filtering elements of various types and structures, and drainage water intaking devices. New methods of calculating and substantiation of both operational and technological regimes of water intaking measures for regeneration of filters and other means were developed for infiltering-filtering and combined intakes.

THE NEW ORGANIZATIONAL PATTERN FOR WATER AND HEAT ENERGY CONSUMPTION MONITORING

Verbitsky A. S.
MOSVODOKANALNIIPROJECT Moscow Institute for Water & Wastewater Research & Desi, Technical Director (Zenner - Vodopribor), Moscow, Russia

The reform in the field of municipal services which has been initiated in Russia can not be realized successfully without the establishing of efficacious system for municipal services monitoring, especially concerning the heat energy, cold and hot water consumption.

At present there are many companies in various cities of Russia that offer their services in the field of metering instruments installation. Nevertheless under the conditions of the existing demand characterized by limited solvency it would be expedient that these companies switch over to rendering services in the area of the resources consumption metering instead of the instruments installation only. The price of those services is relatively low and it will be possible to use consumers' money (that will be made available as a result of the instruments installation at the expense of the communal payments lowering) as remuneration for the new type of services. Hereinafter the main principles and advantages of the proposed pattern for water and heat energy consumption monitoring are examined.

1. The Company which assumes the responsibility for rendering services in the field of municipal services metering (hereinafter referred to as the Executor) makes a contract with the Consumer (a company supported by funds from the state budget, a local housing authority, a condominium association, etc.) which envisages that the Executor is to carry out all the works concerning design, complete equipment, installation and putting into operation of the Center for municipal services consumption registration (water, heat energy) by means of the Executors' own resources and / or bank credit. The Executor is obliged to coordinate the conditions of this Contract with the municipal services Supplier.

2. The Executor will remain in charge of the instruments and the equipment of the Centre installed by him (there are no any reasons for which the Suppliers or the Consumers have to be in charge of the instruments). The Contract on rendering the services in the field of measurements must envisage the Executor's material responsibility for the measurements reliability which is to be controlled by the Consumer and the Supplier of the municipal services. The duration of the Contract validity is not to be limited; in order to guarantee the required reliability of the measurements, the Executor must (at his own expense) timely provide the metrological checks of the metering instruments, their repair, maintenance and replacement (in case of necessity). This is of special importance since as a rule the servicing personnel of the Consumer has no skill and qualification required for the metering instruments operation.

3. In accordance with the Contract the Executor may assume responsibility for timely submitting (to the Consumer and the Suppliers) of the data concerning the resources consumption conditions (the scope is to be indicated in the registration Centre design documentation). This is of special importance in case of heat meters installation (hourly data concerning the heat-transport medium temperature, for example).

4. In accordance with the Contract, the Executor may assume responsibility for municipal services bills making out.

Nevertheless this work is not obligatory for the Executor, taking into account the fact that many Suppliers have already established automated systems for municipal services payment. It is considered to be sufficient that some mediator between the Supplier and the Consumer should function and the commercial efficiency of this mediator should depend entirely on the reliability of the resources consumption measuring results.

5. In accordance with the requirements made by the Consumer, the Executor may (within the framework of an additional Contract) assume the responsibility for the organization of municipal services consumption automatic monitoring, for example, in the form of a single Centre for information collection within the framework of the local housing authority, Department or Administration of Education (Health). Since at present many organizations supported by funds from the state budget (schools, polyclinics) are not juridical persons, the information concerning the resources consumption must be addressed to the centralized accounting departments that make the relevant payments.

6. A Contract on rendering the services concerning the resources consumption metering may be made by the Executor only in case the Consumer gives sufficient warranty of these services timely payment. It is probable that the organizations supported by the funds from the state budget will find it expedient to make a contract on the non-acceptable form of payment for the new type of services from the account of the financing organization. The guaranty of a third party may be also used; the administration of a city should be this guarantor since it is the administration that is mostly interested in the lowering of payments for municipal services and in the lowering of the dotation from the budgetary sources for the resources payment by the population.

The proposed arrangement of municipal services consumption monitoring will be easily incorporated into the market relations which are being formed in the municipal services area of the country. In every city several companies may emerge which will offer their services in the field of measurements; as a result of such a situation a competitive environment will be gradually formed and the tariffs for these services will not be established on arbitrary basis. The Executors will strive to develop the type designs of the Centers for municipal services consumption registration, to unify the measuring instruments and equipment and to provide the required processing of the measurement information.

According to the approximate calculations the cost of the proposed services will not be more than some 5 - 10 % of the tariff for the resource measured. At the same time, judging by the experience gained during the metering instruments installation, it is obvious that the lowering of payments may amount to some 30 - 40 % in case of correct registration of the resources (in case of rejection of various standards and design scopes of consumption). That means that the introduction of the new type of services will not result in the increase of the payments made by the consumers and will be always profitable for them. Additional means from the budget are not required for the introduction of this new types of services; it needs only the good will of the administrations of the regions and the cities who has decided to start the reform in the field of municipal services and do not want to sabotage it.

SURFACE WATER: AN ALTERNATIVE SOURCE TO GROUNDWATER

Wilfredo A. Carbonquillo
Davao City Water District

In many parts of the Philippines. groundwater is the main source of potable water. Davao, one of the fastest-growing cities in the Philippines, derives about 95 percent of it's water from groundwater sources.

Contrary to the popular belief, however, groundwater is finite and must be utilized wisely and managed carefully. Otherwise, wanton exploitation can bring about disastrous consequences. Continuous utilization of the well fields coupled with the unregulated withdrawals by large industrial users and private well owners, can trigger the decline of water levels due to increased production. There is also the possibility of saline intrusion which could likewise affect the well fields due to the proximity of most of these to the coast.

In an effort to preserve its groundwater resources for the sake of future generations, tile Davao City Water District intends to develop a surface water source. Aside from environmental considerations, DCWD came about with this option after realizing that it has become heavily dependent on electrical power. At present, it draws water from 37 pump wells. Hence, when power outages occur, its service is seriously hampered and huge system losses are incurred.

After thoroughly studying the matter, DCWD has decided to tap the Tamugan River as all alternative source. Originating from tile slope west of the city boundary and north of Mt. Talomo, this river is capable of producing 250000 cubic meters a day- Once completed, the project. will enable DCWD 10 serve between 80-90 percent of Davao's population and ensure the city of a continuous and abundant supply of water up to the years beyond 2000. More importantly, DCWD will no longer be relying much on electrical power since water will be delivered by gravity. The project, however, is father ambitious and is estimated to cost approximately P1.5 billion. Because of the huge capital investment requirement, DCWD will undertake this project through BOT.

With this DCWD hopes to draw on the technical expertise, financial resources and utility management skills of the prospective concessionaire from the private sector. If successful, the concessionaire will sign a agreement with DCWD to undertake all facets of the designs construction, management, operation and maintenance or the system. The concessionaire will operate and manage the system over a period of between 20 to 25 years.

NEW DEVELOPMENTS IN NANOFILTRATION TECHNOLOGY

De Witte J.

The problems associated with the production of drinking water from surface water sources are well known: the increased demand, coupled with requirements for better quality (due a to both legislative constraints and customer demands) has lead to a re-engineering of the water treatment process. Membrane technology, already well established in desalination of sea water, is slowly gaining acceptance as one of the possible options for advanced treatment of surface waters.

Unsuitable drinking water sources can be divided in roughly two categories: on the one hand waters with acceptable salinity, but contaminated with organic chemicals (natural or man-made), and on the other hand waters with salts contents above the guide lines for drinking water.

Most surface waters in the industrialised countries have acceptable salt content in order to be used for drinking water. Residual organics such as herbicides, pesticides and plain trace chemicals can pose a health risk.

Few options are available for removing organics from surface water supplies. Until recently, possible treatment consisted of either adsorption , oxidation or a combination of both. The conventional treatment only removes low solubility pesticides and with limited success.

Activated carbon has been reported to remove the most common herbicides and pesticides. However, questions remain as to the effectiveness of the process, as the other organic matter in the water competes with the herbicides for adsorption. If THM control is also to be taken into account then short contact GAC (granular activated carbon) alone is not considered an effective solution for long term THM control or THM-precursor removal.

Oxidation with ozone will reduce pesticide levels, although triazines are not sufficiently reduced to avoid installing an additional GAC column. THM precursors are not totally destroyed by ozone. They are broken down to low MW organic molecules, increasing the TOC load of the water and consequently increasing the available nutrients for bacterial development. Adapting the ozone concentration to the organic load is difficult, so the preferred method is overdosing. This method cannot cope with severe concentration overloads as in the case of accidental spills or dramatic increases due to runoff after the first rains.

Reverse osmosis (RO) has been considered for the removal of organics from potable water. Most membranes remove more than 95% of the dissolved organics, regardless of the incoming concentration. Unfortunately, the RO membrane also removes most of the inorganic salts, and in the case of surface water treatment, the product water cannot be regarded as being of drinking water quality in accordance with the laws of most European countries. Inclusion of a membrane, with the ideal characteristic of removing low MW organics only, in the treatment chain will give additional benefits, apart from herbicide removal. Most of the dissolved total organic carbon (TOC) will be rejected. As a consequence the absorbable and assimilable part of the TOC will decline, eliminating nutrient sources for bacteria. Logically it would be possible to operate a distribution net with an absolute minimum of chlorination. This would result in a greatly reduced amount of THM's and other by-products of the disinfection process.

A step in the right direction was made with the introduction by FilmTec of the FILMTEC* NF7O membrane (polyamide on a polysulphone basis), which is the prototype of the nanofiltration membrane . The name nanofiltration has been chosen to reflect the fact that the membrane has a different rejection spectrum when compared with the normal FT30 range of reverse osmosis membranes. Although the term cut-off is not normally used in RO, we could say that with the NF7O we are looking at a cut-off in the range of MW 200-500; this corresponds to hypothetical pore sizes of 10 angstroms, or 1 nanometer. Hence the name nanofiltration.

Nanofiltration membranes will reject divalent ions better than monovalent ions. This will result in a softening of the water, and this was the first use of nanofiltration membranes in the late 70s in Florida. The NF70 membrane produced water that was almost completely softened and removed residual colour from the highly charged waters from the Everglades.

Water quality regulations in Europe are different, and a residual hardness is required, if not for health purposes then in order to avoid corrosion in the distribution network. In order to satisfy those requirements Dow developed the FILMTEC* NF200 membrane. This membrane typically removes 50% of the calcium from the water, but will (on a single element) remove better than 93% of atrazine. This results in a removal rate of 90% on a membrane system with 85% recovery.

Typical nanofiltration installations operate at pressures between 5 bar in Summer and 12 bar in Winter (depending on the degree of fouling). The impact on the cost price of the water can be estimated to be around US$ 0.15 per cubic meter which can be weighed against the benefits mentioned above.

PATHS OF TACKLING THE PROBLEMS OF PROVIDING THE POPULATION WITH QUALITATIVE DRINKING WATER

Yakovlev S. V.
Research and Engineering Institute for Water Supply, Sewage Systems, Hydraulic Structures, and Engineering Hydrogeology (VODGEO Russian Federation Research Center), Moscow, 119826 Russia

The problems of water-resources management and technologies of treatment of natural water and wastewater have been given attention in Russia at all times, however, it has been far from adequate.

At the present time, 96.8 cu km of water is withdrawn annually in Russia. About 76.7 cu km of water is used: 41.8 cu km by industry, 14.2 cu km by communal services, 11.1 cu km by irrigation, 3.5 cu km by agriculture, and 7.1 cu km by oher sectors of economy. The wastewater disposal to water bodies amounts to 62.1 cu km: 24.4 cu km of treated effluents, 17.8 cu km of inadequately treated effluents, and 6.5 cu km of untreated wastewater.

Centralized water-suply systems exist in 99 % of industrial centers of cities and towns and in 89 % of industrial settlements. New waterworks with a total capacity of 10 900 000 cu m per day are being constructed in 151 cities and towns, and waterworks with a total capacity of 20 000 000 cu m per day are planned to construct and reconstruct by the year 2005. However, numerous accompanying problems, which should be solved immediately, are faced now; they are problems associated with the quality of drinking water and water bodies, wastewater treatment, and processing of water precipitate and sewage sludge.

The existing technologies of water treatment for drinking water supply, settling, coagulation, filtration, chlorination, and ozonation of water were elaborated in the years when the surface water sources were fairly clean. However, it is common knowledge that water bodies are being subjected to the increasing human impact now, and this results in their pollution with heavy metals, detergents, pesticides, nutrients, nitrogen, phosphorus, chloro-organic compounds, and other toxicants. The applied water-treatment procedures and technologies are in no position to provide the required quality of drinking water.

In addition, water bodies are being contaminated at a global scale by polluted precipitation and as a result of washing with surface water from agricultural fields of fertilizers, pesticides, nitrogen compounds, phosphorus and other chemicals and as a result of the delivery of heavy metals, oil products, and other pollutants from urban areas and industrial plant sites. It should be remembered that Russia has an incomplete separated sewerage system: domestic and industrial sewage is treated, whereas storm sewage is not treated. However, this type of sewage carries a large amount of pollutants. Global contaminants and diffusive wastes account for 50 % of pollutants. For this reason, the action of high priority now is taking measures for provision of the ecological safety of drinking water, i.e., obtaining the drinking water of the proper quality.

The above measures may include introduction of the rcently developed (as a result of research and organizational efforts) technological processes, engineering facilities, apparatuses, and chemicals applied to wastewater treatment (high-molecular floculants, new filtering materials, dual-media carbon-sand filters, bactericidal irradiation units, mixers, flocculation chambers, thin-layer blocks, floaters, filters of electrodialysis amd membrane units, etc.). Noval technological processes, facilities and plants for water treatment have been developed on the basis of new principles of natural water processing and municipal and industrial wastewater treatment making, it possible to extract from natural water all the pollutants with the use of biological techniques, involving biosorbers, sorbents, and strong oxidizers. Measures for reducing drinking water losses, accounting for 70 %, are being elaborated.

Because the technologies of advanced treatment of natural water are costly, they will be introduced gradually. A strategy of multistage construction of new plants for treatment of heavily polluted water will be pursued.

Russia has large resources of ground water with a more stable chemical composition and a better sanitary level as compared with surface water. For this reason, we should use ground water for water supply where it is possible.

In many cases, when the supplied water does not meet the standards, the population should use domestic treatment units for obtaining drinking water of required quality. This measure should be temporal, and centralized water supply is to be introduced.

Remediation of sources of drinking water supply is also an important problem. It is a difficult task because 50 % of pollutants are delivered by regulated disposal. The rest of the pollutants are supplied at a global scale with polluted rain and snow and as a result of other world-wide processes.

Another problem is that of treatment of the water of regulated disposal, sewage water, and storm water. Remediation of water bodies without solving this problem is impossible. The necessity and expediency of advanced wastewater treatment should be reconsidered. It appears that wastewater must be treated by the classical method, which reduces the pollution by 95 %, and then the effluent must be subjected to final treatment.

An urgent problem is improvement of the technology of industrial water supply and introduction of closed water circulation systems.

An important problem i processing of wastewater sludge and natural water precipitate. Wastewater treatment produces annually about 100 000 000 cu m of sludge. It is necessary to find an engineering decision for designing the socially safe sites for long-term storage of wastewater sludge, which presents the first-class hazard. The main use of the sludge of municipal effluents is that in agriculture as an organic fertilizer. However, the penetration of heavy metals and toxicants from industrial plants to municipal wastewater restricts appreciably this use of sludge. As of now, many reliable and effective methods of sludge treatment have been developed. They are aeration stabilization, compaction, mechanical dewatering with the use of vacuum filters, membrane-filter processing, fermentation, composting, and oven drying.

THE CLOSED SYSTEM OF WATER USAGE AT THE ENTERPRISES OF LIGHT INDUSTRY

Yakovlev S.V., Alfyorova L.A., Dyatlova T.V., Zemlyak M.M., Sokolo E.V., Churbanova Va,I.N.
The firm "BIONIK", Moscow, Russia

Development of the closed systems of water usage and effective technological circuits of purification, realizing the opportunities of reception of treated water quality, required for these purposes, is the only economically expedient way for industrial enterprise.

The closed system of water usage is understood as a system,when water - supply,drainage and waste water treatment are considered as the preparation for their reuse in total. In this case treated industrial waste water is a source of technical water - supply, and fresh water is used only for the special purposes and at lack of treated waste water.

For creation of the closed systems of water economy at the enterprises of light industry, first of all, the development of scientifically reasonable requirements to water quality,used in all technological processes and operations, is necessary.In this case the standards of such water utilization should be mutually coordinated with material balance of water usage and drainage as on quantity, as under the

qualitative characteristic of water with regard for all components, removable from the process with waste water.

The association of the competent experts of the firm "BIONIK" has experience of development and introduction of the closed systems of water usage at the enterprises of light industry, for example at AO PO "ISKOZH" (Neftekamsk).

The main source of waste water production at the integrated plant is the dye-finishing manufacture of the knitted-goods factory which water usage and drainage reach 3000 m3/d (at the total waste water discharge equal to 4860 m3/d).The used reagents of the technological processes: dyes, pigments, surface-active agents,textile-auxiliary materials, dressing and finishing agents, make up main weight of contaminations.

At the first stage of the rational water usage system formation the valuation of the main manufacture technology was carried out, which has shown that there is an opportunity to reuse thin contaminated waste water formed during washing- up after operations of bleaching and dyeing ,as well as residual dyes.It permits to develop the resources-economizing technology , that is a rather actual problem for today.

The joint efforts of the specialists of the knitted-goods manufacture of AO PO "ISKOZH", the technologists on dyeing of fabrics and the experts of the firm "BIONIK" allowed to carry out great activities with the purpose of determination the maximum permissible concentrati- on of electrolytes (chlorides, sulphates, phosphates, ammonium nitrogen and nitrates) ,surface-active agents in process water, intented for reutilization and the opportunity of durable usage of residual dyeing water in the process of fabrics dyeing in dark and half-dark tones.As a result, the practical recommendations for reagents,chemical materials and water saving ,as well as the recommendations for organization of the system of dyeing solutions durable reutilization were given.The system is simple in operation ,it does not cause technological difficulties, it is not required capital costs for its realization.Its introduction will allow to save 10-15 kg of dye, 150-160 kg of salts and 50% of soda from one unit of the equipment a week. When adjusting and reusing the residual dyeing solutions of the knitted -goods factory,the content of chlorides in total flow may be reduced up to 30% ,direct dyes up to 79%.

As a result of the valuation of influence of the residual chemical reagents contents in used water on the main technological processes (dyeing,bleaching,wasing-up) and the determination of maximum permissible technological concentrations of recirculated water components, the requirements to its quality were developed;they were used at the development of the system of recycled water usage of the knitted-goods factory AO PO "ISKOZH".They cardinally differ from the existing ones at the factory and include the requirements to water quality as for separate operations, as for the whole technological process of manufacture (with regard for their maximum significances on operations.- See the Table).

The analysis of the balance of water usage and drainage ,as well as the content and quantity of substances polluting waste water has allowed the firm "BIONIK" to select the rational technological circuit which is effective for the given conditions of the industrial flow treatment.The block of mechanical treatment,constructed at the AO PO "ISKOZH" consists of the fibre-collector, the sand trap, the tank for discharge stabilization.The subsequent two-step biological treatment is carried out in the towe-type devices under anaerobic and aerobic conditions. (the development of the Architectural-Building Academy in Nizhniy Novgorod).The introduction of the circuit permits to obtain the required quality of purified water according to all parameters, exept of salt content, and to feed about 80% of treated water into the recirculating water-supply system.

COMPACT DOMESTIC SOLAR WATER DESALTER

Yefremov H.A., Kuchner B.I., Kochnev I.A.
NPO mashinostroenia, Reutov, Moscow Region, Russia

NPO mashinostroenia, one of the leading aerospace enterprises in Russia has developed a domestic solar desalter intended to produce purified drinking water using solar energy from any type of water with increased salt content (sea or underground - well water) and also from contaminated surface water, with application of high technologies which are used for creation of space vehicles.

The desalter effective area 0.85 sq. m allows to get 7 litres of fresh water daily using solar energy for the purpose, what corresponds to production of 8.5 lit. by an evaporation mirror of 1 sq. m.

The world output of daily water production amounting to 4-5 lit. of fresh water was achieved by single-stage desalters from an effective area of 1 sq. m. area.

Such high condensate output is provided by application of special coatings, which are capable of maximally absorbing solar energy, and also by the desalter structure features, where not only the translucent surface of the desalter but also the casing proper are used as a condensing surface.

The desalter is manufactured from food aluminum and stainless steel and is designated for individual usage like any domestic device, providing fresh water for a 3-4-men family.

A replaceable water conditioning units as a component part of the desalter, purifies the desalted water from harmful impurities and pathogens, saturates it with requisite trace elements and brings its drinking quality up to the world standard.

The desalter is of a sectional structure and due to this it is easily transported.

Technical Characteristics:

- effective area 0.85 sq. m.
- daily amount of drinking water 7 l.
- overall dimensions:
- folded position 1530x800x300 mm
- assembled position 1530x740x950 mm
- mass 45 kg
- service term at least 10 years
- replaceable conditioning unit resource 1000 l.

The solar water desalters can also be delivered in a module-type design with an area of 4; 8 and 12 sq. m., producing daily 30; 60 and 90 l. of drinking water, respectively.

COMPACT STATIONS FOR DRINKING WATER PREPARATION FOR SMALL WATER SUPPLY SYSTEMS

Zinberg M.B., Mezhebovskaya G.P., Nasibullin B.M.
Firm "Ecobios", Orenburg, Russia

Nowadays there is no complex of all necessary facilities for small duty watersupplies, that in turn does not allow to provide villages, shift settlement, small towns with quality drinking water in a centralized way.

Besides, concrete structures are used for water treatment at the small duty water supplies, and these structures require considerable capital investments, great building material consumption and the absence of sufficient construction base prolongs the terms of putting into operation for 5-7 years or more.

Firm "Ecobios" are developing principally new technological lines, more adapted for small and medium duty watersupplies conditions and taking into consideration local peculiarities of an object and quality of water under treatment. It created designing documentation and performs full complete delivery of a manufactured drinking water preparation station (DWPS) on the basis of its developments. "Ecobios" performs construction assembing and starting - putting into operation works.

The new russian equipment and units are used in the complex of technological equipment of the drinking water preparation station, and different materials and chemicals are applied there.

Technological equipments is located in a heated block-box. Dimensions of a block-box, set of equipment and its type and standard size are determined considering quality of water under treatment and required capacity.

The scientific-production enterprise "Ecobios" manufactures and performs delivery of the DWPS of complete available for service with capacity of 25 to 500 m^3/day for drinking water preparation from underground water supply sources with high iron, manganese content and high turbidity.

In the set of the DWPS technological equipment are used filtering modules, made of titanium elements and bactericide units. DWPS are provided with a necessary set of pumping aggregates, water flowneters and automation systems.

DWPS-are located at the free areas, offerred by the Customer and joined up to already existing watersupply systems.

Application of the manufactured complete available for service drinking water preparation stations will give an opportunity to conduct technological studies to get ready designing documentation, to perform contract supervision, starting and putting into operation works and to hand over the station for the Customer on turn key basis in three months.

SAND FILTERS CONVERSION WITH AN APPLICATION OF ACTIVATED CARBON ON BASIS OF THE OPENED WATERDRAFT OF ORENBURG AS A SAMPLE

Zinberg M.B., Mezhebovskaya G.P., Shamsutdinova M.V., Genisher M.D.
Firm "Ecobios", Orenburg, Russia

In connection with the development and introduction of a new National Standard (GOST) "Drinking water", which introduces new more strict requirements for organic substances content, new methods for water treatment have been included into the water preparation technology; and the most effective method among them is sorption treatment with activated carbon application.

As far as designing and construction of sorption treatment facilities require a long period of time and great capital investment, it is possible to translate sorption technology into life only by reconstruction of already existing sand filters.

The conversion of five speedy sand filters have been performed in the commercial conditions of the opened waterdraft of Orenburg; in course of it the following types of work have been done: sand charge has been drawn out; drainage system has been reequipped expanded clay aggregate layer has been charged hight was up to 20 sm; air supply system has been mounted necessary for coal charge bioregeneration works performance, activated coal charge has been cone.

Different grades of activated coal of native and foreign production have been studied and tested as a sorption material. Coal charge of the grade SGL (USA) has been selected for speedy filters recharging, it combined filtering and sorbitizing characteristics. The coal charge height was taken considering 30% layer expansion and made up 1,2 m.

Conversion of speedy filters has been performed within two months and was held step by step in non-stop duty of the waterdraft treating facilities.

Since February 1997 speedy coal filters have been put into operation. Filters operation is monitored and water quality is controled according to the main and individual factors: turbidity, chromaticity, oxidizability, oil products, surfactants, phenol, aluminium.

Coal filters operation results during winter, high-flood and summer period proved a high degree of activated coal charge of the grade SGL (USA) efficiency as sorbitizing and filtering material compared to sand charge filters performance.

For example: in high flood period of duty observation for one day 1 kg of coal charge sorbates 0,52 g of dissilved organic contaminators and 1,47 g of suspended substances; 1 kg of sand charge removes up to 0,1 g of dissilved organic compounds and 0,42 g of suspended substances. According to individual contaminaators by 1 kg of coal charge are removed up to 0,08 g of surfactants and up to 0,42 g of oil products, and at the same time sand charge sorbates up to 0,004 g of surfactant and up to 0,014 g of oil products.

Results of duty observations of speedy filters performance gave an opportunity to make a conclusion on activated coal SGL (USA) effeciency for application as filtering and sorbitizing charge and advantages of its application for sand filters conversion, the conversion could be performed in a short period of time and in non-stop duty of the waterdraft treating facilities operation.

Nowadays preparation works are conducted for sorbitizing characteristics of activated coal charge recovery by bioregneration method at the opened waterdraft, that work would be performed step by step at each speedy filter.

Successful practice of activated coal application at the large-scale production could be used for water treating technologies modification at the water preparing stations of cities of Russia.

ROLE OF THE FIRM "ECOBIOS" IN THE ORENBURG REGION POPULATION SUPPLY WITH QUALITY DRINKING WATER

Zinberg M.B., Maslova O.G., Mezhebovskaya G.P.
Firm "Ecobios", Orenburg, Russia

The problem of population supply with quality drinking water is growing more and more actual in this country, and in a number of regions it has critical character. Deficiency and unsatisfactory quality of drinking water determine low level of sanitary-epidemiological well-being of the population of these regions.

Solution of that problem is possible in the whole only under complex approach; that includes putting of existing waterdraft facilities, systems of water preparation and supply in accordance with modern standard-technical regulations, and also modification of standartization and control systems of drinking water. But performance of that scope of work requires long periods of time and great capital investments.

At present time the most real way out is use of different water treating facilities and units directly in the place of water consumption "at the tap", and also bottling of high quality drinking water, what is widly used in the West, and is spreading in recent years in this country.

Development and introduction of technologies and equipment for quality drinking water preparation is one of the main trends of the firm "Ecobios" activity. Within the limits of that field the firm perform the following kinds of works at the objects of Orenburg and the Orenburg region.

1. The firm "Ecobios" develops principally new technological lines, more adapted to small and medium suty watersupplies conditions, considering local features of an object and quality of water under treatment. On the basis of the developments it makes designing documentation and performs full complex delivery of manufactured drinking water preparation station (DWPS). In executes construction-assembling and starting-putting into operation works.

Application of manufactured complete available for service drinking water preparation stations will give an opportunity to conduct technological studies, to get ready designing documentation, and to conduct contract supervision and starting-putting into operation works and to hand over the station for the Customer on turnkey basis within three months.

2. Since 1994 in Orenburg has been working a plant of the concern "Aqua life" ("Zhivaya woda"), for bottled water production, constructed by the French company "SIDEL". "SIDEL" technology for water preparation includes four stages, and also two staged ozonization, that provides to get high quality drinking water. But according to the technology the stage of adsorption after treatment of water on activated coal after ozonization is not included; but it is quite necessary to avoid possible getting of residual ozone and toxic products of ozonolysis in bottled water and to comply with modern regulations.

The firm "Ecobios" has conducted studies of a pilot adsorption unit on real water of the concern "Aqua life" and as a result was proved and grounded the necessity and advantage of including of adsorption stage into the water preparation technological line, were determined process technological parameters and peculiarities of the construction of instrumentation.

On the basis of the obtained results calculation and designing documentation were fulfilled for commercial production of a adsorption unit. Nowadays the manufacture of it is performed by the concern "Aqua life" and the firm "Ecobios".

3. In connection with development and introduction of the new GOST (standard) "Drinking water", which implies more strict requirements for organic substance content, new methods for water treatment have been included into the water preparation technology; and among these methods the most effective is sorption treatment with activated coal use. At present time on one of the waterdraft of Orenburg - the opened Ural waterdraft with capacity of 56 thousand m^3/d is realized sand filter conversion with activated coal use, that provides modification of water preparation technology and upgrades drinking water quality with out expenditures for additional facilities construction, the work is performed by the firm "Ecobios" design.

Successful experience of activated coal application at the waterdraft of Orenburg could be used for modification of the water treatment technologies at the water preparation station of the cities and towns of Russia.

RECONSTRUCTION/REHABILITATION AND EXPANSION OF SEWAGE TREATMENT PLANTS

Mantyk
Berliner Wasser Betriebe, Berlin, Germany

The principal subjects and theses of the above lecture are as follows:

- Factors that call for necessary reconstruction/rehabilitation work and expansions in a sewage treatment plant
- Recording of important basic parameters
- Evaluation of developments in the collecting area of the sewage treatment plant
- Possibilities for an enlargement of the capacity using the existing plant as far as possible
- Possibilities of a process expansion using the existing plant as far as possible
- Examples

SECTION II
WATER DISPOSAL

ECWATECH

ADVANCED DEVELOPMENTS IN MIXING TECHNOLOGY FOR NITROGEN AND PHOSPHATE ELIMINATION AND SLUDGE DIGESTING BY ABS MIXERS AND AGITATOR

Abona M.
ABS Pumps International AB

1. For nitrogen and phosphate elimination mixing of treated waste is required. A widely spread methods are application of top entry agitators and submersible mixers with horizontal axis of rotation. However in the case of tanks of rectangular or circular shape the use of above mentioned units are of not much effect. A unique submersible bottom-mounted mixer HYPOMIX®, designed by ABS engineers, is characterized by symmetrical flow propulsion without the creation of surface turbulence, thus excluding unnecessary oxygen input

A comparison of submersible motor propeller mixer with horizontal axis and a rated power 3.0 kW equals with the operating characteristics of HYPOMIX® with hyperboloid mixer body, vertical axis and a rated power of 1.0 kW.

2. For sludge decomposing in digesters at any temperature conditions sludge motion in the hole body of a digester is necessary. Widely spread agitator with central tube has turned out to be ineffective due to unrobust design, large power consumption, inconstant circulation of sludge and temperature distribution, and also the most urgent problem - braking of sludge cake for biogas removing. Application of propeller agitator SCABA of ABS with propellers of different diameters for maximum liquid motion control allows to avoid the above mentioned problems. Shaft of different diameters minimizes agitator's weight. A risk of propeller clogging due to fibrous matter is avoided by reverse propeller rotation for several minutes. A construction with upper propeller provides constant braking of surface sludge cake. And an advanced propeller form managers to prevent sand sedimentation and moving through the tank.

For several decades in Sweden all the digesters were renovated from old design with central tube. Like in Gothenburg, Sweden, two digestion tanks of 11 000 m^3 with temperature of 37.5 °C were modernized for SCABA agitators. Through utilization of modern technology the dwell time was reduced to 10-12 days with power consumption only 11 kW per agitator.

3. Advanced research and development in pump design are backed by engineering heritage going back 125 years. Today ABS is one of the world's largest manufactures of pumps and leader in pump design. ABS offers submersible and dry installed pumps, mixers and aerators for Water & Waste, the Process Industry and for Building & Construction.

ABS - экономичность и надежность.

TRANSIT FLOW IRREGULARITY INFLUENCING SELECTION OF OPTIMAL PARAMETERS OF DRAINAGE NETWORKS

Abramovich I.A., Prokopov A.V., Fenchenko V.N., Fenchenko N.V.
UKRKOMMUNNIIPROGRESS, Kharkov, Ukraine

The complicated structure of drainage transport network in large cities includes a large number of components connected in consecutive or parallel order. At present network components are designed for maximum capacity, this results in redundancy during exploitation process. However it is showed in [1] that level of redundancy could be reduced if a system has special damping ("smoothing") components, regulating vessels in particular. Diameters of non-pressure and pressure pipes in water-mains and capacities of water-purification plants could be reduced by using of such reservoirs smoothing irregularities of the flow. That leads to reduction in capital investment.

It is advisable to put regulating vessels in the network's points with the maximal irregularity of water-drainage, in particular before pump stations and water purification plants. In order to increase economic effect of the reservoirs utilization their design should be based on determining of optimal capacity and layout of vessels.

One of the possible solutions of this problem , as in the case of pumping out with the constant intensity from a vessel forming a part of sewer network, which also includes pump station, pressure pipe-line, and non-pressure collector, is given in [1]. This solution was extended in the work [2] to the case of arbitrary changes in intensity of pumping out from regulating vessel, the network components placed "above" the regulating reservoir were added to the examined fragment of a network. Proposed in the work [2] mathematical equations describing space-time evolution of a daily diagram of outlay at every point of network were used for calculation of liquid flow in network components. However, influence of "transit" flow irregularity on selection of optimal capacity of reservoir was not accounted for in both [1] and [2]. It is evident that if schedule of pumping out from regulating vessel is to be coordinated with intensity of "transit" flow, then in some cases a significant economic effect could be achieved. In some cases this effect could be achieved by using smaller diameter of collector, achieved reduction of prices compensating construction of a bigger regulating reservoir. In other cases economic effect could be achieved by reducing of the regulating reservoir required capacity without changing diameter of collector and , consequently, its cost.

The previously designed algorithm was used for choosing optimal capacity of reservoir with regards to irregularity of "transit" flow. The algorithm was modified in order to have the scheme of pumps functioning coordinated with intensity of "transit" flow, namely, at moments of "transit" flow intensity reduction there was increase in pumping out from

the reservoir, and there was reduction in pumping out from the reservoir during increase of "transit" flow. This algorithm was realized in a computer program to be used for technical-economical substantiation of engineer solutions of pumping station regulating reservoir capacity selection with regards to irregularities in "transit" flow. The program looks through versions of network changing vessel capacity, this results in simultaneous change of outlay daily schedule at the exit of pump station, and technical specifications of the following network components.

The fragment of drainage network including regulating reservoir, pump station , and non-pressure collector (picture 1) was used for simulating of "transit" flow irregularities influence on selection of optimal parameters. Pictures 2 and 3 are displaying the results of one of the computer simulation of economic effect achieved by reducing the required regulating reservoir capacity.

The latter and other computer experiments have confirmed conclusion [1] about the capacity of reservoirs used in typical projects being far from optimal.

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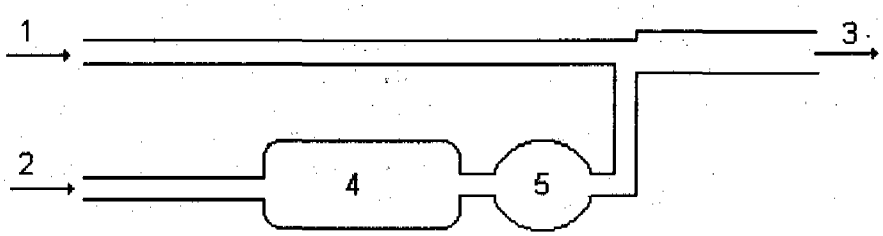
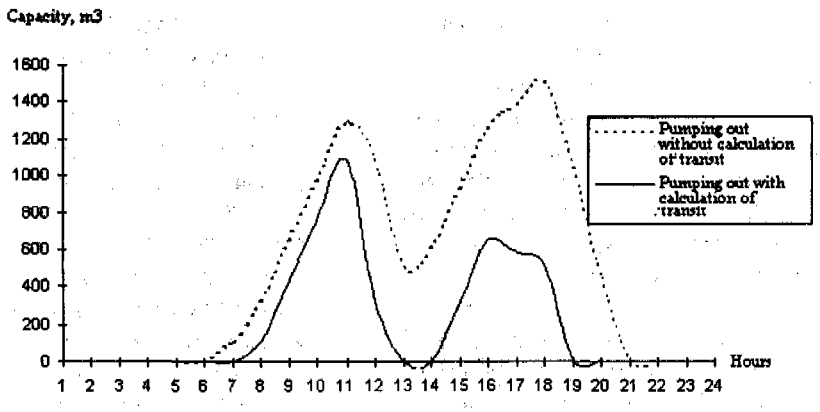


Picture 1. Analyzed fragment of network.

1 - transit flow,
2 - incoming flow,
3 - overall outgoing flow,
4 - regulating reservoir,
5 - pump station.



Picture 2. Graph of reservoir filling in

PROBLEM OF WASTE WATER SLUDGE TREATMENT AND CERTIFICATION

Agranonic R.Y., Gunter L.I., Belyaeva S.D.
"BIFAR" Co. Municipal Water Supply & Treatment Research Institute

In order to prevent environmental pollution, the problem of waste water sludge treatment must be aimed at maximum reduction of its volumes and utilization in different branches of economy.

To solve these problems it is necessary not only to treat the sludge using modern technique s and equipment? But also to work out methods for agro-ecological and toxicological evaluation of the sludge so as to determine a possibility of its utilization or disposal throughout the environment.

These question have become especially acute in connection with stricter requirements on behalf of the State Committee on Nature Protection when it establishes limits on formation of wastes and their disposal together with increased charges for environmental pollution.

A decrease in volumes of sludge is attained by using approved modern technologies: thickening, stabilization, and dewatering by employing imported and, what is particularly important, native equipment. The Kaluga Turbine Plant together with the "BIFAR" Co. have organized production of large centrifuges with an output up to 100 m^3 per hour. When sludge is dewatered by high-capacity centrifuge at the Kaluga sewage treatment plant, the effect of solids retention is 98 to 95 per cent, moisture of dewatered sludge is up to 70 per cent. Native band filter-presses installed at a number of treatment plants also achieve an effective separation and dewatering of sludge.

To solve problems connected with sludge utilization and disposal it is necessary to work out new improved regulatory and instructive documents, allowing to classify sludge of different qualities and to determine ecologically safe ways of its disposal in the environment. At present the «BIFAR» Co., together with other organizations, is working out a number of instructions on disposal of non- utilizable sludge at solid-waste sites and at special at ecologically safe sites for sewage sludge.

Modern approach to utilization of waste water sludge is impossible without such procedure as certification, i.e. an independent and qualified evaluation whether the formed waste correspond to the regulatory documents. The "BIFAR" Co. has developed a "System of voluntary certification of waste water sludge". The System is registered by the Russian State Standards Committee (certificate # РОСС RU.0001.04ЮЖ00 dated 18 august 1997) and is used according to «Regulations on performing certification in Russian Federation», Documents of certification system in the State Standards of Russia, and Guide lines: 9SO/MEK 2, 9SO/MEK 16, 9SO/MEK 40, 9SO/MEK 56.

The System interact with international and regional organizations in the field of environment protection.

The objects of certification are wastes (sewage and industrial waste water sludge), products made on the basis of wastes, as well as work on treatment, utilization, rendering harmless, and burial of wastes. The work is done by a certifying organ using different schemes, including also analysis of the state of production and inspection control of certified products. The certificate of compliance of the set sample contains information on: chemical composition of waste or its products; danger class of the waste; basic regulations of dealing with the waste or its products. The certifying organ's function includes also keeping and actualizing the fund of regulatory documents.

PROSPECTS OF CIRCULATING WATER-SUPPLY ON ASTRAKHAN GASCHEMICAL COMPLEX (AGCC)

Andrianow V., Spirn V.
"Astrakhangazprom", Astrakhan, Russia

Stable development of enterprises of oil-gas complex is connected with the translation of technological processes on circulating water-supply. One of such enterprises is AGCC, where is produce mining and conversion gasochemical cheeses (contents H_2S 25 %) with getting sulphur, gas and fluid fuel.

Main pollutions agents sewage are organic materials: hydrocarbons $C_6 - C_{10}$, mono- and dietanolamin, mono and dietilenglicol, metawhined, components of inhibitors of corrosion, as well as hydrogen sulfide, elementary sulphur, oil-products, mercaptans and others.

Design scheme of conversion cheeses excludes all unset of sewage straight in the shallow rivers, so their salvaging is produce on the territory of complex. For what sewage after the peelings are accumulate in the capacity of seasonal regulation of volume 8,5 mil.m^3. And at vegetation period are utilize on agricultural floors of irrigation. Such method to take exemption to water during 10 years has bring about ecological problems on the territory AGCC, conclude in the ascent of ground water and appearance technogenetic lakes.

Decision of this problem on AGCC is connected with making a circulating water- supply. Under existing system of peelings recurrent use without further processing possible only for non many whole.

In this connection the conduct cycle of studies, direct to the development of technology an repelling for the reason raising efficiency of process. Were practiced different acceptance an repelling: biofilterring through granular filters; adsorption on the active carbons and biorepeling by immobilized microorganisms. The Most efficiency has show a way, based on immobilization of microorganisms (87 - 92 %).

This technology is designed in the institute of colloidal chemistry and chemistry of water by it. A.W. Dumanski (Ukraine). In the base of present work are place results of

joint studies, received under experienced-industrial testing an installation biological repelling sewage AGCC.

immobilization allows create and support m the bioreactor high biomass of bacterias- destructors. Raise stability to hard conditions. One of the main features of immobilized hutches is their increased metabolic activity. For immobilization of microorganisms is used checker of type "VILA" made from kapron or polyethylene threads in the manner of tapes with the fringe. It has a high sorbtional surface, movable in the reactor, simple in the fabrication.

In conditions is experienced-industrial test a shaping biocenosis passed depending on the composition of sewage, temperatures (20 - 25°C), contentses biogenic elements (NH_3 - 10 mg/dm^3, P_2O_5 - 9 mg/dm^3), O_2 - 8.8 mg/dm^3 during 96-48 hours. In the operating duty a process a peelings lasted 6-10 hours.

On results of studies a contents main pollution agents after biorepeling formed: on COD 10-15 mgO_2/dm^3; on weighted materials 16-25 mg/dm^3. Toxicity Level was reduced, practically, before the zero (100% survivability testobjects).

Studies have show that using immobilized hutches in the clear of sewage AGCC is one of the most ask and efficient ways of conservation stability working the peeling buildings. Repeeling will reduce a load on adsorbtional block of installing deep repeeling in 6-10 once, that will allow to lead an adsorption on more high velocities before 8-10 m/sec when increasing duration filter cycle in 3-5 once.

Thereby, construction and commissioning a system an repelling will allow translate AGCC on closed water-supply, enlarge a production output and decide many ecological problems.

TECHNOLOGICAL SCHEME OF PURIFICATION AND COMPLEX TREATMENT OF BOTTOM' S PRECIPITATES AND PRECIPITATES FROM PURIFICATION STATIONS.

Anufrieva S.I., Malikov V.A., Krylov I.O., Lugovskaya I.G., Esin A.V.
All-Russian Scientific Research Institute Of Mineral Resources Named After N.M.Fedorovsky,
Ecological Fund Town Development - "ECOGOROD".

The unified technology of extracting petroleum products, heavy metall's ions and other organic and inorganic impurities from raw materials (slime, sands, bottom's precipitates) have been developed.

The complex scheme of treatment of such precipitates, including the technology of mechanical separation and separated treatment of each fraction (sand and silt) have the most ecological and economical efficiency.

The proposed scheme has a block-module construction.

Block 1. Sorting and separation of precipitates into sandy-growelly and silty fractions, cleaning of sand from petroleum products by flotation. Cleaned sands may be used in highway engineering and production of building materials. Supplementary cleaning of sands allows to use them in glass industry and obtain heavy metal concentrate (Ti , Zr).

Block 2. Processing of silty-clay fraction by hydrometallurgical methods with cleaning from heavy metals, mixed iron-aluminium coagulants, organic-mineral fertilizers or recultivated grounds. The part of silty-humus fraction may be subjected to pyrolysis with obtaing sorbents for cleaning of technological waste waters.

Block 3. It is intended for cleaning technological waters, obtaining in blocks 1 and 2.

Waters are cleaned up to the level of standards on service water and are used in the system of water recycle in 1 and 2 blocks.

The end product of block 3-dry salt of heavy metals, that are sent to burial.

This technology is protected by the patent of Russian Federation.

Changing the composition of raw materials and using other sorts of petroleum and oils the characteristics of the process can be modified.

The scheme is equipped with standard native devices and apparatus.

Characteristics and completion of this scheme may be changed in accordance with one who orders.

ECOSYSTEM PRINCIPLE IN WATER MANAGEMENT AT STOCK-BREEDING FARMS

Assonov A.M.
RosNIIVKh, Yekaterinburg, Russia

Stock-breeding farms are large water-consumers and powerful sources of water pollution. These farms include premises for the stock accommodation, a boiler-room, garage, laundry, waste-water treatment plants, etc.

Despite the fact that the necessity for forming water management systems, based on ecosystem principle, in stock-breeding was announced, it has not been put into practice yet. As in the majority of national economy branches of this country, the problem concerning water resources uses and protection are not integrated in the range of problems relevant to the sustainable nature ecological balance. At the same time their integrity is obvious, i.e. water resources use and protection are two sides of one and the same coin.

Underestimation of this most important methodological aspect results in the fact that water uses for the milk and

meat production is more often than not dealt with separately from waste water treatment and utilization. It is not systematic approach to the problem solving that can account for the situation when one designing institute is engaged in working out the technology of the stock maintaining and the complex vital activity system, including among others water supply, and the other institute, without interfering with the water use technology, is solving the problem of waste water utilization on agricultural irrigation fields, formed at the complex.

Solving of a particular problem of manure hydrocleansing from the stock premises without using ecosystem approach in the stock-breeding water management organization led to a number of economical and ecological threats. It is true that hydrocleansing method of manure removal is cheaper than a mechanical one and minimum labor-consuming. However, treatment and utilization of great amounts of high-concentrated manure-containing waste waters formed demand powerful treatment plants with mechanical and two-step biological purification, agricultural irrigation fields with areas up to 3,000 ha, pond-collectors up to 30 ha, etc. Considering the fact that water protection personnel amounts to more than 30 % of the whole number, staffed at the complex, and demands the development of social infrastructure, including houses, schools, hospitals, etc., it is obvious that the underestimation of ecosystem principle while developing a complex water management system results in negative economical and ecological problems.

When handling the stock-breeding complex production installations as being integrated, united by water management systems, it is possible to foresee probable economical and ecological results of this or that step to reconstruct a production process not only at this very installation, but also at some others, contributing to the complex functioning.

Many-years research of RosNIIVKh to improve water management systems at stock-breeding farms, while using ecosystem approach, permitted to recommend integrated water management systems, the effectiveness of the latter being characterized by the reduction of manure-containing waste waters by 5.5 times and their use as nutrient substract in green feed hydroponic cultivation by almost 30 % reduction of fresh water use to chemically prepare water in a boiler-room, using all waste waters from Na-cation filter regeneration, containing common salts and hard salts (calcium, magnesium) in the stock fodder.

The system approach in environmental protection while producing at a stock-breeding farm makes it possible, in addition to great savings of nature fresh water for manufacture, to stop completely the discharge of manure-containing waste waters, highly-mineralized waste waters formed by the boiler-room Na-cation filter regeneration, to guarantee the all-year-round production of fresh vitamin green hydroponic feed for the stock.

THE BELT FILTER PRESSES OPERATION EXPERIENCE IN RUSSIA

Avdokhin S.
JSC "DAKT-ENGINEERING", Moscow, Russia

JSC "DAKT-ENGINEERING" is established in 1992 as a firm of engineering services.

"DAKT-ENGINEERING" activities base on high technologies, the clients are provided with high quality products of well-known in the world manufacturers.

The firm has the design bureau, chemical-analytical laboratory, mechanical assembly shop and services center.

One of the activities directions is a municipal branch. Working in this field "DAKT-ENGINEERING" cooperates closely with ANDRITZ AG as its official representation in the territory of CIS. We present jointly up-to-date technologies in the domain of sediments utilization and sewage purification.

"DAKT-ENGINEERING" is an only Russian firm that has 5 years experience of the belt filter presses installation and operation.

"DAKT-ENGINEERING" has installed mechanical dewatering shops at Abashevskaya, Kuzbasskaya and Aijutinskaya ZOFs (coal slime), at cleaning constructions of 23 Bearings plant of Vologda (galvanic slime), of Nizhniy Novgorod and Stariy Oskol. At the stage of equipment production and erection - the cities of Kursk, Vyborg, Borowitchi, Nizhniy Novgorod (second turn), cleaning constructions of OAO "GAZ".

The first mechanical dewatering shop was started up at Abashevskaya ZOF on November, 1995. Based on its operation we'd like to generalize experience of the belt filter presses exploitation in Russia.

The shop works in very intense conditions - twenty-four-hour operation, hard coal slime with unstable features (ash, granule-metric composition and chemical composition changing, that depends on preparation process...). During this exploitation there were not any serious failures. All repairing works caused from preventive measures and fast wearing parts replacement as, for example, valves, sprayers of wash system of filter-belt, scrapers. All set of expendable materials was delivered with the equipment and had not been filled up for all time of operation. All equipment parameters are within guarantee obligations. Floculant consumption is 5 kg per one ton by cake residual humidity is 70-72%.

ANDRITZ equipment operation with coal slime confirms its reliability and allows to consider ANDRITZ equipment operation with coal slime (that is lighter from the positions of dewatering and abrasion) with a great reliability reserve in comparison with other manufacturers equipment.

Based on exploitation experience nowadays "DAKT-ENGINEERING" jointly with ANDRITZ AG works with the equipment adaptation to Russian conditions. Thus we have already found analogues of lubricants, bearings, stuffing-boxes and so on; electrical cabinet is Russified. All this makes easy exploitation, reduces exploitation charges and

detailed technical documentation in Russian language allows to make small urgent repairing works by own forces.

In the nearest time the assembling production will start up in Russia keeping all quality and technological parameters, that will allow to reduce the price of the equipment and make it more accessible for municipal branch.

All this is only the first stage in the sediments utilization technology proposed by "DAKT-ENGINEERING" and ANDRITZ AG. The following steps are, for example: drying with preparation of granulated powder subsequently used in quality of aggregate for asphalt preparation; construction of burning, that does not practically require power due to utilization of sediment burning energy and so on.

The described technology is a considerable step to improve ecology of cities and regions and also human health.

Due to a large specter of activities "DAKT-ENGINEERING" is able to take a flexible financial policy working with partners, to suggest a number of services: payments by installments, money operations through FPK "DAKT" in roubles or value papers, different types of crediting and other services.

THE ROLE OF FLOCCULATING BACTERIA ZOOGLOEA RAMIGERA IN REDUCTION OF QUANTITY OF PATHOGENOUS MICROORGANISMS IN WASTE WATERS(ELECTRON MICROSCOPY STUDY)

Bannikova D.A.

Allrussia Science-Research Institute Of Veterinary Sanitation, Ecology And Hygiene Russian Academy Of Agricultural Science

One of the ways of development of the ecologically safe technological processes for wastewater cleaning is making use of microbiocoenosis of active silt. The leading part in functioning of the microbiocoenosis is assigned to flocculating microorganisms particularly bacteria Zoogloea ramigera. For study of the happening processes a new methodological approaches are needed,one of which is the study of bacteria as a population.

The use of scanning electron microscopy offers an opportunity to study reciprocal action of cells in colonies with environment as well as survival, development and reproduction of the cells without infringement of the cells' architectonics.

The subjects of the present report are the results of the study *in vitro* of the role of Zoogloea ramigera population in reduction of quantity of pathogenous bacteria. For the study the electron microscope "Hitachi-800" with the scunning supplement "H-8010" had been used.

From active silt of aerotanks and films of their filters' covering 11 strains of bacteria Zoogloea ramigera generation with different flocculating ability had been released and identified (A.V.Barkov,1995). The strain 19a Zoogloea ramigera had been deposited in the Microorganisms Collection of the IBFN RAN (Russian Academy of Science).

The main stages of bioflocculation and peculiarity of existence of Zoogloea ramigera in liquid and on hard nutrient mediums had been studied by scanning electron microscopy methods.

For experimental study of interaction processes of Zoogloea ramigera with pathogenous bacteria test-strains an original method had been worked out for cultivation of monolayer Zoogloea ramigera cells in liquid nutrient medium on a glass slide.

In the study test-strains of pathogenous bacteria Staph.aureus 209R,E.coli K88,Sal.typhimurium 19 had ben used. The contact time 1 - 3 hours.

The study of the preparations revealed adhesion of test-strains' cells of the above mentioned bacteria to the surface of Zoogloea ramigera cells' monolayer which consists of covers surrounding separate cells as well as intercell matrix - semitransparent cover into which pathogenous bacteria cells were plunged.

To study the influence of adhesion's processes on quantity of pathogenous bacteria a method of sowing them from serial delutions in drops of semiliquid agar had been used with dosaged applying of definite quantity of Zoogloea ramigera cells and test-strain cells.Colonies of Zoogloea ramigera cells without interaction with pathogenous bacteria served as a control. It was revealed that as a result of such interaction the quantity of pathogenous bacteria decreased by 3 - 4 orders.

In parallels with the above a morphology of Zoogloea ramigera population's cells had been studied after 18,24 and 48 hours of interaction with test-strains of pathogenous bacteria. Electron microscopy study reveals that after such interaction con-

siderable part of test-strains' cells were in heteromorphous

growth stage with spheroplast type cells of different size and and small forms of 0,2 - 0,4mkm were analogues to bacterial L-forms. When studying of waste-water samples taken from expulsor aerotanks where population of flocculating bacteria were prevailing some flocks of different structure were revealed usually in the form of long strands which consist of Zoogloea cells surrounded by dense intercell matrix on the surface of which often adhered cells of outside bacteria can be seen.

It was found that L-forms of test strains' pathgenous bacteria in favourable existence conditions (enreached nutrient medium, optimum temperature of cultivation) restored capacity for growth and reproduction what is evidence of potential ability to retain pathogenous characteristics.

The results of the study showed that in the process of waste water decontamination an active part take flocculating bacteria Zoogloea ramigera which possess a unique ability to produce glutinous water-unsoluble matrix of polisaccharide nature and serve as an original "trap" for outside bacteria.As a result of adhesion of the bacteria normal process of cell's division is disturbing and in consequence of that some of them perish but with the rest an atypical form of reproduction by budding is taking initiative with forming cells peculiar to heteromorphous growth.

ANAEROBIC TREATMENT THE PULP AND PAPER WASTE WATER. WASTE WATER TREATMENT

Barankova N., Shubnitsyna E., Kuchin A., Demin V.
Institute of Chemistry, Komi Scientific Centre, Urals Department of Russian Academy of sciences, Syktyvkar, Russia
Kalyuzhnyi S.
Moscow State University, Moscow, Russia

Anaerobic digestion is one of the perspective methods of the streams with high concentration of soluble organic treatment. In recent years power costs have risen dramatically and sludge disposal has become much more difficult and costly. Anaerobic pre-treatment of wastes is very cost-effective compared to traditional (aerobic) treatment:

- no energy requirement for aeration;
- low waste biological solids production ;
- biogas production (methane contention 70- 80%).

The principle of aggregated sludge retention is used in anaerobic reactors of new generation. Sludge retention as dense granules in suspended layer allows to increasing loading rates and sludge age.

Anaerobic treatment is applied for a number of wastewaters, such as sugar-beet, yeast, bakery, beer, vine, alcohol and potato-processing wastes, slaughter-house and pigsty and poultry farms waste waters, pulp and paper industry wastewater.

The interest to the intensive biotechnology is risen in Russia at present in connection with the energy cost growth. The anaerobic digestion is only used in methantanks in Russian industry so far.

In Syktyvkar Timber Complex (Komi Republic, Russia) they were carried out the experiments of high-concentrated waste waters from some mills (yeast, chemical-termomechanical pulp, Kraft evaporate department) anaerobic treatment in 1992-1997.

The feasibility of high-strength 2 g/l wastewater treatment in the anaerobic reactors of different types was demonstrated in the pilot-scale experiment with chemical-termomechanical pulp wastewater using UASB (Upflow Anaerobic Sludge Blanket) reactor with granular sludge. The optimal conditions for the process and the influence of their changes to the treatment process were determined.

GALVANOCOAGULATIONAL METHOD OF NATURAL AND WASTE WATER TREATMENT FROM ORGANIC CONTAMINANTS

Batoeva A.A., Zhalsanova D.B., Ryazantsev A.A., Sizih M.R.
BINS SD RAS, Ulan-Ude, Russia
Tumurova L.V.
BCSM and S, Ulan-Ude, Russia

The treatment of water of not composed impurity dangerous to health and enviroment such as pesticides, chlororganic compounds, dyes, lignosulfonates etc., represents an important problem.

One of the most promising ways is based on the combination of adsorption methods and oxidizing destruction by oxygen air initiated by such strong oxidizers as ozone or hydrogen peroxide.

At the first step of treatment when water and air contact in the device with a porous load consisting of the mix of an iron shaving and coke (galvanocoagulational method), iron scrap is oxidized and this results in the formation of plenty iron oxohydrogenphases, on the surface of which the contaminants specified above efficiently sorb and then are removed in the form of sediments. The concentration of impurity in water thus is reduced from several hundreds up to several units mg/l. With addition of H_2O_2 in the processed water at the second step of treatment in the same device the conditions for existence in flowing mode of Fenton Fe^{2+}-H_2O_2-O_2 and Raff Fe^{3+}-H_2O_2-O_2 systems are realized. The influence O_2 is carried out not through initial components but through intermediate products formed during primary oxidation of organic substrates by oxyl radicals.

The degree of phenol decomposition in waste water (Cph_{in}=20 mg/l, pH=3.5) comes nearer to 100% after 5 minutes contact with the load. Thus as experiments have shown for effective course of destruction process it is enough to add into a solution only 20-30% of the amount of H_2O_2 required according to stoichiometry. The amount of oxyl radicals necessary for complete oxidation of organic substrates can in addition be formed through interaction of ions Fe (II), continuously generated during iron scrap oxidation with molecular oxygen:

$$Fe(II) + O_2 \Rightarrow Fe(III) + O_2^{\cdot -}; \quad O_2^{\cdot -} + H^+ \Rightarrow HO_2^{\cdot}; \quad HO_2^{\cdot} + Fe(II) \Leftrightarrow H_2O_2 + Fe(III)$$

The destruction process of phenol with pH>4 proceeds appreciablly slower and with formation of intermediate compounds in IR-spectra of which there is no C=C bonds. Nevertheless, even in this case the process of treatment is efficient, as the products of phenol destruction sorb on the surface fo oxohydrogen phases of iron and transform into deposit. The above mentioned features of the course of waste water treatment make the use the described method economically quite effective. The opportunities of the galvanocoagulational method of water treatment from toxic organic impurity are evidently illustrated by the results of processing of pesticide solutions (C_{in}=0.1 mg/l). Efficiency of treatment for α-HCCH - 94.7%, γ- HCCH - 96.8%, DDT and metafos - 100%.

In all cases the prevailling mechanism of pesticide extraction from water solutions is galvanocoagulational, but not oxidizing. Nevertheless, the contribution of oxidizing destruction for α-HCCH and γ-HCCH exceeds 10%.

REPAIR OF SEWERAGE NET BY CLOSED METHODS IN SAINT PETERSBURG

Blagonravov A.V., Karmazinov F.V., Tazetdinov G.M.
SUE "Vodikanal of Saint Petersburg", Saint-Petersburg, Russia

The city of Saint Petersburg with the population of about 4.7 million is the second city of Russia and is situated on the coast of the Gulf of Finland. The city occupies the square of about 600 km2 and situated on the banks of the Neva river, which is the source of water supply.

The most of the buildings in the center of the city were built in 18th and 19th centuries. UNESKO included the city of Saint Petersburg in the list of the World Cultural Heritage.

In 1863 the system of central water supply was created, and therefore the necessity of the creation of municipal sewerage net appeared.

According to the experience of some German cities, Hamburg mainly, the general floating system of sewerage with the direct discharge of sewage into reservoir through floodgates and direct drains was adopted in Saint Petersburg. In 20...30-s the full separate sewerage system was projected and constructed as an experiment on Vasiljevsky island. Nevertheless this experience of use of the full separate sewerage system was not widely used in Saint Petersburg and during the following years the general floating system was developed in accordance with the General scheme of sewerage development.

The realization of the strategic program of the development of water discharge systems of Saint Petersburg is based on the use of advanced native and foreign experience in this field with the use of the newest technologies.

The present program is in the first stage of realization, however even now positive results are received:

- Non-trench technologies of the construction and repair of water supply and sewerage nets are mastered.
- The program of the decrease of non-purified sewerage discharge into the rivers and channels of Saint Petersburg was developed and is realized.

International projects take an important place in the realization of these measures. At the present time more than 20 international programs with the participation of the European and World Bank for Reconstruction and Development, Environmental Ministries of Germany, Finland, Denmark are being fulfilled in the frames of the realization of this program.

At the present time the total length of sewerage nets in Saint Petersburg is 6159.8 km, the length of unserviceable net - 1200 km. 200 km of this unserviceable net demand urgent repair.

Until the last time the main method of sewerage nets repair in Saint Petersburg was the open method, during which the breaking of roadbed was effected for the reconstruction of destroyed or worn collectors parts.

The so called methods of repair and reconstruction of engineering nets are the alternative to this method.

One of the groups of non-trench technologies - repair and reconstruction of existing sewerage nets, which were approved and found technical use in the sewerage nets of the SUE 'Vodokanal of Saint Petersburg", is examined in this article.

Following the advance experience of sewerage nets construction and repair, a lot of methods of non-trench technologies were approbated in Saint Petersburg within several years. The following methods passed practical test for effectiveness:

- Destruction method;
- Flexoren;
- Insituform;
- Chennelline;
- Trolining.

Destruction method was one of the first methods of the repair of sewerage collectors by non-trench technology, which successfully passed tests in Saint Petersburg.

This method is realized with the help of special equipment - pneumo-punch machine. Pneumo-punch machine (an underground Russian rocket) is a pneumatic machine of striking action intended for driving of holes in the grounds of different kinds, destruction of old pipelines, driving of steel pipes and sheet pile into the ground. Pneumo-punch machine, invented in 1958 by Polish engineer V.Zenkovich, was further modernized in the Institute of Mining Engineering of the Siberian department of the USSR Academy of Sciences in 60-80-s. Later on all famous world companies produced this rather modernized by them equipment by the license bought from this institute.

Here short branch pipes with the length up to 1.5 m, the mounting of which is effected from a well with the help of thread connections, can be used as a new pipeline. In the cases when local conditions allow, the arrangement of small trench, flexible polyethylene or vyniplastic pipes, separate parts of which are connected on the surface of the earth with the help of welding, are used. At the present moment in Saint Petersburg there is a positive experience of the use of this method during the reconstruction of sewerage collectors from pig iron, concrete, ferro-concrete and even wooden pipes of 200-300 mm diameter.

In this method the main equipment, which effects the destruction of an old pipe and arrangement of a new one, is a pneumo-punch machine. A winch connected with a pneumo-punch machine by a cable is auxiliary and intended only for the organization of the direct movement of a pneumo-punch machine. In the other case a pneumo-punch machine can deviate from the axis of an old pipe and go aside into the ground.

The use of this method allows to repair sewerage collectors parts, having small falls-through and displacement of pipes with respect to each other (up to 0.25 Dy). In the cases when the part of a pipeline has large falls-through, it is impossible to reconstruct them with the help of the indicated method and in these places it is necessary to effect the local digging out of a pipe and its change by traditional method.

In the cases, when there is well-grounded possibility of insignificant decrease of a collector diameter, the modification of this method is used, which consists in the fact that existing pipeline is not destroyed, and polyethylene (vyniplastic) pipe, forming a ring space between new and old pipes, which is filled with concrete and sandy solution, is spread inside of it. The mounting of a new pipe being effected from one start pit for the length of 100 m. The use of this method is specially effective for the reconstruction of collectors of more than 400 mm diameter.

The other kind of the method of sewerage collectors reconstruction, considered above, is the method of flexoren, which allows to repair sewerage collectors of small diameter, up to 300 mm, also without the arrangement of trenches and pits and the destruction of old pipe. This method became very popular owing to the use of flexible pipes of the company «Uponor». These pipes side by side with a high mechanical strength have the bending radius of 3 Dy, what allows to mount these pipes from the surface of earth through the cover of well. For the purpose of promotion and increase of reliability of connection, one of the ends of this pipe is supplied with a heating element even when produced on a plant.

The flexoren method found the greatest popularity among the known methods of the reconstruction of small diameter sewerage collectors because it is rather simple, does not require complex and expensive equipment, the speed of reconstruction being high. Taking into account that the length of sewerage net of Saint Petersburg of 300 mm diameter is more than 50 %, this method has good perspectives. As to the volume and speed of the reconstruction of sewerage collectors of Saint Petersburg, the flexoren method takes the leading positions for the present moment.

The Insituform method is used on the world market for the period of 20 years already, and more than 3600 km of nets were successfully reconstructed with its help, and according to the estimations of English specialists the date of expire of reconstructed collector increases for more than 50 years.

The reconstruction of sewerage collectors with the help of the Insituform method in Saint Petersburg firstly was carried out on experimental, small areas at the beginning of 90-s. Pipelines of from 100 to 200 mm diameter can be reconstructed by this method. The essence of this method consists in the fact that a resilient hose from non-woven material, preliminary impregnated with polyester resin, is inserted into the reconstructed pipeline.

This "second"pipeline is moved forward into the reconstructed pipe under the hydrostatic head of water (0.5 0.7 atmospheres excess), which straitens the hose and presses it down tightly to the internal surface of an old pipe. Simultaneously with its movement forward the hose pulls a heat resistant hose of 80-100 mm diameter, necessary for circulation of hot water along the full length of the reconstructed pipeline. After arrangement of the hose in the necessary position, the heat-resistant hose is connected to the pressure branch pipe of boiler unit and the heating of a hose with hot water up to 60 C is started.

The process of "sleeve" polymerization lasts from 8 to 16 hours, depending on the length and diameter of a reconstructed area. The final operation of sewerage collector reconstruction is the manufacturing of the chute part of observation wells and the final control of the quality of the works made with the help of video filming. On the fig.5 there is shown the internal surface of the sewerage collector reconstructed with the help of this method. It is possible to reconstruct the part of the collector of up to 300 m length with the help of this method, only twenty four hours being spent for reconstruction.

The same method is used for reconstruction of side connections. In the cases, when non-well connections exist, the main difficulty while their repair consists in the removal of a polymerized hose in a main collector. In such cases the cutting out of a hose is carried out by a special robot, which is positioned in a main pipe exactly in the place of connection with side connections with the help of television unit.

In the cases, when the pipeline being repaired, has a wrong form, e.g. oval or tent section, it is expedient to use the other method of collectors reconstruction, i.e. chenneline.

The technological process of sewerage collectors reconstruction according to the chenneline method reduces to the determination of the technical condition of the reconstructed part of a collector, determination of the dimensions of a cross-section, preliminary manufacturing of separate elements of collector internal lining from glass-plastic at a plant, their delivery to a working place, mounting of elements in a collector, injection of the concrete and sandy solution into the ring space between newly installed panels and the internal surface of the existing pipeline.

As an example the project of the reconstruction of sewerage nets on Nevsky avenue with their total length of about 6 km can be taken.

Sewerage collectors on Nevsky avenue, laid in 1890-1930 from brick and concrete and sandy pipes have rather heavy destruction for the period of their exploitation and their technical condition was estimated by the fact that sewerage collectors pass through the both sides of the public road of Nevsky avenue. The main condition which was put before the carrying out of repair works was the full preservation of outward appearance, car and pedestrian traffic on Nevsky avenue itself and on all streets adjacent to it. From the other side the time of collectors reconstruction was also limited, i.e. not more than 20 months were given for the whole project including a preparatory period. The reconstruction of sewerage nets in this project was effected by combined method with the use of practically all methods indicated above.

The companies "Per Aarsleff" (Denmark), "Insituform Suomi OY", (Finland) together with the SUE "Vodokanal of Saint Petersburg" took part in the realization of the present project, financial support being rendered by the Environmental Ministries of Finland and Denmark.

In the result of such close and fruitful cooperation the project of the reconstruction of sewerage nets on Nevsky avenue was fulfilled in full volume and within the terms indicated above.

The availability of the variety of conditions and the increasing requirement in repair and reconstruction works demanded the search and introduction of new, more effective methods of carrying out repair and reconstruction works from the services and departments of "Vodokanal of Saint Petersburg". Therefore, a new, even for many west European countries, method of pipelines sanitary inspection according to the Trolining system passed the approbation at the sewerage nets of Saint Petersburg in 1997 for the first time in Russia. As to its ideology this method, developed in 1993-1994 in Germany by the company "Tropoplast" is like the method Insituform, considered higher, however for its realization much less equipment and energy consumption are needed, and it combines the positive properties of the flexoren and insituform methods. With the help of this method the sanitary inspection of practically all canals independently of their form and cross-section: circle, tent or oval can be fulfilled.

The brief characteristic of the method is reduced to the following.

An internal hose, preliminary manufactured in the form of a pipe with the thickness of wall 2.5 mm with the help of welding of two sides of sheet material from polyethylene Vestolen A3512 and having relief (fungous) surface with the height of bulge 10-16 mm, is introduced into a sewerage collector having defects.

The mounting of a hose is carried out with the help of an ordinary winch for the length of 120 m. The installation of a hose in a pipe is carried out through sewerage holes in the same way as in the flexoren method. If necessary, a hose can be folded twice in the fore-and-aft direction with the help of guide rolls. To make a hose take the form of a repairing collector after installation, it is filled with water or air with the pressure of 0.5 atmospheres excess.

The circle space, which is formed by relief bulges between a hose and the internal surface of a collector, is filled with a special injection concrete (solution). Holes and connections of the repairing pipeline also being filled. This highly strong and slightly viscous concrete fixes a polyethylene hose in the need position. The smooth side of a polyethylene hose serves as an internal surface of the repaired collector. The lasting quality of the used material is guaranteed by the 30-years positive experience of its use for hermetic sealing and hydra-isolation of polygons in different regions of Germany for the storage of different kinds of industrial and domestic wastes.

Good information about the technical condition of water drain nets is the obligatory precondition of the reconstruction or capital repairs of the system. This information should be rather full and objective to accept optimal decisions when choosing the method of reconstruction. At the present moment there are not so many methods and means for the determination of technical condition. As a rule, television inspection is used for this purpose.

It is obvious that the results of television measurements will be trustworthy if inspection is carried out in a clean pipe, only in this case all available defects can be bound out and identified.

The results of video filming are subjected to further treatment and analysis according to the method of expert estimations, on the basis of which the conclusion about the use of such or another method of the reconstruction of pipelines depending on available technical means and also the estimation of the cost of repair and reconstruction works, is made.

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THE PROGRAM OF THE CHANGING OF OUTLETS FROM RESERVOIRS TO THE CITY SEWERAGE OF SAINT PETERSBURG

Blagonravov A.V., Livshits M.B., Gumen S.G., Tazetdinov G.M.
SUE "Vodokanal of Saint Petersburg", Saint-Petersburg, Russia

The stopping of the discharge of non-purified sewage (domestic and industrial) into the water channels of the city is the main ecological task, the decision of which will allow to improve not only the state of the city water basin, but also the state of the Gulf of Finland and Baltic Sea connected with it.

Nowadays 2.2 mln.m3 of sewage per 24 hours is subjected to the full biological purification on the three purifica-

tion stations - the Central Station of Aeration, the North Station of Aeration, the Krasnoseljckaya Station of Aeration, that is approximately 70 % from the total amount of sewage.

Moreover, in the different regions of the city (Primorsky, Petrogradsky, Krasnogvardejsky, Nevsky, Kirovsky, Admiraltejsky, Central, Kalininsky, Vyborgsky) 397 outlets, through which non-purified sewage in the amount of 1300 m3 per 24 hours is discharged into the city reservoirs, operate nowadays.

206 outlets belong to the SUE "Vodokanal of Saint Petersburg", and 191 outlets - to different enterprises and organizations. There are no purification constructions of the surface discharge at the outlets of rain net in the regions with separate sewerage system.

The sewer of the city was effected according to the General Scheme of sewerage developed in the end of 70-s and adopted in 1982. The indicated General Scheme foresaw the stopping of the discharge of non-purified sewage into the city reservoirs. Insufficient financing of works upon the development of the city and suburb sewerage in 80-90-s did not allow to carry out the measures, necessary for the changing of the above stated 400 outlets.

The General scheme of the sewerage of Saint Petersburg and its suburbs foresaw the full stopping of the discharge of non-purified domestic and industrial sewage into reservoirs until 2005, the condition of financing being fulfilled.

Table 1. The approximate total amount of the changing of 206 city and 191 industrial outlets of non-purified sewage into the system of the city sewerage in Saint Petersburg

No.	Name of constructions	Measuring unit	Volume	Approximate amount mln.Rbls. in the prices of 1984
1.	Street sewerage nets with regard for industrial enterprises without reconstruction of public services and amenities and roads	km	150	100
2.	Reconstruction of public services and amenities and roads			80
3.	Tunnel collectors	"	28.0	190
4.	Sewerage pump stations	m3/24hours	8.0	30
5.	Sewerage purification constructions with main sewerage stations	thous.m3 per 24hours	1100	430
	TOTAL:			830

Notice: Moreover, the expenses for the reconstruction of about 1000 of industrial sewerage on industrial territory will be1000 mln.Rbls. approximately. These expenses are to be specified during the working out of feasibility study for each industrial territory.

The total amount of the works is 830 mln. Rbls. in the prices of 1984.

According to the General Scheme of sewerage the program of outlets changing until 2005 is worked out.

The main principals adopted in the program are as follows:

- The priorities of the fulfillment of works upon the changing of outlets are determined (the historical part of the city, as to the volume and quantity of pollution, the protection of water intakes, correlation with the introduction of new capacities of purification stations, etc.).
- The areas of work, which are to be fulfilled by untraditional methods according to the foreign countries technologies are determined (e.g. the area of Isaac square, embankments Dvortsovaya, Kutuzova, Sinopskaya etc.)
- The places of outlets connection to the city sewerage are specified.
- The inventory of outlets of the city industrial enterprises with their laying out along sewerage basins is made.
- The ecological estimation of measures is fulfilled.
- The approximate amount and the volume of works, connected with the changing of outlets, is determined.

For the determination of the priority of outlets changing four levels of systematization in the sewerage system of Saint Petersburg are studied:

- Outlet (group of outlets at the crossing of streets with reservoir, on the territory of enterprises).
- Area (street area from cross-road to cross-road, a street - embankment, enterprise territory).
- Region (administrative region, sewerage system basin).
- Basin (the basin of the city sewerage purification constructions, e.g. the North Station of Aeration).

The priority of outlets changing is divided into three turns:

- The first turn
- The second turn
- The third turn.

The specialists from Germany, i.e. from the company "GET" and the engineering bureau of doctor Pecher, who suggested the untraditional methods of sewerage laying in the zones, where it is impossible to use the open method, participated actively in the working out of the program. These technologies were studied in details, and the pilot project of the changing of sewerage outlet from the Repin square was worked out together with German specialists.

Nowadays, the works upon the changing of the outlets of Petrogradsky region are carried out though with a great lag, but we hope to finish them in 1998; the unique construction of the first line of the underwater pipeline - the prolongation of the main collector of the North will be soon finished. Putting it into operation will allow to transfer the amount of about 300 thous.m3 per 24 hours on the purification constructions of the North Station of Aeration.

For the solving of this difficult task it is necessary to effect the stable financing of these objects.

THE PYROFLUID® INCINERATOR

Boeuf G.
AO "Saint-Petersbourg - Pure water", St.-Petersbourg, Russia

Basic design

The fluidised bed PYROFLUID® furnace incinerates sludge produced in sewage treatment plants, reducing to their minimum the volume of solid waste and associated nuisances.

In the heart of a fluidised sand bed, the process ensures the combustion of sludge in the presence of air. The sand bed is fluidised by an ascending air flow, preheated or not.

During steady-state operation, the sand bed scatters sludge particles through friction between the grains, which accelerates heat exchange. Moreover, the mass of sand constitutes an important store of thermal energy.

The mixture of gas and ash, product of the incineration, flows through the top of the furnace. Gases are treated in wet or dry separators to comply with emission guidelines before release to the atmosphere.

Basic specifications

The PYROFLUID® furnace is made of superposed insulated zones:

- the windbox, at the bottom, into witch combustion air is blown, generally preheated by heat-exchange with flue gases
- the fire-box, separated from the windbox by a dome, equipped with nozzles to inject combustion air and to fluidise the sand bed.

The combustible matter (sludge, gases, fuel-oil) are introduced in the fluidised sand bed. Under the joint action of heat and the mechanical effects of the bed, they are dislocated and then gasified, whereas mineral particles are transformed into very fine inert ash suspended in the gas. The combustion of gases in presence of oxygen takes place in the fire-box, where an adequate detention time and some excess air lead to complete oxidation.

Major assets

The PYROFLUID® incinerator provides the following benefits:

- reliability due to the absence of moving mechanical parts,
- flexibility due to the thermal inertia created by the sand bed, which allows the furnace to cope with changing sludge quality and discontinuous operating conditions,
- ease of operation due to the use of very reliable sensors allowing, if required, fully automated control and operation,
- tried and tested technology due to long term experience with furnaces of various sizes,
- compactness minimising space occupancy and construction costs.

Performances

The incineration temperature is greater than 750°C, which guarantees the complete combustion of gases and, hence, complete adour control.

The concentration of non-burnt organic matter in the residual ash is always lower than 2% in weight.

The PYROFLUID® process allows the construction of very compact units which can fit into a large range of plants, from 10 to 50 tons of dried matter a day, using a single furnace.

METHODS OF PURIFICATION AND DISINFECTION OF WASTE WATERS FROM ELECTROPLATING OR FARMING PRODUCTION FACILITIES BASED ON APPLICATION OF ELECTRIC AND MAGNETIC FIELDS

Bondarenko N.Ph., Gak E.Z. Rokhinon E.E., Shapkin M.P.
The Agrophysical Research Institute RAAS, S.-Petersburg, Russia

During years the Laboratory of Hydrophysics of Agrophysical Institute (RAAS) is engaged in theoretical, experimental and applied studies of magnetohydrodynamic and electrohydrodynamic effects taking place in aqueous solutions of electrolytes and natural waters [1]. Based on the above studies the methods and equipment have been developed for purification of waste waters from electroplating processes. The core of above methods is the convection stream originated under influence of electric and magnetic fields tailored by mixing of near electrode layers of liquids, thus strengthening the diffusion processes and enlarging the maximum currents. The works have carried out in cooperation with VODGEO (Moscow).

There have been developed the method of deposition of heavy toxic metal hydrooxides of considerable concentrations taken from completed concentrated solutions by doping of alcali fractions from electroactivators during electrochemical dimensional metal treatment [1].

Method of complete decontamination and disinfection of waste waters from beef cattle production based on electrochemical systems with dividing membranes has been developed and tested in field conditions. The works have been carried out jointly with personnel of joint-stock society AO Nelazskoie, Cherepovets district, Vologda region [2,3]. The latter method can be reasonably applied for purification of waste waters from meat and beer manufacture plants.

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THE DEHYDRATION OF DEPOSITION WITH USE DRUM-TYPE VACUUM - FILTER

Bouzilov A.A., Pikoulin Y.G., Boulatov M.A.
Moscow State University of Engineering Ecology, Moscow, Russia
Voronov V.I.
Moscow enterprise " Promothody", Moscow, Russia

The drum-type vacuum filteres are using at Industrial water-treatment system to dehydrate the deposition very often. But to ashieve high efficiency in this process it's necessary to examine technologycal equipment under operating conditions and only after that to tender one's own way to improve vacuum-filter performance.

First of all the overall performance of the filter may be defined by the consistence of a filtered deposition and technological mode of operation .

The inspection of the working drum-type vacuum - filters at the industrial waste water-treatment system was carried out. There were the main vacuum-filter performance under consideration such as speed rotation of a drum 0.2 rev/min; number of mixer swings in a bath is 26 per minute; the specific charge of vacuum (1,2-2) m^3 / ($min \cdot m^2$).The thickness of layer deposition formed on a filtering fabric, was about (1-1,5) mm..

The normal technological mode of operations and the vacuum-filter performance were not achieved. As a result of the additional charge at the vacuum system the large speed of filtrate flow in vacuum - filter piping system was occured. It caused the significant mechanical damages of the filtering fabric and of the piping system.

We obtained the value of specific resistance of deposition $r_s = 11,5 \cdot 10^{10}$ cm/g. The content of moisture in depositttion was 99,6 (as.per cent). If the moisture and consequently the density of layer deposition varied, the size of specific resistance varies also. Rather high value of specific resistance was caused by the presence of a plenty of fine particles by a diameter (20-40) microns, and this value also depended on high contents of mineral oils about-13,2 g/l.

The presence of fine particles in a deposition testified that the layer deposition on a filtering fabric is like an additional filter for them.

So , in order to ensure normal functioning of vacuum filter it should be necessary to carry out next preliminary work:

1. To supply the technological process with proper filtering fabric;
2. If coagulants and its doze are choosen right one must realize even mixing of two flows (reagent flow and suspension flow) before filter and protecting of flocs and providing conditions for their further growth;
3. To replace the centrifugal pumps by the reciprocating pumps to prevent the destruction of large flocs.

SIMULATION AND OPTIMIZATION OF THE WASTE WATER FLOW IN URBAN SEWER NETWORK

Boyarshinov M. G., Kozlinskikh A. E., Trusov P. V
Perm State Technical University, Perm, Russia
Lepikhin A. P.
Centre of Applied Ecological Researching, Perm, Russia

At present time the regulation of periods and volumes of waste waters dumping by industrial firms is not fulfilled, that causes the emergencies in urban sewer network. Under unfavorable circumstances the waste streams can be dumped immediately in natural reservoirs without clearing. As only industrial sewers can be controlled it is required to change phases and volumes of waters dumping by industrial firms to regulate the total waste streams receiving in the treatment system.

The industrial firms and the residential areas are divided into separate sites to formulate the task. For each site the rational dumping condition is determined. It is assumed that for every firm 8 phases are established (duration of any ones is equal to three hours); during each phase the expenditure of waste waters is fixed. The objective function is determined as remainder between the highest and lowest wastewater levels, i.e. nonuniformity of the loading of the waste water treatment system. It seems right that a decreasing of waste waters inflow nonuniformity from each site will reduce a nonuniformity of the clearing buildings loading. As additional restrictions for the optimization task the system of the nonlinear differential equations describing the process of non-stationary transposition of fluid within a pipelines system is used. Basic simplifications are assumed: the liquid with

dissolved impurities is considered as ideal and incompressible; the concentration of impurities are small and do not influence the properties of a liquid and character of current; the dissolved substances do not react with each other, also the impurities do not drop out and do not evaporate from the surface of the flow; the speeds of all particles of a liquid in a plane of cross section are identical and are directed along an axis of a pipe; the current of a liquid changes slowly; sewer network is simulated as a set of rectilinear sites of pipes, connected among themselves; walls of a pipe are absolutely rigid and motionless, their influence on the current is taken into account using the roughness factors, describing a material and condition of pipes, and the physical properties of a liquid; when two or more flows merge (the sewer network junctions) vectors of a liquid particles speed are turned instantly without change of modules; hashing flows occur instantly on the whole section.

To decide the task about the fluid flow within a sewer network it is required to integrate the system of nonlinear differential partial equations with appropriate initial and boundary conditions. Well known finite - difference method is applied here. To decide an obtained system of the nonlinear algebraic equations numerically a Newton's method is used. To estimate the adequacy of the mathematical model to a real liquid flow the comparison of a numerical solution to experimental data was carried out. The distinction of calculated and measured parameters of a liquid flow has appeared not more than 17 %. It may be explained by a lack of exact data about the real locations, time and volumes of a waste waters dumping by firms and habitation arrays in urban sewer network. The defined solution shows that the nonuniformity of the fluid inflow on the clearing buildings can be reduced about twice. It confirms a real possibility to define the conditions of a waste waters dumping which will help to reduce a loading of the biological clearing buildings.

THE CLOSED RESERVED SYSTEMS FOR UNDERGROUND INJECTION OF LIQUID WASTE FROM ORENBURGS DEPOSIT OF OIL-GAS CONDENSATE

Butolin A.P.
Orenburgs branch of Mining Institutes from Ural Department of Russian Academy of Sciences, Orenburg

The extraction of oil and gas accompanied with accumulation of stratum waters on earthly surface. Volume of this stratum waters in Russia on different facts exceed 5 billions cubic metres in a year. Besides from primary complex preparations of gas and oil is formation sewage with high concentration methanol, sulfur hydrogen, inhibitors of corrosion which becomes dangerous for the environment and human health. High-mineralised stratum waters and sewages which also can be potential source of hydromineral row material (Li, Pb, Sr, B, Br, I and others) does not worked up in Russia. Such waters are pumped buck to the bowls or to productive stratum to support pressure or to the deep water containing horizons.

On 1997, 11 functions on Orenburg passing stratum waters taking out from exploited chink is regulated with the gas payment coefficient standard, K=0.78, inspite of planned gas-extract decrease pumped waters volume mount to 2 millions cubic meters at year. Pumped waters are biochemically combinated with stratum waters and absorbing stratum rock and not set in colmatation near the chink zone in high-penetrate intervals limits. That's why pumping is in process with closed reserved technological scheme without special preparation and purifying and without contact between pumped liquid and atmospheric air. As time when this waters is in technological cycle is considerable short, volume of corrosion and quantity of weigh particles and hard mechanical admixtures are reduced.

Stable of pumping construction working makes sure by the control of basic technological parameters and prophylactic measures, such as periodical restoration приемистости of chink by hydrochloric acid processing and extraction the hard sediments from three-phase separators in planed preventive works time. Stratum waters level in separator is automatic controlled this level-measurer. In order to control quality of pumped water there is taking tests to define pH, availability of H_2S, methanol, liquid .УВ ,mechanical admixtures, common hard, alcali and ion-salt structure. In order to protection of sulfur-hydrogenical corrosion and hydrate-formational inhibitors. Taking into account then some pumping chinks are situated not far from Ural river and populated areas, there is carrying out control over the regimal observation net for quality of atmospheric air, soils, fresh underground and superficial waters.

Inclusion of the method of passing stratum waters return to oil-water pressure system on Orenburg deposit allows to realize without staff increase the reserved cycle of non-balance waters as medical, industrial and energetical. Besides it is no possible polluting superficial and underground waters in Ural middle stream's drainage basin by toxic components of passing stratum waters and sewage. In spite of sewage underground throwing off method is regarded as forced measure, we consider that with "lucky" combination of favourable geological, hydro-geological condition and big volume of extracted passing stratum waters, as on Orenburg НГКМ , this method became sufficiently necessary and ecologically acceptable.

Investigations of problem and inculcation of working out results into technological regulations of exploitation of construction for passing stratum waters and sewage underground throwing off are executed with protetipation and support of Orenburg gas department of RAO Gazprom.

EFFECTIVE TECHNOLOGY OF CLEARING WASTE WATER ON RANGES BURIAL PLACES FIRM HOUSEHOLD WASTES BY REAGENTS ON THE BASE OF ACTIVATED HUMIC ACIDS

Choulguine A.I., Putsykin Yu.G., Chapovalov A.A.
Closed joint-stock company "Special biological-physical technologies", Moscow, Russia

The clearing filtrate, i.e. waste water formed as a result of a filtration of superficial and underground waters through a body of a dump, represents urgent ecological task. Contained in filtrate in a heavy metals, organic substances and the microorganisms will form steady system, to destroy which with use known of floculants and coagulants extremely difficultly. The mechano-biological and physical-chemical methods of clearing of filtrate manage very expensive. In view of specifity of ranges the application last is rather problematic.

Last years is developed the effective technology of clearing of filtrate is mastered. The technology is based on application unique on the properties, functions, results and areas of use activated humic acids (AHA) and reagents on its base. Being on the nature by organo-mineral substance, AHA effectively connect ions of heavy metals, sorbed organic and microbiological impurity. That is AHA simultaneously carry out functions ionexchange material, floculante and coagulante.

The technology of clearing includes introduction AHA or reagents on its base in filtrate, concentration, issue of the cleared water and removal of a deposit. As a rule, the deposit comes back in a body of a dump.

DETOXIFICATION OF SEDIMENTS OF RAINFALL SEWAGES OF INDUSTRIAL AND MOTOR TRANSPORTATION WORKS, REFUELING AND CAR WASHING STATIONS WITH OLEOVORIN TECHNOLOGY

Chtcheblyikine I.N., Barbot V.S., Shushenacheva E.V., Levandovskaya U.B., Bitteeva M.B., Biryukov V.V., Kirjanova I.S., Gildenskiold R.S.
GOSNIISINTESBELOK, Moscow, Russia

The sediments of rainfall sewage of the majority of the industrial plants are polluted by oil products and heavy metals. Depending on a type of the plant from which the sludge is collected, the concentration of oil products in it can be from 10 up to 100 g per kg of dry weight.

Biopreparation named OLEOVORIN, consisting from dried but living oil oxidizing microorganisms is developed by GOSNIISINTEZBELOK and in production from 1993.The preparation had passed necessary tests and is allowed for the purification of soil and water.

The technology OLEOVORIN includes the whole complex of measures, directed on reduction of concentration of oil products in a sediment, including treatment by a biopreparation, mineral fertilizers and biogenic components. Applying of structure forming additions (such as peat etc.), loosing, humidifying of a sediment are the very important components of technology. It is also necessary the regular chemical, analytical and microbiological control for the optimization of the clearing bioremediation process.

The tests were carried out in Moscow on purification plant on the concreted platform by the area about 350 m^2, supplied by a drainage. The design of a platform excludes an opportunity of permeation of drainage waters in underground horizons.

During bioremediation two main biological processes proceed: aerobic treatment in presence of oxygen, and another process without oxygen.

At the first stage of purification the important role plays the process of oxidation by microorganisms of hydrocarbon compounds, as of main polluting components. Thus will be formed more simple and harmless substances and large quantity of microbial biomass, and also carbon dioxide and water. Then products of oxidation of oil products (the organic acids, aldexydes, ketones) together with biomass with of active participation of soil microorganisms and anaerobic conditions will be transformed in soilforming organic substances.

The practice of realization of works has shown, that the OLEOVORIN technology helps to restore natural soil microorganisms, that in turn, allows to receive high rates of biodegradation of oil products.

It is established as a result of carry out researches that the treated sediment was taken more than from 100 different places of location. The average sediment has following fraction composition (in mass percents): 60-75 - sand, 15-25 - clay, 10-15 - water. The concentration of oil products in a sediment averaged 30,2 g/kg dry weight.

It was shown that the oil product content in the sediment had decreased by 6 times during the period of biodegradation - down to 5 g per kg. It was also established that these oil products were not washed away from the sediment even under intensive watering.

When began the cold weather, we came to decision to complete the experiment. We studied the dehydrogenase activity of microorganisms in the sediment, which characterizes the intensity of oxidizing processes, under participation of soil microorganisms. The initial sediment had low activity . When the process of purification was completed, the activity of soil microorganisms was by 9,5 times more. It was shown in result of carried out tests that the purified sediment with its qualities approximates to neutral soils (pH - 7,2), but with higher loose and humidity. It was shown according to confirmation of Moscow institute of hygiene, that purified sediments could be used for road-bed of roads and on usual places of a storage of harmless wastage.

PURIFICATION OF ACID MINE SEWAGE WITH PRODUCTION OF MARKETABLE PRODUCTS AND DRINKING WATER

Chtcheblykine I.N., Fomchenko N.V., Biryukov V.V., Volchek A.M.
GOSNIISINTESBELOK, Moscow, Russia

Acid mine sewage is a source of pollution of an environment by salts of heavy metals. For example, the sewage of one mine contains sulfates of zinc, copper, cadmium and some other salts in amounts, exceeding in 1 - 10 thousand time limit, established for pure natural waters.

For researches we received a sample of such a sewage. It contained the following components, mg/l: zinc - 550, copper - 172, cadmium - 2,14, iron - 1068, manganese - 185, magnesium - 409, aluminium- 260, calcium -456, sulfate-ion - 7600,

In result of performed researches the technological flow-sheet of treatment of acid mine sewage was offered. It consists of four main stages.

At the first stage in a compact residue as sulfides are precipitated copper, cadmium, and zinc (under pH 2,2 - 2,5), and the other metals remain in a solution.

On the second stage of process there is the precipitation of iron and partially calcium under pH 3,5 - 4,0, and manganese and aluminium remain in a solution.

At the third stage there is the precipitation of manganese and aluminium under pH 9,0.

At the fourth stage - the complete removal from water of residuary metals - calcium and magnesium, and also precipitation of sulfate-ion as hard soluble sulfate barium under pH 8,5 was offered. The received in such a way pure water corresponds in its quality to water of natural sources, used for the drinking purposes.

Processing residues, received on each of four stages, realized as follows.

Mix sulfides of copper, zinc and cadmium, received on the first stage of the process, is acidated by a sulfuric acid. Thus sulfate of zinc passes into solution, and the formed hydrogen sulfide recirculates to the first stage of precipitation. The mix of residues of copper and cadmium sulfides is a marketable product. The zinc is recovered from the sulfite solution by electrolysis as a marketable metal form. The formed in this process acid comes back in the block of dissolving of zinc sulfide and the effluent gases are used in a cycle of reducing of barium sulfate, received as a residue at the fourth stage of process of purification of water.

The residue of gypsum in a mix with hydrooxide of iron is isolated on the second stage of process. Increase pH and the formation of the residue occur due to of recirculation of a residue from the third stage on the second. Thus the reception of iron in a marketable form as magnetite (black pigment), and also gypsum is provided.

At the third stage of process there is the precipitation from a sewage of residues of manganese and aluminium. The process realizes with addition of calcium oxide and with aeration of formed suspension. The all residuary metals precipitate and the concentration of sulfates in a solution is reduced from 7600 down to 3000 mg/l.

For increase of concentration of manganese and aluminium in formed residue 80-85 % of its amount recirculates on the second stage. The purification from iron is carried out by acidation of a residue with transfer in a solution of aluminium and manganese. The hydrooxide of aluminium is precipitated by gaseous ammonia from a solution. The residuary solution of sulfates of manganese and ammonia arrives on electrolysis. The manganese is recovered from the solution by electrolysis as a marketable metal form, and effluent gases are directed to a cycle of reducing of barium sulfate. Formed under electrolysis ammonia sulfate is removed periodically from process.

On fourth stage of purification of the sewage by barium carbonate barium sulfate, calcium carbonate and magnesium carbonate are precipitated. From this residue is received marketable light magnesium. The residuary mix of barium sulfate and calcium carbonate is processed by hydrochloric acid with forming the marketable calcium chloride. The residue of the barium sulfate arrives in the furnace for its partial reducing to sulfide and its transfer to carbonate. The process proceeds under 900° C and interaction of a residue with products of partial combustion of natural gas with formation of a mix of sulfide and carbonate barium. Carbonation of barium sulfide is carried out by carbon dioxide in water solution and received hydrogen sulfide is directed on the first stage, and carbonate barium - on fourth.

Thus, the offered technological flow-sheet treatment of mine sewage provides utilization all formed during purification products. Thus such metals, as zinc, copper, aluminium, iron, manganese, magnesium and calcium are received as standard marketable products. As non-standard products are received only gypsum and ammonia sulfide, which can serve for production of cement and fertilizers with the additives of microelements.

COMPLEX OPTIMIZATION OF SEWER SYSTEMS AND WASTE WATER TREATMENT

Chupin V.R., Baimashev U.N., Alexeev I.B.
Irkutsk state technical university, Irkutsk, Russia

At present deficit of means for expansion and reconstruction of sewer systems the problems of its optimization have a great importance. Especially the most actual ones are the problems of complex optimization of sewer systems and waste water treatment.

This work is based on the methodology of sewer system optimization on the basis of design superfluous circuits. It was offered in 80's by Chupin V.R. and Lendenev V.S. According to this methodology the superfluous circuit of the sewer system taking in consideration the existing lines and

charges is planned. On the superfluous circuit a tree of the initial approach (TIA) with the root top, appropriate to the treatment plant location is chosen. The TIA is chosen by chance or trees of minimum length or shortest "distances" are under construction. On TIA the optimum grade line is determined by the dynamic programming method. After this by the contours optimization method the drawing of the network is corrected. The method deals with the consecutive sorting of trees variants by replacement of the chord on the branch in contours with not optimal decisions scrapping. Studying every variant of tree the grade lines is corrected only for analyzed contour and "tail part " of the network connecting this one with a tree root. The optimization criterion is the minimum of the given expenses.

Thus the optimization was made only for sewer system without account of location and content of waste water treatment plants. Total cost of the waste water treatment were constant. This present work offers the development of these given method and its integration on the joint optimization sewer system and waste water treatment. The bogus nodes simulating any possible locations of the waste water treatment and a number of bogus branches simulating different productivity of the treatment plants are entered. Taking in view of that superfluous circuit all the possible network variants are analyzed at the changing of the charge in location units of the waste water treatment (i.e. the productivity of the waste water treatment plants are varied) from zero to total charge. With this purpose first of all the problem of optimization structures of waste water treatment for all range of the charges, i.e. the function of expenses for treatment depending on charge of water by given limits (initial structure of waste waters, required degree of treatment, local conditions and etc.) is formed. Studying these functions we solve the problem of network optimization, localities and pumping stations parameters, localities of waste water treatment plants and their productivity.

The problem of drainage and waste water treatment of individual houses and cottages, which building is increased last time, are interesting and actual. By using these method it is possible to solve the problem of decentralization of waste water treatment and the choice of optimum structure of drainage for cottage building. These problems are independent and will be considered in next publications of this authors.

COMPLEX TECHNICAL SOLUTIONS ON WASTEVATER PURIFICATION AND UTILIZATION OF REZIDUES REZULTING FROM THE GALVANOCHEMICAL INDUSTRY

Covaliov V.V.
ResearchCenter of Applied and Ecological Chemistry at the Moldova State University, Kishinev, Moldova

The Programme draft has been elaborated that forsee galvanochemical workshops (GCV) concentration at several basic enterprises. The concept is based on three levels of providing the ecologically friendly production. The first level is based on using the rational technology at the GCW, that includes low-concentrated electrolytes, rinsing processes with the reduced water consumption and the number of another technological factors.

The second level is based on using the processes of selective extraction of metals from rinsing water, and the regeneration of used technological solutions. The third level includes additional purification of mixed multi-component wastewater for its repeated using, as well as providing the ferritization of the residues formed for their further utilization.

The method of estimation of GCW's technico-ecological level is proposed, based on the calculations of "desirability function" according to the following formula:

where d=exp[-exp(-Y')]I Y' - dimentionless value of each

$$D=\sum_{i=1}^{n} d_i/n$$

of the technico-eco logical factors, n - their number.

The influence of complex formation and the distribution of d-metals (Cr, Zn, Cd, Cu, Ni) complexes in wastewater in the presence of such ligands as NH3, P^O^' * Citr^, Tartr^", Ox^ is studied. Using the NMR-spectroscopy method it was shown that the share of water-soluble complexes accumulation in wastewater can amount to 75X and more at the pH 6-6,5 - 14. That makes It difficult to treat such wasewater with alcalIne chemicals. So using the electrochemical technology is more advantageous.

Using of new systems producing low wastes is proposed as an alternative way to resolve ecological problems in platingindustry. They belong to two directions: selective regeneration of used technological solutions and local treatment of rinsing water. The regeneration of degreasing alcalIne solutions can be done at the ultrafIltratIon units of the "Ultra-OR" type (patent LU94846) with the ultrafIlters regeneration (pat.tti6i698i), permeate utilization (pat.fti6258i8) and that of retant (pat.fti049453, 1421395).

Used decapatIon solutions utilization can be provided by electrolysis In two-phase water-organic medium (pat.tti756282, app1Л15059705 of 15.09.92). The other solution is the method of "semi-dry neutralization" including the preparation of sorbents (pat.ttI790996).

To provide selective metal extraction from used technological solutions and rinsing water, method of catalytical reduction initiated by application of physical effects can be used (pat.ftI675407, 1749182). These processes can be realized by the method of diaphragm electrolysis (pat. ^1203123) or by direct electrolysis of euates in the intensified conditions (pat.»i662675, 2044693).

Electrochemical processes of wastewater purification in the intensive regimes provide ecologically friendly coating production. The kinetic dependence was deduced linking the amount of the substance extracted with the parameters of electrochemical peocess and the impurities adsorbtIon. It

can be caressed by the first-order equation:

$$\lg C_i = \lg C_o - Kt, \text{ где } K=\Gamma_\infty \eta \frac{A1}{VnF}$$

This core Hatlon makes it possible to distinguish the factors providing the intensification of water purification, which include the increasing of the rate of the anodic dissolving component C^3) and adsorbtion (Г^) increasing.

Theoretical aspects of pulse bipolar current using for anodic surface activation are considered, compared to the treatment using the constant current. The regularities can be described in general by the following equation:

$$\frac{t^p}{t} = \frac{\eta I_a}{\eta^p I_a^p} + \frac{\Sigma \tau_k^i}{t}$$

where "p' index attributes corresponding values to the pulse regimes of treatment. As It follows from this expression, the reducing of the t^/t ratio, i.e. increasing the rate of water purification during the pulse treatment can be done by the increasing of ^J in the pulse regimes, and from the other side -by the minimizing the total time of cathodic activating pulses ^~r/ . In this connection the mechanism of the activating action of cathodic pulses is considered, and the way of Its using is proposed (pat .^929582). The source of supplying with periodic current with the regulated reverse pulse is proposed (pat. ^1201995) for the implementation of the processes involved.

The unit of the "Elemag" type has been elaborated with the rotative abrasive cathode (pat.»i583362, 1554928, 1810305), that provides the decreasing of electrical resistance in the system due to the reducing the inter-electrode gap to 0,3-0,5 mm with the simultaneous mechanical activation of anodic surface. The specific feature of this process is the possibility of forming the complex crystal lie structures of the "spinel" type in the inter-electrode gap on wastewater purification process:

$$nMe^{2+} + (3-n)Fe^{3+} + 6OH^- \xrightarrow{\text{кат.}} Me_nFe_{3-n}(OH)_6 \xrightarrow{1/2O_2} Me_nFe_{3-n}O_4 + 3H_2O.$$

Optimal conditions of carrying out the purification process with the formation of residues processing the ferrimagnetic properties, are considered. The mechanism of fertilization process has autocatalytical nature and is connected with the heterogeneous Interaction of positively charged radicals of hydroxyl forms of metals on the negatively charged surface of the catalyst ' s part ictes.

The residues formed have increased chemicalstability compared to hydroxides, fact that provides higher degree of water purification from the heavy metal ions by 1-1,5 orders. There exist at least 9 types of the method involved that can be applied depending on the *production conditions.* The number of methods for the utilization of such residues is proposed (pat. fti049453, 1303569, 1421395). The possibility of preparation of carbon-mineral magnetic hydrophobic sorbents using such residues is the good prospect for the water *surfaces purification from the oil spills* (pat.tti667921).

ON PROBLEM OF BIOGENIC POLLUTION OF WATER BODIES BY DIFFUSE FLOW FROM RIVER CATCHMENTS

Dalkov M.P., Borissova G.G., Makarova E.N.,
RosNIIVKh, Yekaterinburg, Russia

The aggravation of ecological problems concerning the deterioration of water bodies conditions under the anthropogenic impact is caused the necessity of maximum accurate and reliable information on their pollution sources and amount of pollutants.

At present there is universally recognised that the significant portion of pollutants enters the hydrosphere not from the point sources but by the diffuse flows from the river catchments.

The scale of the negative impact of the pollution diffuse sources on the surface water quality may exceed the influence of the controlled flows by several parameters. In a number of regions the diffuse flow from the catchments brings 70-90% of the total volume of pollutants into the water bodies in the periods of high water-level.

Among the sources of the water bodies diffuse pollution, located at the river basin catchments, the agricultural areas have the priority by virtue of their spacious dispersion. So assessing the pollutive impact of various diffuse sources on the hydrosphere, the evaluation of the volumes of substances entered the water bodies from the agricultural areas becomes urgent.

Recent decades the eutrophication processes have been becoming the serious threat for the water bodies. As a result of the abundant flow of nutrients from the catchments (compounds of phosphorus and nitrogen mainly) the quality of natural water deteriorates being accompanied by the change of the conditions and structure of water bodies ecosystems. During the spring floods and summer rainfall floods the agricultural areas are the main emitters of nutrients. According to our researches and available scientific information their influence on the biogenic pollution of water bodies can be equal to 70% and over. These facts are evidence of the necessity to increase the accuracy of the quantitative assessment of the nutrients emission from the agricultural areas.

At present a lot of mathematical models have been elaborated in Russia and abroad. They are intended for the calculation of the nutrients emission from the agricultural areas. The majority of them describes the local level (field level) and requires the big volume of nature data; it makes difficult to use them for the assessment and forecasting of the river basins biogenic pollution.

The accuracy of the assessment of the pollutants impact on the surface water quality and the extent of their defense by water-protection measures are defined mainly by the hydrological conditions. Meanwhile up to now the available guidelines and recommendations concerning the calculation of the amount of pollutants entered the river network contain no approaches to the fixation of rated hydrological periods which show the most unfavourable conditions in regard to the surface water quality under the diffuse flows influence.

The scientists of RosNIIVKh have worked out the methodics of the calculation of nutrients emission into water bodies from the agricultural areas that enables to calculate the value of nutrients emission from the dry-farming as well as irrigative lands. It is recommended to use the spring flood of 25% frequency and period of summer rainfall floods of 25% frequency under the low water dry-weather period as the rated hydrological periods. Summarising the available information and conclusions of our own researches for each rated period we have chosen the representative agricultural backgrounds where the emission assessment is recommended to be organised.

The improvement of the methods regarding the calculation of the amount of nutrients bringing from the catchments by the diffuse way is necessary to forecast the water bodies eutrophication, to standardise and improve the economical activity in the river basins and to form the water protection zones and design the complex of measures aimed at the water protection as well.

A SYSTEM CONCEPT FOR THE ASSIGNMENT OF MAXIMUM PERMISSIBLE DISCHARGES

Dolgonosov B.M., Kocharian A.G., Khranovich I.L.
Institute of Water Problems, Russian Academy of Sciences, Moscow, Russia

The system goal is to reduce the river basin to the standard state for a certain time under minimum outlay. Within the system concept, the assignment of maximum permissible discharges (MPDs) for separate water users should be embedded to the system of coordinated water protection management for the entire river basin. The goal is achieved by stepwise revisions of MPDs toward reducing the discharge of pollutants and improving water quality. For the assessment of surface water quality, one of the available ecologo-sanitary classification (e.g., Council of Economical Coexistence [1]; Braginskii [2]; Zhukinskii et al. [3, 4]) is suggested to be employed. This approach is based on the double-level optimization: for the entire river basin using aggregated factors and for each water-resources region, on which the basin is subdivided. For the aggregated representation, we use the concept of the total equivalent mass of pollutants that is introduced by the following series of definitions: (1) *the individual hazard* of a pollutant is the quantity reciprocal to its fish-husbandry maximum permissible concentration (MPC); (2) *the total group hazard* is the sum of individual hazards of pollutants of this group; (3) *the hazard factor* of the pollutant of a given group is defined as the ratio of this pollutant's individual hazard to the total group hazard; (4) *the equivalent mass* of the pollutant is its mass multiplied by its hazard factor (to distinguish between the two masses, we will measure the equivalent mass in kg-eq); (5) *the total equivalent mass of pollutants* is the sum of equivalent masses of all the pollutants present in the water.

The sequence of operations for achieving the system goal is described below.

1. Subdivide the river basin by regions using administrative criteria. Any region should have a single guidance for making decisions with respect to legal subjects of water management.

2. Identify the aggregated model for the river basin. The model should describe the balance of pollutants, accounting for their intake from regions, a partial decrease due to assimilation processes, and transfer through the boundaries of regions.

3. For each region:

3.1. Determine the state of water objects. Gather information about hydrological, hydrochemical, and hydrobiological factors at all characteristic sites of the water objects. Such information is collected at the stations of State Environmental Monitoring Service, State Committee of Environmental Protection, and Ministry of Natural Resources.

3.2. Calculate the average class of water quality. Use monitoring data for previous 3–5 years for finding the averaged water quality indicators. By these values, the water quality class is determined according to the adopted ecologo-sanitary classification.

3.3. List main water users. Gather information about resident areas, industrial objects, animal husbandry objects, and farmlands, disposed in the region.

3.4. For each water user:

3.4.1. Determine user's state. The following information should be gathered:

for a resident area: population; total area; fractions of municipal and individual developments, roads, green belt; availability and condition of sewage disposal plants, efficiency of purification, influent and effluent composition;

for an industrial object: water consumption and disposal guidelines; air-emission guidelines; production volume; labor force; art of technology, state of facilities; availability and condition of waste treatment plants, efficiency of purification, influent and effluent composition;

for an animal husbandry object: water consumption and disposal guidelines; livestock capita and maintenance conditions; availability and condition of water-protective objects;

for a farmland: initial content of biogenic elements in soils; rates of chemical and organic fertilizer application; irrigation rates; area and structure of the watershed.

3.4.2. Determine the annual discharge of pollutants in water objects using the information gathered about the water user.

3.4.3. Determine user's pollution function. This function describes the discharge of pollutants (in kg-eq) versus outlay needed for stepwise improvement of the main technology

and waste treatment plants, when going toward the best available technology and the best water-protective practice (the function is given by the user itself on the basis of its action area plan, cf. item 6.5.2).

3.5. Determine the total discharge of pollutants in water objects by summing discharges of all users.

3.6. Determine the pollution function for the region on the basis of aggregated indicators of the region state such as: the total discharge of pollutants generated in the region; the discharge fraction provided by treatment plants; the average efficiency of purification.

3.7. Determine the maximum permissible harmful effect (MPHE, in kg-eq/yr) for the region by averaging local MPHEs for all characteristic areas of water objects (the local MPHEs are based on the fish-husbandry MPCs).

4. Determine the minimum outlay needed to reduce the river basin to the final standard state. Solve the total outlay minimization problem for the entire river basin at given: pollution functions of all regions, the aggregated river basin model, and the pollutants discharge limitations imposed by the regional MPHEs. The problem results in the minimum outlay for the river basin and the distribution of outlays between regions.

5. Distribute the total outlay between stages and set the time for achieving the goal. The outlay distribution is made by the federal authorities with regard to the federal and regional budgets, capabilities of water users, economic climate, as well as the current environmental situation in the river basin. The preliminary stage is to elaborate the program of improvement of the river basin environmental state, which includes: deployment of a monitoring system for natural water quality and effluent chemical composition, gathering the initial information, identification of the river-basin and regional models (the stage duration should be 1–3 years depending on the basin area). Within this stage, the provisory MPDs for water users are established using the preceding normative system (for users, who have had the agreed-on MPDs, these are extended on this stage). The consecutive (main) stages imply the activity of regions and separate water users related to: planning water-protective measures, design, construction and startup of waste treatment plants, updating the main technology. Each of these stages must reduce the discharge of pollutants in water objects. Duration of these stages is 2–3 years. It should be borne in mind that the reduction of the pollutants discharge does not immediately affect the water quality because of retarded exchange in the watershed–river system and the influence of bottom sediments.

6. Within each stage for each region:

6.1. Assign the water quality class acting to the end of the current stage. The class is adopted to be equal to the average water quality class at the beginning of the stage. This class defines the system of MPCs (needed for calculation of the limiting harmful indexes, LHIs) acting to the end of the stage.

6.2. Find the minimum discharge of pollutants to the end of the current stage at the given outlay, as well as the optimal outlay distribution between water users and the target pollutants discharge for each user to the end of the stage. For this purpose, the total discharge minimization problem must be solved for the entire region at given: the total regional outlay, pollution functions for all users, and water quality limitations (imposed on LHIs for the adopted water quality class) at monitoring sections. Water quality at a monitoring section is calculated depending on morphological and hydrological nature of the water object by the Frolov–Rodziller [5, 6] and Ruffel [6] methods. The background concentrations required for these methods are determined at the section 1 km above the effluent site for large and moderate rivers and at the section 0.5 km above for small rivers. At high natural background, instead of MPCs it needs to use the background concentrations in the calculations. The minimization problem yields the minimum total discharge of pollutants, the outlay distribution between water users and their target discharges to the end of the stage. The calculated discharge for each user is assigned to it as the target annual MPDs (in kg-eq/yr) for the next stage.

6.3. Determine the water quality class for the region for the next stage. By the distribution of discharges to the end of the current stage (found according to item 6.2), the water quality indexes at the monitoring sections are calculated and then averaged over the entire region. Based on the averaged indexes, the average water quality class for the region is found within the adopted ecologo-sanitary classification. This class is assigned for this region for the next stage.

6.4. Assign the charge for 1 kg-eq of pollutants, single for the entire region, as the ratio of the total outlay to the total discharge of pollutants in the current stage.

6.5. For each water user:

6.5.1. Assign MPD for the water quality class adopted for the current stage, based on the water quality limitations (by LHIs) at the monitoring section of the effluent. The MPDs for water users are established for the period up to 3 years at presentation of the user's project in the territorial environmental protection authorities. These authorities execute periodical inspections of the volume and chemical composition of effluents subject to their agreement to the assigned MPDs.

6.5.2. Develop the action area plan for reducing the discharge of pollutants to the level required to the end of the stage. This plan includes updating the main technology, design, construction and startup of waste treatment plants, etc. with indication of their costs. Realization of the plan is examined by the territorial environmental protection authorities.

6.5.3. Determine the charge for the discharge of pollutants. The charge is collected to the end of the stage and calculated as the difference between the cost for the discharge of pollutants for the past stage and the finances committed to the effluent reducing measures provided that the discharge to the end of the stage reduces to the required level (if this difference is negative, the charge is not collected). The discharge of pollutants in excess of the assigned MPDs is amerced with a certain charge.

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DEVELOPMENT OF THE TECHNOLOGY OF " DEEP" PURIFICATION OF PHOSPHATE-POLLUTED SEWAGE WATER

Dunajtsev I.A., Jigletsova S.K., Kondrashenko V.M.
State Research Center for Applied Microbiology Moscow region Obolensk, Russia

At present, reducing phosphate concentrations in sewage waters is considered a key problem among other relevant ones. Aerotank-based systems used in the country fail to provide such phosphate elimination that could meet national standards.A biopurification technique that employs both aerobic and anaerobic processes is considered the most suitable all over the world.

A technological scheme of bioremediation of phosphate-poluted sewage water is offered. The technology is cost-effective and can be applied to urban purification facilities. In addition to the available system for aerobic purification, the technology uses an anaerobic slime activation system allowing one to correct biocenosis. Stimulation of the anaerobic process needs for arranging an ouside contour to treat slime or using some aerotanks which capacities fit to that of a purification facility itself. Anaerobic activation usually lasts from 0.5 to 2 hours and depends both on a composition of waste water and aerobic step duration.

A bioreactor with a continuos supplying phosphate-reducing bacteria is needed to provide the correction of biocenosis.

When developed for a particular purification facility, the technology guarantees the reduction of phosphate content up to 1-2 mg/l.

POSSIBILITIES FOR ANAEROBIC-AEROBIC BIOLOGICAL TREATMENT OF SEWAGE

Dyatlova T.V., Zemliak M.M., Sokolova E.V., Churbanova I.N., Yakovlev S.V.
The firm "BIONIK", Moscow, Russia

Biological methods used for treatment of various types of wastewater are relatively well studied. Potential for their intensification, both structural and technological, is far from being exhausted, though.

A well-promising approach to treatment intensification is to raise the biomass concentration in the active zone of the treatment installation. This makes the treatment process less affected by toxic substances, increases the oxidizing capacity, increases the percentage of pollutant removed from the wastewater, and minimizes the excessive biomass produced.

To raise the biomass concentration in the reactor the inert beds for microflora immobilization are widely used.

Another well-promising approach is to use the technology with the fluidized layer in the active or inert beds. This also allows to treat sewage with higher concentration of the activated sludge.

There are various types of biooxidants working with high doses of active biomass.

The *Bionik* company developed a new generation of anaerobic, anaerobic-aerobic, and aerobic column bioreactors.

In the anaerobic column reactor the sewage is successively treated in the fluidized layer of activated carbon, and in the suspension of the granulated activated sludge. In these zones organic compounds are taken from the wastewater and substantially destroyed due to their adsorption on the bed surface and oxidization by the sessile microorganisms. In the granular layer organic compounds are rapidly destroyed, and this is the structure of the activated sludge which gives large dose of the biomass, high speed and deepness of destruction and low level of effluent suspended solids.

The fixed fiber bed in the separation zone of the mixed liquor serves as a hydraulic stabilizer for the upcoming water flow and promotes agglomeration. The fine particles of the biomass coming from the granulated sludge layer are fixed on the fiber bed surface. These particles make additional oxidization of the organic compounds.

Anaerobic-aerobic column *Biofos* reactor combines aerobic oxidization, nitrification, denitrification, dephosphatization, and secondary sedimentation of the mixed liquor in the same camera. This allows the wastewater be cleaned deeply not only of organic compounds but also of biogenic elements.

Compared to previously used installations, the *Biofos* reactor has the rate of silt growth 1.5–2 times less, and takes 20 to 40 % less air. The sedimentation of the activated sludge is high. The excessive sludge has low resistance to filtration. It is stabilized and does not require special treatment before drying or mechanical dehydration.

The aerobic bioreactor uses the biosorption treatment technology. Sorption, biological aerobic oxidization of the organic compounds, and mixed liquor separation by sedimentation, radial filtration through fiber bed and vertical downward filtration through granules are performed in the same camera. The specifics of the process is that the recirculated liquid is saturated by the oxygen at high pressure. This allows to increase the concentration of the dissolved oxygen in the reactor and to decrease the recirculation number.

This reactors allow to form various schemes of treatment.

Wastewater of various origins may have different compositions. Usually it is to be cleaned from both inorganic and organic compounds such as compounds of phosphorus, various forms of nitrogen, sulfates, etc. This complicated problem can be solved by the three-stage treatment technology including: anaerobic treatment of the concentrated local or common sewage stream, anaerobic-aerobic cleaning, and deep aerobic treatment of sewage to clean them from remaining bioresistent compounds. The scheme can include one, two, or three stages depending on quality of wastewater and requirements to the quality of the effluent.

The anaerobic-aerobic treatment is performed also by the normal series of the *BRIZ* installations. Their throughput is 0.5 to 100 m^3 per day. The installations are designed to treat domestic sewage from small facilities. The successive anaerobic and aerobic treatment gives the cleaned water of high quality: BOD is 3 mg/l, SS 3 mg/l, and the sediment is stabilized. The effluent can be used to water plants or discharged to the water body.

The new generation of biological reactors developed by the *Bionik* company are widely used at various industrial and domestic sewage treatment facilities.

THE APPLICATION OF COMPUTER SIMULATION METHOD FOR THE DESIGN OF WASTEWATER BIOLOGICAL TERTIARY TREATMENT FACILITIES

El U. F., Shelomkov A. S.
MOSVODOKANALNIIPROJECT Moscow Institute for Water & Wastewater Research & Design, Moscow, Russia
Danilovitch D. A.
MOSVODOKANAL MSE, Moscow, Russia

In accordance with the existing requirements of the Russian Federation the wastewater treatment must provide the meeting of the quality standards requirements established for the water bodies of fishing quality. At present the wide-spread municipal sewage treatment facilities do not provide the established quality indices. The modernization of these facilities must firstly be aimed at the improvement of organic pollutants and nutrients (nitrogen and phosphorus) removal efficiency. At present the availability of a large number of technological schemes and methods for wastewater biological tertiary treatment, a wide variety of treatment facilities in operation as well as a broad variance of wastewater initial quality indices do not make it possible to offer any type approaches to modernization. In every specific case it is required to carry out a large amount of preliminary design calculations to determine the optimum process parameters, the configuration and the size of the treatment facilities.

In this case the most expedient method for the work carrying out is the computer simulation that simulates the chemical reactions, the physical phenomena and the biological conversions that are characteristic of the situation when a given substrate (the organic substance of wastewater) is decomposed under the influence of microorganisms biocenosis (activated sludge). At present a large number of computer programs are available at the market; these programs provide the modeling and simulation of various configurations of wastewater biological treatment systems.

Together with DHV Consultants BV (a Dutch company) we have chosen Simba simulation program which is the registered trade mark of IFAK (the City of Magdeburg, Germany). This is a complete package of applied simulation programs that provides the simulation of any desirable process with a high flexibility level concerning the alteration or extension of the process models. In particular, in order to model the wastewater treatment bio-chemical processes, DHV Consultants BV has already developed the "averaged" set of constants obtained on the basis of the data obtained from a large number of Dutch wastewater treatment plants and we make use of this set of constants. In every specific case it is required to make some constants more precise in order to bring the model into line with the existing conditions. It results in the achievement of a large degree of the model identity to the modernization project being considered thus making it possible to study the variants of the wastewater treatment facilities optimization.

We use the simulation modeling to determine the optimum variant of treatment facilities reconstruction, to evaluate their operation modes and to establish the final effluent quality indices for various wastewater treatment plants. The project of the reconstruction of the existing facilities of Ljuberetsky Wastewater Treatment Plant of the City of Moscow, the project of the of the construction of a new part (of 1.000.000 m^3/day treatment capacity) of this Plant and the project of modernization of the Wastewater Treatment Facilities of the City of Chelyabinsk are among the largest projects carried out. In all the cases above-mentioned the application of computer simulation method has made it possible to considerably decrease the time required for the design work carrying out, to offer the most expedient variants of the facilities and the entire technological scheme modernization as well as to minimize both the volume of the reconstruction work and the expenditures required for its carrying out.

PURIFICATION OF SEWAGE OF THE INDUSTRIAL PLANTS FROM HYDROGEN SULFIDE, PHENOL, AMMONIUM AND OIL PRODUCTS USING BIOPREPARATIONS

Fomchenko N.V., Biryukov V.V., Chtcheblykine I.N., Kopytina S.V., Barbot V.S.
GOSNIISINTESBELOK, Moscow, Russia

Oil refining factories are one of the most active contaminatior of natural water recourses. The waste waters of these plants contain significant concentrations of oil products, hydrogen sulfide, phenol and ammonium. It is established, for instance, that in waste waters of Moscow refining factory there are significant overshoots of content of these contaminants beside alloved limits for Moscow municipale sewerage plants.

The performed analysis of effluents from various stages of technological process of oil refinery has allowed to allocate the most concentrated effluent containing the main amount of pollution. Researches carry out on local purification of this effluent with application of microbiological preparations. The active biocatalyst for removal the most harmful of components - hydrogen sulfide, phenol and sulfur alcohol is developed. During laboratory researches optimum conditions for production of the biocatalyst and oxidation by it of these harmful components were studied. That has allowed to issue the recommendations for realization of industrial tests at Moscow oil refining factory for purification of concentrated effluent.

The industrial tests were carried out on usual industrial equipment for purification of the waste effluent which contents hydrogen sulfide, phenol and sulfur alcohol. In this tests we used the before manufactured sample of the biocatalyst. It is established during realization of the tests that the proposed method of purification provides reducing of concentration of hydrogen sulfide from 3700 - 4500 down to 1,2 - 2,0 мг/л, phenol - from 28 - 50 down to 0,4 - 1,0 мг/л, sulfur alcohol - from 2 - 5 down to 0 mg/l.

On the sewage of industrial plant of another oil refining factory we studied the removal also ammonium contaminate. This effluent contained much more pollution, than similar effluent of Moscow refining factory.

It is established during realization of the tests, that offered method can solve in industrial conditions the problem of purification of sewage down to limits corresponding to optimum conditions of its further biopurification. It allows to reduce the contents of hydrogen sulfide from 5000 - 11000 practically down to 0 mg/l, phenol - from 500 - 1000 down to 20 - 40 mg/l, ammonium from 2500 - 5000 down to 10 - 20 mg/l.

The technologies of firms «Linde» (Germany) and «Rayox» (USA) which were developed for the same sewages were more expensive and less effective.

As a result, the biotreatment of the total sewage of the oil refining factory is offered, which uses the biopreparation «OLEOVORIN» and meets all quality regulations concerning oil products, ammonium and phenol. The biopreparation contains bacteria *Acinetobacter oleovorum* and other microorganisms, has all necessary permissions of state sanitary authorities for its application on ground and water.

Purification of sewage is made by using the biopreparation, which is immobilized on regular packing. After this treatment the concentration of oil products is reduced down to 2 - 4 mg/l, phenol - down to 0,1 - 0,05 mg/l, ammonium down to 10 - 20 mg/l, that completely meets the requirements to the purified sewage. The process can be realized in compact installations and does not require the significant areas and high expenditure of energy.

Proposed technology can de used on any industrial plants with the similar sewages.

ASSESSMENT OF INTEGRAL TOXICITY OF POLLUTED WATER AND SOIL AND ITS VARIATIONS DURING POLLUTANT DEGRADATION

Fomchenkov V.M., Irkhina I.A., Novikov I.A., Petukhov V.N., Shtuchnaya G.V., Gurov B.N., Kholodenko V.P., Chugunov V.A.
State Research Center for Applied Microbiology, Moscow region Obolensk, Russia

In last years, numerous bioassays are widely used to analyze environmental pollutants since any test-organism is capable of responding to the total effect of all toxicants involved. Thus, a bioassay allows predicting of the actual hazardous effect of environmental pollutants, while neither physical method nor chemical one provides such a possibility.

Integral toxicity (IT) in oil-polluted soil and water specimens and its variations resulted from toxicant degradation were studied.

For water toxicity testing, the following biotests were applied: *Photobacterium lelognathi* BKM B-1719 bioluminescence assay (BL), electroorientational (EO) and osmooptic (OO) assays as well as *Agrobacterium radiobacter* BKM B-1218 reducing activity redox dye biotest (RA), and *A. radiobacter* and *Euglena gracilis* IPPASE-236 growth test. The higher plants, including certain garden and cereal cultures, were used for soil toxicity testing.

The growth test usually shows the effect that pollutants can make on the growth and reproduction of test-organisms. Bioluminescence and reducing activity bioassays indicate the influence of toxicants on intracellular enzyme activity, while electro-orientational and osmo-optical ones give evidence of changes of bacterial cytoplasm barrier properties.

Oil-products under investigation were treated with an association of degrading strains, such as *Acinetobacter sp., Mycobacterium flavescens and Rhodococcus sp.* It was

found that bioassays used may fall into the following succession as to their sensitivity to motor fuel pollutants in water: BL > RA = the growth test > EO. Thus, the results suggest that oil toxicants in low concentrations (< 1%) affect primarily enzymic and physiological properties of cells, while these in much higher concentrations may disrupt extensively a membrane permeability barrier.

Integral toxicity testing of water polluted with diezel fuel and kerosene showed no marked increase in toxicity after the pollutant being degraded. In contrast, the rapid assays (EO, OO, RA and BL) revealed a significant toxicity increase in the same environment, whereas the prolonged growth test failed to provide a statistically reliable IT increase. The latter is likely to be associated with the ability of the test-culture to acclimate to the environment under study. It can be concluded that despite the initial negative response of the test-culture to biodegraded pollutant water, the growth or reproduction of the test-culture was not significantly inhibited.

The growth biotest using higher plants and model oil and diezel fuel pollutions demonstrated that a number of garden cultures (mustard plant, lettuce and dill) are more susceptible to the pollutants than cereals (oats, barley and wheat). The mustard plant bioassay showed an IT decrease in diezel fuel –polluted soil samples (2%) after a month treatment of them with a mixture of degrading microorganisms.

Results suggest that these bioassays are a suitable tool for IT testing of polluted soil and water as well as for purification quality surveillance. The battery of biotests is advantageous for this purpose because it allows to assess fully a test-culture's response to toxic conditions.

Investigations were performed in the framework of Project #119-95 of International Science and Technology Center (ISTC).

THE USAGE OF NEW SORBENTS ON THE BASE OF HYDROLYSIS LYGNINUM

Fomina E.U., Novikova L.N.
Irkutsk State Technical University, Irkutsk, Russia

The enterprises of the hydrolysis industry are connected with the formation of the liquid and solid (hydrolysis lygninum) waste quantity. The most perspective method of the cleaning of the concentrated sewage of the hydrolysis enterprises post-yeast liquid (PYL) is the sorption with the using of the hydrolysis lygninum by shecial sorption modified technology.

The modification of the hydrolysis lygninum is made by alkali, electrohydraulic shock and electrical gas discharge that leads to the changes of the reaction possibility of the surface connected with the functional content and porosity sorbent' structure.

The laws of the extraction of the organic components's PYL are stated: kinetic and balance parameters of the sorption; the mechanism of the sorption by method of infra-red and ultra-violet spectroscopy, gel-filtration, potentiometry, funcional analysis; also thermodynamic characteristics of the process are calculated.

On the base of these studies and technical-economical calculation we offer the technological scheme of the local cleaning of the PYL with a using as a sorpbent the hydrolysis lygninum activated in the alkali medium by the electrohydraulic shock. The positive result are got in the process of the test of the developed sorbent as a organic-mineral fertilizer.

MODERN CLOSED-TYPE SYSTEMS OF REFINERY WASTE WATER TREATMENT

Galeev R.G., Teljashev E.G., Lokshin A.A., Baikov V.A., Kuptsov A.V.
The Institute of Petroleum Refining and Petrochemistry Problems of the Academy of Sciences of the Republic of Bashkortostan (IPNKhP), NPTs "The Academy of the Universe", Ufa, Russia

One of the urgent tasks of oil refining alongside with efficient use of oil and deepening of its refining is the abatement of water and air resources pollution.

The results of our tests show that the complex of mechanical waste water treatment facilities (oil traps, after-treatment ponds, quartz, filters) now in use do not guarantee needed efficiency and full treatment of waste waters satisfying modern standards. Besides open mechanical waste water facilities used for a long time became out of date from moral and physical points. Of view, are the sources of air pollution and do not satisfy the modern requirements.

The modern closed-type process of waste water treatment - efficient and compact facilities (hydrocyclone, self sedimentation tank, turboflotator), developed by IPNKhP, SP "Istekoil" and NPTs "The Academy of the Universe" group. Only oil sludge and sludge lagoons are left open. The Academy of the Universal" group. Only oil sludge and sludge lagoons are left open. The germetic full-scale plant of mechanical treatment of waste waters was built on its bases, which is efficiently used since 1995 at AO "NUNPZ", which made it possible to reduce petroleum products evaporation into the atmosphere by 3600 t/year. The reconstruction scheme of the mechanical and physics-chemical waste water treatment facilities for industrial wastes of the second sewerage system of AO "UNPZ" was also developed. According to this scheme the wastes of the second sewerage system pass

preliminary treatment at three-phase headless hydrocyclone, than art closed shelf sedimentation tank, designed on the basis of special experiments of kinetic relationships of petroleum products and suspended solids sedimentation at static conditions. Then the sewerage enters the turboflotation facility, where the final treatment lakes place.

The use of this scheme makes it possible to improve the quality of final waste waters in accordance with the modern standards ensuring a 2,5-fold decrease of space required and a 4-fold decrease of energy consumption, besides, what is the most important, a 1,5-fold decrease of discharge of harmful substances into the atmosphere, significantly improving ecological situation at the refinery.

FLOCCULANTS FOR OIL SLUDGE SEPARATION

Galeev R.G., Kuptsov A.V., Gemajev R.Kh., Teljashev E.G.
The Institute of Petroleum Refining and Petrochemistry Problems of the Academy of Sciences of the Republic of Bashkortostan (IPNKhP), The Bashkirian State University, Ufa, Russia

One of the modern methods of reduction of oil sludge formation consists of its treatment at three-phase centrifuge. For efficient separation a flocculant is used individually selected for each oil sludge.

The following flocculants were tested with the oil sludges of AO "UNPZ":

- flocculants of Praestol type (ZAO Company - Stokhausen - Perm),
- flocculants of Zetag type (Germany),
- polyacrylamid of technical type (PAA).

To compare efficiencies of these flocculants (dosage 25-30 g/ton) tests of oil sludge separation under the effect of centrifugal forces were conducted at the laboratory and plant centrifuges. The oil sludge had the following characteristics:

- water content, % by weight 89.7
- mechanical impurities content, % by weight 1.3
- petroleum products content, % by weight 9.0
- density, g/cm^3 0.988

The results of the tests are given in table 1.

Table 1. Analysis of the upper and the low phases of AO "UNPZ" oil sludge during separation at the laboratory centrifuge.

Products	Upper phase				Low phase			
	yield, % vol.	content, % by weight			yield, % vol.	content, % by weight		
		water	mech. impurities	petrol. Prod.		water	mech. impurities	petrol. prod.
Crude oil sludge without flocculant	14.5	52.0	3.0	45	10.5	73.0	8.2	17.9
Oil sludge treated with Zetag flocculant	22.0	58.7	2.2	39.1	5.5	79.3	14.9	6.2
with Praestol flocculant	22.0	58.7	2.1	37.9	5.0	80.2	15.6	4.2

The flocculant of Praestol type was tested at the full-scale three-phase centrifuge. The results are given in table 2.

Table 2. The results of AO "UNPZ" oil sludge separation at the full-scale centrifuge (flocculant Praestol).

Products	Content, % by weight		
	water	mech. impurities	petroleum products
Upper layer of petroleum products	20.2	1.9	78.9
Low layer of petroleum products, sludge	76.2	18.7	5.1

A good correlation the results of the laboratory and the full-scale tests (look tables 1 and 2) shows about a possibility estimation efficiencies of the flocculants on the foundations of the laboratory experiments.

DEEP TREATMENT OF PETROLEUM REFINING AND PETROCHEMICAL WASTE WATERS

Galeev R.G., Ioakimis E.G., Gubanova G.D., Galeeva G.R.
The Institute of Petroleum Refining and Petrochemistry Problems of the Academy of Sciences of the Republic of Bashkortostan (IPNKhP), Ufa, Russia

For refineries and petrochemical plants with independent waste waters discharge into receiving water bodies the maximum permissible concentrations of contaminants in waste waters discharged into receiving water bodies are set up at MPC level (maximum permissible concentrations), which ammount (in mg/l) to: COD - 15-30, BOD(total) - 3, petroleum products - 0,05, phenols - 0,001.

Before discharge into receiving water bodies waste waters of many oil refineries of former USSR undergo biological treatment with subsequent after - treatment at biological tertiary ponds, sane filters and flotators. After this subsequent treatment the quality of waste waters is characterized (in mg/l): COD - 60-120, BOD(total) - 10-25, suspended solids - 10-25, petroleum products - 0,5-3,0, phenols - 0,005-0,08. This quality does not satisfy the enchanced requirements to waste waters discharging into receiving water bodies. New methods, schemes and constructions, permitting further deepening of waste waters treatment should be used.

Besides our earlier developed technology of adsorbtion treatment of waste waters on carbon sorbents with after - treatment by means of thermal regeneration we proposed a new technology of waste waters treatment - biosorbtion with fluidized bed adsorbent.

The process of biosorbtion was tested at the IPNKhP pilot plant with the capacity of 50 l/sd.

For definition(determination) of efficiency of clearing and the most perspectiv load of research were carried out(spent) on one drain and four in parallel working биосорберах, loaded activated углем of the marks АБД, АГ-5 and natural сорбентом СГН-30А крупностью of particles 0,5-2мм and 0,5-1мм. The average results of spent researches are resulted(brought) below.

Table.

Parameters Qualities Waste waters	Up to Clearing	After clearing with use			
		ABD	AG-5	ABD	SGN-30A
		крупность of particles, mm			
		1,5-2	1,5-2	0,5-1	0,5-1
COD, mg/l	67	22	25	19	44
BOD, mg/l	9,5	2,6	3,0	2,3	4,0
Petroleum, mg/l	0,82	0,06	0,07	0,05	0,05
Weighed Substances, mg/l	13,0	2,7	2,8	2,3	2,0
Phenols, mg/l	0,020	0,001	0,005	0,002	0,007

Received results show, that the biologically cleared drain Уфимской of group НПЗ and НХЗ on the basic parameters is exposed deep доочистке up to the requirements of norms ПДС by use угля of the mark АБД with крупностью of particles 0,5-2mm. Efficiency of clearing thus makes (in %): on COD 67-72, on BOD(total) 73-75, on petroleum 93-94, on phenols 90-95 and on weighed substances 79-82. The basic technological parameters, ensuring a high degree clearings, following of : relative expansion сорбента 30 %, speed псевдоожижения сорбента 20-25 м/ч, time аэрации in a zone окисления 0,5 ч.

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PROBLEMS FOR SELLECTING AERATORS FOR SYSTEMS OF BIOLOGICAL WASTEWATER TREATMENT

Galich P.A., Marchenko Y.G., Meshengisser Y.M.
SIF "ECOPOLYMER", Belgorod - Kharkov, Russia - Ukraine

Presently there are many firms producing pneumatic aerators, and in many cases a selection of the right type represents an essential problem. Based on power characteristics approach the fine-bubble diffusers of any design are equivalent. Therefore, it is necessary to search base for comparison and, primarily, in constructive differences influencing operational characteristics of diffusers. Structurally, porous diffusers can be divided on two large groups. The first group of diffusers which can be fastened to a special air releasing system stacked at the bottom of aeration tank might include tubular and flat (plate, disk) diffusers. The second group consists of diffusers combining air supplier and dispergator in one designed unit.

Diffusers of SIF "ECOPOLYMER" belong to the second group. It essentially allows to reduce installation costs, speed up to exploitation, increase their reliability. The availability of air cavities between a skeleton and aeration element provides air redistribution and alignment of its discharge along the length of the diffusers. The dispergative layer represents a porous tubular element allowing air and water to escape from all the points of the circular section. It is extremely important and positive feature of tubular diffusers in general. They are not afraid of neither on-off of pressure-blowing units, nor changes of a load on structures.

Today, currently existing flat diffusers (as well as tubular) are produced in two different ways: from a porous material or from synthetic membranes for escaping air bubbles.

There are some common disadvantages of all flat diffusers in comparison with tubular diffusers: 1) they require special air distribution system; 2) complex and not enough reliable design of fastening of plates to air device; 3) they require special valves or other devices to remove the entrance of sewage into the diffuser in the moment when air discharge is cut off; 4) the big number of diffusers per system complicates the installation process and reduces general reliability of system; 5) the plates work in a rather narrow range of air discharges, that makes a rather doubtful posibility of their use by changing loads and in cases of a sudden electric power failure.

The main dignity of membrane diffusers is the automatic closing the fine-porous in a membrane at the moment of reduction of air discharge below than a certain limit. It differs from porous aerators. At the moment of increasing air discharge the sizes of membrane diffusers air bubbles are increased. That results in decrease of the mass transfer coefficient. At the same time membrane diffusers give more uniform distribution of air bubbles.

We consider, that the further development of pneumatic aerators (diffusers) should go with association of dignities of tubular and flat diffusers, and the first design of such diffusers is developed by our firm.

K RER PURIFICATION IN MICROBIOLOGICAL INDUSTRIES

Gorshkov V.A.

Fast-Doctoral Degree, Institute of Ecology and Genetics of Microorganisms, Ural Branch of the Russian Academy of Sciences. Perm, Russia

The activity of yeast and beer manufacturing Is followed by formation of high concentrations of waste waters. The amount of BOD (biochemical oxygen demand) in these waters varies from IOOOO to 40000 mg/cub.dm. Present technologies provided for waste water treatment do not involve utilization of residual contents of organic compounds and appear to be expendable. Biotechnologies developed in our laboratory are devoid of the =.+fa+-Prl c*hr'rtf-ominas.

Power-preserving biotechnoJ.ogy Is dasea on tne me*noa ot inoculation of bacterial suspensions of sulfate-reducing bacteria (SRB) into waste water with concurrent increase to pH 8. Hydrogen-sulfide isolated from culture suspension denaturates protein. Flocculus are formed at sedimentation with SRB alive cells as their centres. Supernatant is subjected to filtration on sand filters with subsequent final purification in adsorber. Purified water complies with all the indexes at its release into raservoirs. Sediment basically comprised of yeast protein cells is subjected to composting following the thickening with the aim of providing the fertilizers with their subsequent utilization. Permanent cultivation of SRB is conducted in anaerobic conditions directly on purification Inc*jgll*f-Inns. Waste water serves as nutrient medium.

5io j*y of ccmblnec* '*men* ct nlgnly conc*nLrated *a*r: *_ and 3ost-ye* erme** in particular, is based or;

'& : spatial succession of microorganisms-destructors. The first stage of fermentation involves selected yeast strains to provide nutrient protein. Biomass is subjected to thickening, dehydration and drying. Dry biomass (3...l*% c*isture) serves as nutrient protein addition. The second and subsequent stages of fermentation involve various groups of micrcorganisms-destructors and protozoa. Finally purified wat*r *n laorlds may be used in t******ai water supply or discharged 'n4-n rll'alA*qe.

THE PRINCIPLES OF STANDARDIZING OF SEWAGE INTO WATER BODIES AND MUNICIPAL SEWERAGE SYSTEM

Greedasov V.V., Bagaev Yu.G.
Corporation "Vodokanal", Novokuznetsk, Russia

In total volume of contaminants, feeding into water bodies, a part introduced together with sewage of cities and populated areas, comprises between 10 and 50%. Heavy development of municipal water disposal systems and waste water purification in the seventieth-eightieth caused to that fact that the majority of cities and populated areas have the biological purification plants, providing the removal of 70-90% of contaminants feeding into them. The tendency for purification plants development in the direction of investigation of purification extent through the erection of pre-purification, noted in recent years should be considered as wrong. Operating experience shows, that traditional pre-purification facilities retain 5-10% of total volume of contaminants, contained in the municipal escape through their cost could be compared to the cost of biological purification plants. Standards for a disposal of polluted water into water bodies laid down by basin (hydroeconomic) administrations together with the Environment Protection Committee are insinuative for the purification systems development. The aspiration to set forth the extrastrict standards for the escaping for municipal sewerage systems without solving the problem of water bodies protection from irregular escapes, brings about irrational investment of material resources into the construction of unnecessary pre-purification systems.

Essentially in any city there are 2-3 streams whereby the contaminations from the covered by them drainage basins run off. These contamination exceed the escapes from the municipal purification plants by tens and hundreds by mass. Even superficial analysis of the sources of contamination supply into the water bodies leads us to conclude that the purification extent of the municipal waste waters for the most part must be bounded by coefficients, accessible at the biological purification plants, except toxic matters of anthropogenous origin. The removal of these matters is to be carried out at the local purification plants of industrial enterprises.

According to the resolution of Government of the Russian Federation №1504, dated December 19, 1996 «The procedure of development and statement of the standards for Maximum Permissible Harmful Effects (MPHE) of water bodies», the Ministry of Natural Resources of Russian Federation is responsible for the realization of the development of harmfull effect standards by the basin of water body or it's part. It should be supposed that this document point out the necessity to take into account self-purifying ability of water bodies from contaminant matters coming from all sources of contamination. The following sources of contamination are the most important:

- regular waste water escapes from cities and populated areas;
- regular superficial escape, expendable into the water bodies without purification;
- irregular wastes from the territories of cities and agricultural lands;
- regular escapes from unregistered water consumers.

Regular escapes of municipal waste water systems are provided with the purification plants and developments on purification systems improvements much better. Therefore, it is necessary to set the executive organs the task of providing the right extent of municipal wastes purification at a level of the present purification plants technological possibilities and maximum limiting of the other contamination sources escapes just as through purification plants erection, so keeping the environment from the conditions, aiding in contaminants emergence.

The realization of this regulation can be assured if item 1.14 of the present «Estimation procedure for Maximum Permissible Escape of polluting compounds with waste waters» would be transferred into the new methodical instruction on the standardizing of harmful effect on the water bodies as applied to the municipal wastes. The extent of wastes purification therewith for the majority of bodies should be restricted by the characteristics achievable at Standard Technologies of Water Protection (STWP). The Advanced (ATWP) and the Optimal (OTWP) Technologies of Water Protection could be applied only in ecologically adverse areas. The primary efforts on the reducing of the adverse effect to the water bodies should be directed towards the updating of sludge treatment plants and surface escape purification of the municipal territories.

A considerable effect on the decreasing of polluting compounds, feeding into water bodies, can be attained by the regulation of transit contaminants conditions of escape from the useres of the municipal disposal systems. The present «Intake regulations of the industrial wastes into the municipal sewerage» allow to specify the escape standards subject to standardized purifying effect and separation of acceptable polluting compounds volume between the industrial and domestic escapes. Related point of view results in specifying of the strict escape standards for the «domestic» compounds (nitric compounds, phosphates, chlorides) and rather mild standards for the industrial compounds (heavy metals, petroleum products, phenols and others). Carelessness of some clauses of estimation procedure of the contaminants escape standards into the municipal sewerage brings to the fact that the escape standards on just the same components can differ in tens and hundreds for different cities. Considering the present case it is necessary to determine minimum and maximum sectional standards for the main groups of the industrial enterprises (metallurgical, chemical, food, motor transport industries) of wastes purification level discharged into the municipal sewerage on the major polluting compounds characteristic for these industries. In so doing, water and sewage enterprises must have the right to correct corresponding with the governments of cities within the fixed purification stages (minimum and maximum), the escape standards with regard to water body contamination, polluting contents and real level of the escapes purification at the municipal waste water treatment plant.

In terms of the proceeding it should be inferred that the currently availiable normative documents on the waste water escape terms into the water bodies and municipal sewage systems call not only for amendments, but also for changes of the principals of standartising. Evidently, this work without practical support on the source side of water and sewage enterprises would remain in development stage over prolonged period, as it was in 1990-1997-th years.

THE FLUENCE OF WASTE WATER DISCHANGE OF REDKINO EXPERIMENTAL FACTORY ON THE WATER QUALITY IN IVANKOVO RESERVOIR

Grigorieva I.L., Bugrov A.N., Shtriter E.E.
Ivankovo Station of Water Problems Institute of the Russia Academy of Sciences, Konakovo, Russia

Formed in 1937 , Ivankovo reservoir is a part of Volga cascade. It provides Moscow with water on 60 %.

Redkino experimental factory is one of large enterprises which discharge waste water into Ivankovo reservoir.The project capacity of treatment plants of the factory is 13000 m^3/day. Actual volume of the waste water discharge was 5.6 thousand m^3/day in 1992.Waste water discharge is carried out into Shoshino reach of Ivankovo reservoir through the about 5 km length channel.The mouth of discharge channel is the part of Shoshino reach that is blocked with the dam,

over which the main line Moscow-Sankt- Petersburg is going now. The water effluent is going under the railway bridge.

Shoshino reach was created by flooding the lower parts of the Shosha river body from its mouth to the place where Turginovo village is cituated. It is a combination of the open water areas, numerous islands, the overground shallows which often turn into coastal swamps. The length of the reach is 36 km, the maximum width is 5 km, the water surface area is 112 km^2 (under normal water level), the total volume of the reach is 0.19 km^3.Shosha river and the tributaries of Shosha river consist 11 %. from the total value of surface water flow in Ivankovo reservoir.

Researches of the fluence of waste water discharge of Redkino experimental factory on the Ivankovo reservoir water quality were held in August 1993.

The water sampling for the chemical analysis was made in the mouth of the discharge, 100 m up the channel, 100, 200, 500 & 1000 m from the channel mouth along the dam near the bank of the river, in a transit flow up & down stream from the railway bridge, at the Shoshino reach outlet. At all these points the water sampling of the bottom sediments was proceeded.

Except of standart hydrochemical exponents in the water samples the toxic environment was determined by the method of biotest with the use of luminous bacteria Photobacterium phosphoreum. The The luminescention of the luminous bacteria was determined by the portable test-tube luminometer Emilite-1003A produced by the company Biohimmack.

The analysis of biotest data showed that all the water samples are in no-toxic category, at the same time the water samples of bottom sediments taken in the mouth of the discharge channel turned out in the category of high-toxic sample , the samples taken 200 m down the channel is a weakly-toxoc sample. Thus one can conclude that the polluting matters entering the Shoshino reach of Ivankovo reservoir with the Redkino experimental factory waste water discharge accumulate mainly in the bottom sediments of the mouth area of discharge channel, in the bottom sediments at the distance of 200 m around the channel.In the water samples, taken in the mouth area of the channel the higher concentration of ammonium nitrogen, permanganotic oxidability was observed, the counts of the other parameters (am nitrate nitrogen, sulphates, chlorides, COD5- chemical oxygen damand) were not higher than in other points of sampling Accoding to the concentration of N-NH4 the influence of sewage waters spreads along the dam on about 500 m.In the transit flow the sewage water influence is not observed. It can be explained by the water circulation in Shosha reach, which one can see by the results of the mathematical modelling of the flowing situation in the area of Shoshino reach from the railway bridge to the mouth of it. During the many-direction winds in the widen shallow part of Shoshino reach in the area of the mouth of the discharge channel the closed circulations of water mass are observed. The mass practically does not interact with the transit water flow going under the railway bridge.

So, approximate researches of the fluence of waste water discharge of Redkino experimental factory on the water quality in Ivankovo eservoir showed that the pollution of water mass of the reach with he waste waters of the experimental factory is of local character and does not spread on all the reach down the railway bridge, that is explaned by the circulation of water mass at this place in summer low period.oxic polluting matters accumulate mainly in the bottom sediments of the reach in 200 m radius from the place of discharge.

In future one should go on such researches in other seasons of the years and other periods of fluctuating water volume. The results of modelling of water mass circulation should be confirmed by the natural measuring.

The comparison of water quality counts obtained in summer 1993 in the area of Redkino experintal factory waste water discharge with analogous to the monitoring counts, held in this area by the Solnechnogorsk hydrogeological group from the Hydroregime expedition of Minictry of Geology USSR summer 1972 showed that the water quality became worse on many counts . The N-NH4 concentrations at different layers increased 1.5-2 times , the content of sulphates increased about 1.3 times.In 1972 the water pollution with the N-NO3 in transit inflow was not observed. And in summer 1973 its concentrations in different points of water sampling were0.022- 0.142 mg/l.

By our opinion, during the long-term period water quality in Shoshino reach became worse, partly because of Redkino experimental factory waste waters.

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EMPLOYMENT SURFACE - BARKER DISCHARGE PLASMA FOR REDUCTION OF SEWAGE TOXICE

Grinevich V.I., Kuvykin N.A., Bubnov A.G.
State Academy of chemical technology Ivanovo, Russia

Population provide of high quality drink water and working out of energy saving technologies for sewage cleaning of various productions are the actual problems.

The aim of this work was the investigation of phenol destruction kinetics and products composition under the influence surface- barrier discharge plasma (SBDP) on phenol agues solutions modeling of natural water and sewage.

Experiments demonstrated that efficiency of phenol destruction depends on its initial concentration in solution (when c= 2 mg/l- 73%, c= 20 mg/l- 15%), the discharge

power (when W= 144 mW/csm -15%, W= 325 mW/csm-62%) and active finch of active plasma particles to the solution (when the plasma action time an eight the destruction rate of phenol is increasing a four). The greatest degree of phenol conversion is 73% (c= 2 mg/l, t=314 s, W=325 mW/csm).

When phenol destruction in solution nitrogen oxides and nitrate, nitrite, ammonia ions, hydrogen peroxide are identilicg UAC (table №1) and the concentrations of nitrite ions exceeds its utmost admitted concentration sometimes.

The action of SBDP on the phenol solution leades to the decrease of solution pH that connect with the increase of nitrate and nitrite ions concentration probably not by the accumulation of H_2O_2, concentration which was not higher 0,001 mg/l (tabl. №1).

Data of tabl.№2 confirm that ozone is the mains species determined the qualitative and quantitative composition of phenol destruction products and the processes kinetics in solution. The ozone concentration in solution try to affiaine the constant. Its possible when contamination's: 1. are oxidized to intermediate products completely, 2. convert into intermediate products which are not reacted with ozone almost on account of slight reactivity.

UV- spectrums of solution which was processed in SBDP show that the most probable stable intermediate products forming at the interaction of phenol with ozone are the compounds having aldehydic and ketonic bonds (fomic, maleic, oxalic acids and others). Appearance of this groups simultaneously with phenol destruction, ozonides (in quantity is not less 50% from the other organic compounds in solution) and other lightly volat, le compounds cause the reduction of solution toxic and allow to prevent the formation of high toxic chlorocontaining organic compounds at the subsequent disinfection.

The calculation of material balance shoe dial on the destruction of phenol's one molecule are required 2- 4 ozone molecules. The large stechiometric reaction coefficient point to the several stages. Total combination of experimental and rated data allow to draw that application of SBDP to be able on the prepurification stage. Power consumption of this method is not more 0,5 kW h/m^3 and may be reduce to 0,3 kW h/m^3- with reactor cascade.

Table 1. Accumulation kinetics of nitrates, nitrites and ammonia ions in aqueous solutions after reaction SBDP; (W= 325.454 mW/ csm, Φ_c= 314 s, phenol concentration 5 mkg/l)

Total reaction time, min	pH	Concentration in solution, mg N/l			Concentration in air at discharge reactor outlive, mg/m^3		Concentration in distilled water, mg N/l		
		NO_2^-	NO_3^-	NH_4^+	NO_2	NO	NO_2^-	NO_3^-	NH_4^+
5	5,5	0,019	0,11	0,731	0,139	0,016	0,013	0,09	0,54
15	4,75	0,095	1,14	1,182	0,298	0,056	0,085	0,93	0,99
30	4,35	0,164	2,39	1,307	0,436	0,068	0.152	2,0	1,02
45	4,12	3,74	5,39	1,804	0,439	0,069	3,11	4,97	1,56
60	3,5	5,80	5,55	3,267	0,45	0,076	4,98	5,12	3,1

Table 2. Material balance of ozone

Total reaction time, min	Expended articles of ozone, particles								Introduced particles in all
	In reactor out let, 10^{17}	The rest on reactor	On phenol oxidation, 10^{17}	NO 10^{14}	NO_2 10^{15}	NO_2^- 10^{16}	NO_3^- 10^{17}	All 10^{18}	10^{18}
15	2,341	3,099	0,883	4,307	1,492	0,408	0,490	0,687	3,061
30	4,83	3,888	1,833	10,540	4,376	7,067	10,281	2,159	5,121
45	7,8	4,703	3,451	15,851	6,443	161,031	23,652	5,411	9,102
60	10,7	4,27	4,812	23,410	9,031	250,000	24,343	6,922	10,601

SCIENTIFIC-AND-TECHNICAL PROGRESS AT THE STATE UNITARY ENTERPRISE "VODOKANAL OF SAINT-PETERSBURG"

Gumen S.G., Trukhin Y.A., Goukhberg M.S.
State Unitary Enterprise "Vodokanal of Saint-Petersburg", Saint-Petersburg, Russia

The plans of technical modernization of the State Unitary Enterprise "Vodokanal of Saint-Petersburg" are aimed at the solution of the questions of the day connected with a water supply and sewerage economy of the city and its suburbs.

Up to 20 % of the Saint-Petersburg's water supply and sewerage networks have been amortized and require reconstruction, repair or replacement. They are mainly laid in the central part of the city where the traditional methods of work will be complicated, expensive and long-term. At

present, there are suitable methods of sanitation of the pipelines avoiding or minimizing the excavation and providing the restoration of the pipelines without disturbance of the traffic along the main roads and in the shortest possible time.

There are also rational methods of closing of wastewater discharges and supplying them to the intercepting tunnel collectors in the reservoirs with the help the microtunnel shield which allows to lay the collectors in the water-saturated unstable grounds having a lot of different service lines at the passages.

Immersion pumps are widely used at the sewerage pump stations, especially when reconstructing them. Devices for regulation of rotational speed of the electric pump units are now introduced at the water supply and sewerage stations that allows to adjust the heads and flow rates in the networks and operate them cost-effectively.

A series of pumps ЦНН (centrifugal non-clogging up pumps) are developing at present. They are mainly used for pumping of wastewater raw sludge from primary sumps. They may be also used for pumping the wastewater.

The State Unitary Enterprise "Vodokanal of Saint-Petersburg" pays great attention to pumping the dewatered sludge. Dewatered sludge is transported from the centrifuges to the collecting bins with the help of the pumps (domestic and import production) at all the treatment complexes, for example, by UTK pumps developed by U A Soatov (Water Supply Faculty of the Saint-Petersburg's State Architectural University) at the CAS. At present, they start manufacture of the pumps at the Arsenal Corporation that will be used for the aforementioned purpose.

After a short time, a new State Standard for potable water and improvement of natural water treatment will be introduced. New coagulants and flocculants are being developed. Here, there are certain achievements but the developments are still in progress. Loading materials for water filtration are being searched. Water monitoring methods are being improved.

Problems of water saving are being solved. Activities go in different directions. As this takes place, a great attention is paid to water metering both at the producers and consumers.

A great deal of attention (particularly in the suburbs) is paid to utilization of sodium hypochlorite for decontamination of natural and wastewater. Sophisticated electrolytic plants were developed and they allow to save electric power and salt and improve the operating conditions.

The cascade screens with bar spacing being 6 mm (water flow) and 2 mm (sludge flow) were developed for treatment of wastewater and sludge of sludge of wastewater. These screens provide a reliable operation and increase the removal of additional impurities from the flow that improves the operation of plants for mechanical treatment and wastewater sludge processing.

Fine-bubble aeration with the help of fiber glass pipes is widely introduced at the aeration stations. A shop for burning the dewatered wastewater sludge is being at present constructed at the CAS for the first time in Russia (as well as in the former USSR).

To make the process of burning the sludge more effective, centrifugal pumps are installed in lieu of centrifuges are installed at the CAS. It allows to reduce humidity by 8-10% in comparison with centrifuges. production Centrifugal pumps are now being produced at the Kirovsky Works.

At the end of 1996, the plant for production of flocculants for dewatering the wastewater sludge was put into operation at the CAS. Produced flocculants are not worse than import products, but they are 15-20% cheaper.

The State Unitary Enterprise "Vodokanal of Saint-Petersburg" automates the organizational-and-administrative functions and introduces the Computer-Aided Process Control System (ASUTP) as well as improves the communication.

ASUTP is modernized at the CAS, an integrated system of automation is being at present introduced at the Pushkinsky branch. Data on heads at the controlling points of the water supply network, as well as on operation of the pump stations are being prepared. In future, it will be used to monitor a water distribution.

At present, the research institutes, design bureaus and enterprises of military-and-industrial complex having a significant intellectual and technical potential are also attracted to solve the problems of water supply and sewerage economy.

THE MAIN TRENDS OF ECOLOGIZATION IN DAIRY PRODUCTION

Haritonov V.D., Lisenkova L.
All-Russia Dairy Research Institute (VNIMI)

Ecologization of the dairy industry is the basic part of the conception of stable development that has been studied at the international level within the last years.It envisages the tentative technical and technological development of the processing branches of the Agro-Industrial Complex. The strategy of ecologization envisages the change of branch structure and distribution of production intended for the formation of agro-industrial complex with high level of cooperation for optimization of all types of material and energy resources utilization and minimization of wastes formed with their complex neutralization. With all these the production of ecologically safe products are to be ensured.

The development of ecologization conception requires carrying out and systematization of a large volume of theoretical and practical works. They are as follows:

- development of the conception of wasteless and small waste technologies paying special attention to quantitative aspects;
- unification of terminology in the fields considered;

• choise and evaluation of the criteria of the basic and environmental protective technology;

• development of the basic principles of ecology-economic evaluation of influence of newly developed technological processes and equipment as well as different types of production on environment;

• the basis of ecological education of specialists for all levels of the dairy industry aimed at the development of ecologically oriented social consciousness;

• development and systematization of all types of ecological standards (incl. water consumption index, drainage and pollution of effluents and exchausts- hard, liquid and gaseous).

The mentioned works are carried out in RF dairy industry.

The conception of low waste and wasteless technologies for dairy production has been developed that ensures the following:

• creation of rational, resource saving technologies with complete and complex processing of primary and secondary raw materials;

• collection and processing of wastes - secondary raw material for food and feeding purposes;

• neutralization of non-utilized wastes according to environment protective requirements.

VNIMI has carried out the analyse and evaluation of low waste degree at different dairy productions.

"General concept, terminologies and definitions in the field of low waste and wasteless technologies in the dairy industry" has been developed.

The creation of the complexes for the production and processing of milk for butter, cheese and other dairy products with garanted quality and predetermined food and biological value on the basis of the new intensive technologies and technical means has been carried out.

The receipts and technologies for calf milk replaces have been developed aimed at more rational utilization of raw materials using secondary products and productional wastes as well as non-dairy components

The system of production, treatment and utilization of technological information for the production of ecologically safe products is being developed.

A number of complex works in the field of environment has been carried out:

• collection and processing of productional wastes and their utilization for feeding purposes that makes it possible to reduce effluents pollution by 25-30%. The scheme of wastes treatment has been implemented in a number of industrial projects;

• rational systems of plants water farms with high level of (up to 95%) utilization of recirculated water supply systems and purification of low contaminated drainage wastes;

• the systems of ecology standards on PC basis has been developed and implemented in different projects and operating plants;

• the effective installations for physical-chemical drainage water purification using coagulants has been developed that makes it possible to reduce contamination degree by 70% according to COD; fats and suspended substances - by 80%. They are implemented for the project of the plant being under construction for the preliminary purification of drainage waters;

• the complex system of ecological monitoring using the system analysis methods has been developed and implemented at different plants.

The wide spectrum of all these problems is the basis for ecological productions creation in RF dairy industry.

COMPLEX PROCESSING OF NATURAL AND INDUSTRIAL WATERS FOR POTABLE WATER PRODUCTION

Hojainov Yu.M., Kolesnikov V.A., Neira F., Ilyina S.I.
Menddeev D.I. University of Chemistry and Technology, Moscow, Russia

The aim of this work is to develop telchnology of processing sea after industrial of elktroplating methods for the production of portable water and minimise raw materials. Complex processing includes basic primiplex waste-free prodution, demineralisation with reagents and ecological cleanliness. Methods for preliminary water treatment are filtrate fractional precipitations co-recipltaiion and electroflotations The main membrane methods are electrodialysias membrane electrolysis and reverse osmosis

Complex sea water processing is based on the principle of methods of fractional precipitation, membrane and electrochemical methods of separations purification, demineraltsation and solutions concentrate. The given schemm alws to obtain more than 80% demineralteed water relative to the feeds pure calcium carbonates mixture of CaCO2 and Mg(OH)I with co-precipitated impurity and humic and fulfic acid salts as fertilizer for acidic soils pure MgO for refractory materials and concentrated sohltions of hydrochloric acid and alkali. Preliminary estimations showed that the cost of these products significantly exceeds energy and depreciation cost of their production,

Complex technology for processing rinse waters of electroplating industry uses methods of electroflotation with pH correction for removing organic impurities salts of hardness of waters and non-ferrous metals and electrodialysis method for demineralisation and solutions concentrations In this case, more than 98% of dernmeralized waters alkali and electrolyte solution have been obtained. Products obtained provided for the profit of the whole production.

DECONTAMINATION OF NATURAL AND WASTEWATER IN ST PETERSBURG

Itkin G. I.
The Ekolog Scientific-and-Industrial Center, Saint-Petersburg, Russia
Goukhberg M. S.
The State Unitary Enterprise "Vodokanal of Saint-Petersburg", Saint-Petersburg, Russia

The Building Code used for designing the water and sewage works requires a decontamination of the treated wastewater as well as provision of sanitary harmless pot water. Decontamination of natural and wastewater by liquid chlorine is a practicable method for these purposes. There are many other methods of decontamination, but this method is practically unique for pot water because it alone has an aftereffect. Liquid chlorine is an aggressive poisonous substance and it is extremely dangerous and all the users know about it. Sodium hypochlorite electrolyzed from solution of sodium chloride may be used as an alternative to chlorine. This method is well-known, and installations manufactured at the Kommunalnik factory are operated at many enterprises.

Over a period of years the Ekolog Scientific-and-Industrial Center introduces the electrolytic plants of their own design at many water and sewage stations of Saint-Petersburg. Users positively evaluate these plants. The plants with capacity up to 1 kg of active chlorine per hour operate already about 4 years.

In 1996, plant for production up to 200 kg of chlorine per hour was put into operation (8 kg/hr). In that case, salt consumption per 1 kg of chlorine was 12 kg with consumed power being 6 kW.

ON UTILISATION OF SILTY SLUDGE OF WASTEWATER TREATMENT PLANTS

Kamburov V.A.
North-West Affiliate of RosNIIVKh, St.-Petersburg, Russia
Ogluzdin N.S.
Fruit and vegetable pilot station, St.-Petersburg, Russia

Municipal wastewater discharged into the sewer system contains 50% of domestic wastewater and 50% of industrial wastewater as a rule. Industrial wastewater is polluted to a considerable extent by heavy metals salts. The sludge formed in a process of wastewater treatment is also polluted by heavy metals salts. The presence of these salts causes the ecological threat of the sludge discharge into agricultural soils. The second danger is the availability of helminths and pathogenic micro-organisms in the sludge. At present time the sludge of wastewater treatment plants is disposed at special areas. The sludge storages (moisture is 80%) provide for its reception from the sewage treatment plants after the mechanical dewatering. The sludge is moved from the treatment plants to the disposal area by the special motor transport.

The problem of the disposal of sludge harmful elements is solved by its dewatering and incineration of the solid residual. At present there is no financial possibility to construct facilities of the sufficient capacity to burn the whole of residual and remove the residual accumulated at the places of the sludge deposits.

We propose the second way of the sewage sludge utilisation at the special areas. The sludge will be included into the natural biological and chemical circle at these areas.

There are available data sustaining the possibility of the biological and chemical formation of the heavy metals compounds, which are impenetrable for the biological objects, and their slow dispersion without environment damaging.

The proposed system of the crop rotation with a special soil treatment enables to cultivate the certain cultures by the intensive technology and achieve the bumper harvests of non-foods purposes.

SAPROPELS ARE SORBENTS OF VITAMINS FROM WATER SET

Karabanov A.M., Ignatotoch F.I., Puzach S.S., Levashkevich A.L.
State Yanka Kupala University of Grodno, Belarus
Institute of biochemistry Academy of sciences of Belarus, Grodno, Belarus
Cooperative "Biogel", Minsk. Belarus

Sorbents are of great importance for solving of different problems. They are used nearly in all brunches of national economy, especially in biotechnology to produce vitamins, ferments, aminoacids and other physiological active substances. They also help to economize many valuable expensive solvents and to obtain pure substances.

Besides harmful elements, especially heavy metals, sapropels are able to absorb from water set and concentrate

on themselves useful components for man's and animal's organism, and biologically active substances.

There were carried out two experiments to study adsorbing activity of sapropel of carbonate type (activated and inactivated) to vitamins of group B (thiamin) and it's desorbing ability in comparison with activated coal.

In the first experiment we added at 1ml of distilled water with tracer combination of vitamin B_1 (firm Amerjham, England) to each portion (10, 50, 100 mgr.) of dry inactivated carbonate lake deposits.

After adsorption of different duration (2, 30 and 60 min) of tracer thiamin we centrifuged samples and determined vitamin B_1 which was not adsorbed in above sedimental liquid. Radioactivity was fixed with the help of spectrophotometer Mark II (Nuclear Chicago, USA).

That experiment showed that radioactivity of tracer thiamin became 3 times less in comparison with control when 10 mgr./ml of dry sapropel was put into adsorbing set. And when 50 mgr./ml of dry sapropel was put, radioactivity became 4 times less and the greatest sorbing activity was marked with 100 mgr./ml of lake deposits. It was typical that sapropel sorbed tracer vitamin B_1 on it's surface more actively during the first two minutes, and radio-activity of above sedimental liquid didn't change when we increased (the time of adsorption (30 min and 60 min).

In the second experiment adsorbing and desorbing ability of activated sapropel to tracer vitamin B_1 was studied in comparison with well known sorbent such as activated coal.

Adsorption of thiamin from water set was carried out according to above mentioned method, and desorption of tracer vitamin from coal and sapropel was carried out with the help of acidified methanol. Attar mixing and careful shaking during 2 min and then centrifuging, radioactivity in above sedimental liquid was measured. Results of researches showed, that if inactivated sapropel yielded activated coal according to it's adsorbing quality, then after absorption of dry lake deposits it surpass coal by adsorption of vitamin B_1. It was typical that 56,43 per cents (%) of tracer thiamin was desorbed from the activated sapropel after adsorption of tracer thiamin, but from the activated coal - 56,20 per sent (%).

Thus analysis of exceeded statistics allowed to establish, that carbonate sapropels after activating didn't yield activated coal according to its adsorbing ability and that is why they my be used as a sorbent of vitamin B_1 from water set and for getting of pure physiologically active substances.

MAGNETIC RECEPTION OF CARBONATE SAPROPELS AND THEIR ABILITY OF SORBING OF HEAVY METALS FROM WATER FLOWS

Karabanov A.M., Pavlovich N.V., Reut O.P., Bogjnski L.S.
State Yanka Kupala University of Grodno, State Polytechnic Academy of Belarus,. Belarus

Carbonate sapropels take 3rd place after supplies in the fresh water lakes, and in Grodno region they predominate over other types of sapropel. This lake deposits have high ion-exchangeable and sorptonal quality and they are able to extract heavy metals from drinking water and flows.

Magnetic reception represents a physical term which characterize an ability of substance to change magnetic moment under the influence of external magnetic field.

Magnetic reception represents a physical term which characterize an ability of substance to change magnetic moment under the influence of external magnetic field. It is habitual for sapropel as we didn't find any data on magnetic reception on any types of lake deposits in the literature.

For studying of relative magnetic reception of dry carbonate sapropels deposits of 8 different lakes of Belarus were taken (4 from Minsk, 2 from Grodno and 2 from Vitebsk region). Using a special plant, according to GUI's method, it's reading was carried out. Researches resulted that 5 of that lake deposits considered to be dia-magnetics and 3 - paramagnetics. Maximum quality of negative magnetic reception ($-0,33*10^{-6}$) was determined in sapropel of Khudovets lake (Minsk region) and minimum ($-0,03*10^{-6}$) - in sapropel of Linje lake (Vitebsk region). The highest reading of positive magnetic reception ($+100*10^{-6}$) was marked in deposits of Byeloye lake (Grodno region), and the lowest ($+0,32*10^{-6}$) in Sergeevskoe lake (Minsk region). Perhaps, the degree of magnetic quality of sapropel depends on per sent correlation of containing in it dia- and paramagnetic substances or elements. Phosphorus, calcium, sodium, magnesium, copper, zink, carbon dioxide and most of organic substances, which determine diamagnetic moment are considered to be typical diamagnetic, also ferromagnetics and antiferromagnetics are considered to be paramagnetics (N.V. Pavlovich, S.A-Pavlovich, U.G. Galliulin, 1991).

Sapropels, which were used by us for studying of sorbing ability contained different quantity of substances which determine this or that magnetic moment- It is typical that, much more humin acids determined in diamagnetic deposits of Linje lake, and bitumens predominated m Byeloye sapropels - paramagnetics, and among mineral elements - silicon, and calcium and organic remains in Ozezyanskoje lake.

Owing to presence of paramagnetic substances deposits of lakes of Grodno region absorbed nickel, molly, vanadium, lead, one, manganese, strontium, chromium, aluminum, titanium, selenium and arsenic from water flows and sapropel from Vitebsk region removed only arsenic and molly. Perhsqps, it was because of magnetic quality of sapropel of Linje, substances was directed opposite to external magnetic field and this resulted that 12 mineral elements from 16 including heavy metals removed in water flows.

Thus, sorbing ability of carbonate sapropels depends not only on ion-exchangeable qualities, but on magnetic reception which is higher in lake deposits, which contains more substances determined paramagnetic moment also.

THE WAYS OF THE DECISION OF CLEANING METALLIFEROUS DRAINS OF TASHKENT CITY

Karimov R.Z.
Tashkent, Uzbekistan

In conditions of transitive period, broken economic connections, shortage of reagent, the problem of purification of sewage of the industrial enterprises and other objects from ions of non-ferrous metals for Tashkent has become rather urgent. Presence in the city more than 20 large and small galvanic workshops and sites, the plenty of private concerns on processing fur raw material cause presence of a wide spectrum of metals (Cr, Cu, Ni, Co. Cd and others) in overflowed waters, acting in open drainpipe and the sewers.

Till now for cleaning similar industrial water were used the reagent, ion-exchange, sorption methods, galvanic electricity, however, as absence and the expansiveness of reagent, ion-exchange resin and sorption materials have brought in infringement of the nature legislation, the cases of the illegal overflow of industrial water has become frequent. There have been developed by us the sulphide reagent PSK, synthesized from the local materials and have high activity to ions of metals, forming the hard-soluble sulphide.

In commercial-size basis the process flow diagram is fulfilled, the chimism of interaction is investigated. For such metals as copper, zinc, nickel and etc, are received practically their trail residual concentration in overflowed water. Work on introduction of a method in the Siberian region of Russian Federation is conducted. The recommendations for its use by introduction in overflow water after their cleaning and decontamination on Tashkent urban cleaning constructions are given, through which at the moment transit of these metals in water system of the rivers Salar, Chirchik, Sir-Daria takes place. The industrial development of issue and use reagent PSK. will much reduce receipt of metals in the water reservoir of city.

CLEAN-UP QF WATER FROM TOXIC IONS BY ELECTROSORPTION METHOD

Karlin Yu., Davlethanov R., Sobolev I.
Moscow state enterprise – MosNPO "Radon", Sergiev Posad, Russia

Now the intensive development of an industry is characterises a broad range of wastes on the physical properties and chemical composition. That is why, as a rule, in cases of the sewage water cleaning are uses a multistage technological schemes, in which are combined the different water-cleaning methods. Big interest in this sense are causes the combined methods, when in a one process two or more different ways an treatment of water are combined, because the such combining can leading to essential increasing of the efficiency of water-cleaning processes.

In that report is considered the idea of a one of such combined methods clean-up of water - electrosorption - and shown some results of its efficiency studies.

The essence of electrosorption method is concluded in next. The components of the water solution (mainly last concerns the ion forms of admixture) moved through sorbent layer by electromigration but not with convection flow of solution under treatment. This allows to use sorbents, which on its physical property not available with traditional use in sorption processes. For instance, the fine-size and colloidal sorbents, the sorbents with low mechanical toughness, the fibrous sorbents. Nearest analogue to electrosorption is an electrochromatography known in analytical chemistry.

The processes of the electrosorption can be realise in the filter-press type membrane apparatus with interleaving sorbent chambers and chambers with solution under treatment. On the edges of such multichamber assembly are located electrodes, to which is led difference of electrical potentials. The working spaces of chambers with the water solution and chambers with the sorbent are divided by a fine-porous or ion-exchange membranes. The water solution is passes through chambers with velocity on the membrane surface not less than 0.1 m/s in purposes of decreasing of the concentration polarisation phenomenon.

The electrodialysator with dialysate chambers, filled by ion-exchange material, is a nearest analogue of the electrosorption apparatus. However, assignment of the ion-exchange materials in electrodialysator and electrosorption apparatus is differing and the convective flow of solution through the sorbent layer at electrosorption apparatus is absence.

Obviously that with most efficiency the electrosorption method can be used for the water-cleaning from ion admixtures (for instance, heavy metals and radionuclides). The most close potential consumers electrosorption apparatus should consider a galvanic productions and productions, connected with the nucleus cycle.

The investigations on selective extraction ^{137}Cs from water solutions by electrosorption method with sorbent «Phoenix-A» (ferrocyanide nickel, precipitated on silica gel, production of MosNPO «Radon») are shown that velocity of the sorption caesium is a function of the electrical current density. The degree of ^{137}Cs extraction from density of electrical current practically does not depend. The scheme of the laboratory facilities for studying the electrosorptions is shown on Fig.1. In that report is made the evaluations of the specific capacity of electrosorption apparatus, the cost of the electrosorption water-cleaning and determined some problems, appearing at realization of the electrosorption method.

The investigation on the electrosorption is conducted within the framework of the exploratory program IAEA «Combined methods of processing the liquid radioactive waste» (agreement N9673 from 18 June 1997).

CHEMICAL TREATMENT OF SEWAGE WATER EXPERIENCES FROM WORLD WIDE APPLICATIONS SEPARATION OF SEWAGE SLUDGE INTO VALUABLE COMPONENTS

Karlsson I., Smith G.
Kemira KemiAB, Kemwater

There has been an intensive expansion of sewage plants during the 60's and 70's in the Nordic countries. The purifying process chosen by each country depends on local conditions. In Sweden and in Finland, the biological treatment plants did not prevent eutrophication in tha lakes and rivers. Scientists found that in these inland waters phosphorus often was the limiting factor for algae growth.

Demand for phosphorus effluent standards below 0.5 mg/l initiated the combination of biological and chemical treatment. In most cases the biological process was followed by chemical treatment, post-precipitation. In Norway, with its cold climate and mountainous landscape, low building costs were important. Direct precipitation, i.e. chemical treatment without biological treatment, built compact and cost efficient plants. In Denmark, low effluent standards of nitrogen is important along the coast line. To achieve this, Danish sewage plants are built with long retention times to reducs nitroger..

Today, the ability of chemical treatment to remove organic suspended matters, has been recognised and old plants arc converted as well as new plants are being built with the pre-precipitation process.

Sludge from sewage plants is often a problem today because of the disposal problem and the costs related io the sludge handling. The components in the sludge, however, represents an economical and enviroamental value. A new sludge handling process. KREPRO, is developed by Kemira. This process makes is possible to separate sewage sjudge into five fractioas: organic sludge, organic liquid, phosphorus, heavy metals and the coagulant. All these fractions can be recycled.

This paper will discuss the different processes chosen and especially focus on chemical treatment. alone or in combination with biological treatiacm. Referenccs of the different procceses will be presented, both wilhin the Nordic countries and in other European countries, and cost efficiency and environmental aspects will be discussed. The recycling possibilities of sewage sludge will be presented.

ECOLOGICAL STANDARDS WHEN DISPOSING THE WASTEWATER TO RESERVOIRS

Karmazinov F.V.
The State Unitary Enterprise "Vodokanal of Saint-Petersburg, Saint-Petersburg, Russia
Tsvetkova L. I., Alekseyev M. I.
The Saint-Petersburg's State Architectural University, Saint-Petersburg, Russia

Ecological standards are aimed at the provision of the safe ecosystems and biosphere as a whole (including health of a human being), i.e. preservation of a steady-state equilibrium in a nature within the limits of a possible self-regulation. Because the ecosystem is not equivalent to an organism, the problem of an ecological normalization shall be solved at the above-the-organism level. The ecological standards differ from sanitary and hatchery maximum permissible concentrations. Ecosystem is formed under particular natural environment therefore the ecological standards shall be regional.

Even the strict observance of maximum permissible concentrations does not guarantee the preservation of quality of surface waters. If water concentration is less than maximum permissible concentrations, some heavy metals will suppress self-purification and other processes inside the reservoirs. Phosphates may cause eutrophication if concentration is in some times less than maximum permissible concentrations and requirements of the State Standard for potable water. It results in secondary pollution and deterioration of quality of water according to turbidity, chromaticity, BOD, etc.

We considered a methodology of determination of ecological permissible concentrations (EPC) of polluting substances in a reservoir by an example of change of trophicity of the Neva Bay.

The main factor regulating the development of eutrophication is phosphorus that is a hard-to-reach nutrient element under the natural conditions. As a rule, the main source of the biogenic phosphorus is wastewater. A degree or level of trophicity of a reservoir/receiver of wastewater will be determined by a degree of balance of processes of photosynthesis of organic substance of seaweeds Ф and processes of its destruction Д, i.e. by ratio

Ф < Д or Ф> Д

In dystrophic systems – Ф/Д < 1, in oligotrophic systems – Ф/Д = 1, and in eutrophic systems – Ф/Д > 1.

The Neva Bay was examined by L. I. Tsvetkova, G. I. Kopina, E. V. Neverova et al and close correlation bond between pH value, degree of saturation of water with oxygen and level of trophicity as per integrated indicator was established. pH_{100} (pH value at 100 % of saturation of water with oxygen) was accepted as an integrated indicator.

At pH_{100}	≤5.7 ± 0.3	- dystrophic state of a reservoir;
At pH_{100}	= 6.3 ± 0.3	- ultraoligotrophic state of a reservoir;
At pH_{100}	= 7.0± 0.3	- oligotrophic state of a reservoir;
At pH_{100}	=7.7 ± 0.3	- mesatrophic state of a reservoir; and
At pH_{100}	8.3 ± 0.3	- eutrophic state of a reservoir.

It is recommended to accept a normative (critical) value of pH_{100} with due regard for of confidence interval of boundary value of mesatrophic state equal to 7.85.

A bond between pH_{100} and pH value at other saturation of water with oxygen pH_o will be determined according to the equation:

$$pH_{100} = pH_o + \alpha(100 - C), \quad (1)$$

where C is a concentration of oxygen in water in percentage of a full saturation;

α is a proportionality factor equal to 0.013 for the Neva Bay.

Correlation analysis of the hydrochemical and hydrological data on the Neva Bay has revealed a close bond between an integrated indicator and number of abiotic factors that may be presented by equation as follows:

$$y = \alpha_o + \alpha_1 \cdot x_1 + \alpha_2 \cdot x_2 + \ldots + \alpha_n \cdot x_n, \quad (2)$$

where y is an integrated indicator;

$x_1, x_2, \ldots, x_n$ are priority abiotic factors;

$\alpha_0, \alpha_1, \ldots, \alpha_n$ are factors of regression equation.

The parameters of a linear equation of a multiple correlation were calculated with the help of the computer on the basis of bank of full-scale data.

The narrowness of the bond of an integrated indicator (function y) and each hydrological and hydrochemical parameter (argument x — of abiotic factors) was evaluated consistently by the pair correlation factors:

$$r_{yx} = \frac{n\sum_{i=1}^{n} x_i \cdot y_i - \sum_{i=1}^{n} x_i \cdot \sum_{i=1}^{n} y_i}{\sqrt{\left[n\sum_{i=1}^{n} x_i^2 - \left(\sum_{i=1}^{n} x_i\right)^2\right] \cdot \left[n\sum_{i=1}^{n} y_i^2 - \left(\sum_{i=1}^{n} y_i\right)^2\right]}} \quad (3)$$

Reliability of factors of a regression equation was evaluated as per Student t-test.

With allowance for a boundary mesatrophic state of the reservoir at pH_{100} = 7.85, it is possible to determine the numerical values of the factors or ecological permissible concentration of substances x_i influencing on the trophicity of the reservoir according to the equation:

$$x_i = \frac{1}{a_i}\left(7{,}85 - a_0 - \sum_{i=1}^{n} a_i \cdot x_i + a_i \cdot x_i\right), \quad (4)$$

or

$$x_i = \frac{1}{a_i}\left(7{,}85 - a_0 - \sum_{1}^{i-1} a_i \cdot x_i - \sum_{i+1}^{n} a_i \cdot x_i\right) \quad (5)$$

The offered approach has allowed to determine ecological permissible concentrations of mineral nitrogen, phosphorus and some other ingredients in the treated wastewater and permissible discharges of these substances via the discharges of the sewage works of St.-Petersburg. In that case, permissible concentrations and discharges were different for separate discharges of wastewater after sewage works with due regard for the hydrological characteristics (depth, flow rate etc.) at the places of discharges.

It will provide an individual approach to the degree of treatment of separate ingredients at each sewage works.

The calculations carried out in conformity with the aforementioned methods revealed that the most unfavorable situation (for example, as per permissible concentration of mineral phosphorus) may arise at the wastewater discharges of Pertrodvortsovaya and Southwest wastewater treatment plants of St.- Petersburg.

FACILITIES FOR PUMPING NON-DRIED ASTEWATER SLUDGE

Karmazinov F.V., Zelik L. V., Bolshemennikov J. A.
State Unitary Enterprise "Vodokanal of Saint-Petersburg", Saint-Petersburg, Russia
Ilin Yu. A., Ignatchik V. S.
High Engineering School, Saint-Petersburg, Russia

Twenty thousand cubic meters of wastewater sludge is formed daily at the sewage works of the city of Saint-Petersburg, in that case, perfection of technology of its treatment will to a great extent determine the ecological conditions of the territories of the city and oblast. Therefore, the State Unitary Enterprise "Vodokanal of Saint-Petersburg" has begun introduction of a new environmental safe technology of treatment of sludge providing the multistage process: compaction, mechanical dehydration by the centrifuges or centrifugal presses and incineration. At the Central Aeration Station (CAS) of Saint-Petersburg the construction of the first Russian factory for sludge incineration sludge has been completed.

The features of the implemented technology are the increased requirements for stability and uninterrupted sludge incineration and, as a consequence, provision of reliable operation of all the structures participating in a multistage process of sludge treatment. In that case, provision of reliable transportation of sludge is important among other provisions.

At present, the State Unitary Enterprise "Vodokanal of Saint-Petersburg" operates diverse kinds of pumping equipment for transportation of non-dried wastewater sludge: plunger pumps НП, centrifugal feeders ФГ and СД and screw feeders Г5-100АК, etc. Their operation has allowed to reveal the limitations and advantages of these pumps and determine the ways of provision of reliable pumping of sludge for its incineration.

Plunger pumps НП were operated at the Central Aeration Station and Northern Wastewater Treatment Plants on designs of the Lengiproinzhproekt. Alongside with advantages typical for volumetric pumps, there are also essential defects: low overhaul period (up to 2,000 h) and high failure rate (three and more failures per month). It was impossible to provide a reliable pumping of sludge at the aeration stations of the city of Saint-Petersburg by pumps НП and were withdrawn from service.

Centrifugal fecal pumps with capacity being more than 140 cu m/h are successfully used for pumping a non-dried sludge having humidity more than 94%. However, their operation was impossible under similar conditions with capacity being 100 cu m/h and less because the flowing part of the pumps was constantly clogged.

Screw pumps Netzsch (Germany) and screw feeders PS (Romania) demonstrated high technical characteristics at the aeration stations of the State Unitary Enterprise "Vodokanal of Saint-Petersburg". They provide smooth and specified capacity when pumping non-dried sludge. At the same time, during their operation, the following defects were revealed: high power consumption, cost and operating expenses due to delivery of their foreign-made completing parts; complex repair; flowing part of the pump shall be free of solid impurities because their penetration may cause stator damage. Under real operating conditions, it is necessary to arrange the desilting works at the suction pipelines. Besides, the pump houses equipped with the screw feeders (about 6 m long) of Romanian production occupy a lot of floor-areas.

Therefore, beginning in 1992, the State Unitary Enterprise "Vodokanal of Saint-Petersburg" and the Association of engineers and scientists for water-supply and water-drain has executed two research-and-development works. As the result of these works, at present, three types of new centrifugal non-clogging pumps ЦНН-100/20, ЦНН-100/30 and ЦНН-200/20 are successfully operated at the sewage works of Saint-Petersburg These pumps surpass the previously used units in their dimensional characteristics, reliable operation, convenient maintenance and completing with spares. The pumps were manufactured at the factories of Saint-Petersburg.

In particular, pump ЦНН-100/20 was tested at the Central Aeration Station (CAS) of Saint-Petersburg when pumping raw wastewater sludge with humidity being 92-93 % from the primary sumps [1]. It provides a reliable operation.

Pump ЦНН-200/20 was tested at the CAS of Saint-Petersburg in a system of dosing a mixture of raw wastewater sludge and compacted excess silt supplied to the centrifugal presses (see Fig. 2). The pump demonstrated a reliable operation in the transport system. Taking into account the positive service experience, at present, the State Unitary Enterprise "Vodokanal of Saint-Petersburg" plans to re-equip the station for pumping the compacted silt at the CAS. Four pumps ЦНН-200/20 are being produced at present.

A pilot sample of pump ЦНН-100/30 was tested at the Northern Wastewater Treatment Plant (NWWTP) of Saint-Petersburg when pumping wastewater sludge [2], see Fig. 3. Taking into account a positive two-year service experience, at present, ten pumps of this type have been installed and operated at the NWWTP.

As a whole, operation of the centrifugal non-clogging pumps has demonstrated at the aeration stations of the city under different conditions that these pumps have advantages in comparison with analogues [3-6] offered also by foreign manufacturers, as follows:

1. Nonclogging ability of the pump providing a reliable pumping of sludge under conditions of ineffective operation or failures at the screens of the treatment plants. The pumps transfer sludge containing cloths and metal small-sized impurities up to 80 mm which damage even the most progressive screw pumps of foreign production.

2. Small overall dimensions allowing to increase capacity of the pump houses, low power consumption, reliable and simple design, convenient maintenance and high maintainability.

Taking into account the positive results, in 1998, the State Unitary Enterprise "Vodokanal of Saint-Petersburg" plans to complete the research-and-development work on development and test of nonclogging pumps used for transfer of sludge with capacity being 50 cu m/h.

Conclusion

The centrifugal nonclogging pumps (ЦНН) and transport schemes of pumping of non-dried sludge by them are simple in design, reliable in operation and may be recommended for application at the sewage works of diverse cities and industrial enterprises.

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"NEPTUN SKJ"+"NEPTUN" UNITS FOR TREATING WASTE WATER FROM PROCESSING OF AGRICULTURAL PRODUCTS AND ANIMAL HUSBANDRY

Kazaryan V.A., Terentyeva N.A., Chekalova S.N.
Municipal Water Supply and Treatment Research Institute

Sewerage

The units are designed for local waste water treatment. "NEPTUN SKJ" units are used when treated effluent is discharged into a sewerage system, and "NEPTUN SKJ + NEPTUN" are used when the effluent in discharged into water bodies allocated to commercial fishery.

Perfomance of the units is based on intensive, ecologically safe biological processes, carried out by suspended and fixed microorganisms in anaerobic conditions ("NEPTUN SKJ") , and in both anaerobic and aerobic conditions ("NEPTUN SKJ"+"NEPTUN").

The use of anaerobic method for local treatment is due to characteristic properties of the waste water with its high content of organic pollutants emitted in fermentation processes.

Anaerobic processing is done in a block of two cosecutive anaerobic (biological) reactors, differing by their technological designation and construction. One of them functions also as a quality regulatar and operates with suspended granular micro-flora. In the other reactor both suspended (granular) and fixed micro-flora are employed. Between the reactors there are two recirculation contours, ensuring stable quality of trated effluent when there are changes of polutant content in the influent waste water.

After the local treatment the waste water has the following maximum values of pollutants (mg/l): BOD_{total} - 300, COD - 450, grease - 15, suspended solids - 100, sulfates - 0,5 of that in the influent.

If it is necessary to discharge the treated effluent into a water body, the "NEPTUN SKJ" unit is complemented with the "NEPTUN" unit. The latter operates using 3-stage anaerobic-aerobic biological treatment and consists of two blocks. The first block of intensive treatment contains primary settling tank and anaerobic biological reactor with fixed micro-flora, first-stage aeration tank with suspended and fixed micro-flora, and secondary settling tank. The second block of additional treatment contains second-stage aeration tank with fixed micro-flora, tertiary settling tank - contact reservoir.

For materials-carriers of microorganisms they use thready synthetic materials and porous chemically-active and inert natural materials having adsorptive and ion-exchanging properties and possesing biological activity.

All this allows to obtain the required intensive treatment of highly concentrated waste water spending minimum material resourses.

Ecological evaluation of treated effluent waste water by daphnia test alowed to characterise it as non-toxic, approaching natural water.

With this scheme only an insignificant quantity of anaerobically-and-aerobically stabilized sludge is formed. It can be utilized as feeding additive for cattle, or as aid in preparing silo, or else it can be disposed on arable land.

Treated waste water contains pollutants in concentrations not greater than the MAC for water bodies allocated to commercial fishery, i.e. (mg/l): BOD_{total} -3, COD-15 to 30, ammonia nitrogen - 0,39, nitrite nitrogen-0,02, nitrate nitrogen-9,1, phosphates-0,2, synthetic detergents-0,1, oil products-0,05.

The "NEPTUN SKJ" and the "NEPTUN" units have block-modular construction and are made out of metal under factory conditions. The number of blocks and modules is determined in every particular case, depending on output, pollution of influent water, and required level of treatment.

The units are supplemented with an influent block for primary treatment, recirulaing pumps, and booster pumps (it necessery).

METHODS OF DRAINAGE WATER LOCAL PURIFICATION BY SORBENTS

Kireicheva L.V., Kuptsova A.A.
Kostyakov All-Russian Reseach Institute Of Hydraulic Engineering And Land Reclamation

Among the negative results of irrigation the water removal from drainage system is one of the most significant factors. Now scientists tackle the problem of drainage water utilization because of the inflow becomes higher than 50% of total water volume for irrigation. There is significant variety in drainage water composition. In some cases drainage water contains pesticides, nutrients and heavy metals ions in spite of total mineralization does not exceed 2-3g/l. Then it is perspective to use physical-chemical and biological purification which connected with low energy and minimal environmental impact.

In Kostyakov All-Russian Reseach Institute Of Hydraulic Engineering And Land Reclamation the technology solutions of drainage water local purification on the base of natural sorbents were developed. The purification is performed by the elements of blanket filter, have been made installation on the drains (fig.1), by such local purification elements of drainage system as filtering drainage well (fig.2),.and by filtering gallery. These methods and equipment are easy to use and do not require high energy. Besides they have some advantages with environmental point of view.

In all proposed technologies the natural sorbents and its mixtures can be utilizes as purifying filter. In our institute new sorbent SORBEX was created. Besides SORBEX possesses distinct land-improvement properties. It contains 65% sapropel, 25% zeolit and 10% aluminum sulfate. SORBEX

has high sorption capacity (256 mg-eq/100g) and high-developed surface (160 m^2/g).

The tests of SORBEX efficiency shows that water can be totally purified from persistent Cl-organic pesticides (100%) and practically entirely from such heavy ions as Cu, Zn and Pb (98-99%). After filtration water pH enhances and SAR decreases, that can be attractive for the following use of this filtrate for irrigation.

Local purification elements can be used for high purification of domestic sewage water.

Depending on initial water quality purification elements can be used in complex with biological purification. Then the degree of purification enhances and water becomes free from biogenic pollutants.

BIOCATALYTIC WASTEWATER TREATMENT

Kochetkova R.P.
Center on Ecology of the Joint-Stick Company "Irkutskenergo"
Kovalenko N.A., Kochetkov A.Y.
RPE "Kataliz"
Babikov A.P.
Joint-Stock Company Angarsk Petro-Chemical Company(ANHK)
Borovsky V.M., Kuimov S.V.
Joint-Stock Company "Irkutskenergo"
Yolshin A.I., Chernich V. S., Goryavin S.S.
Joint-Stock Company ANHK

Comparison to ozonisation method, biocatalytic one with two types of heterogeneous catalysts applied : polyfunctional catalyst - for organic ammonium and sulfur-organic combinations and selective catalyst - for nitrite and nitrate reduction, is more perspective for increasing in profound waste water treatment .

This method requires low costs and exploitation expenses. There is no need to use additional equipment since the process, carried out in typical bioinstallations (aerotanks, etc.), provides relatively high profundity of wastewater treatment in organic, sulfur-organic and ammonium, nitrite and nitrate combinations within high volume rate on purified water and relatively low air expenditures, catalyst and activated sludge concentration.

Heterogeneous catalysts can be made in blocks, granules, in the form of a lamp-chimney brush or some other form, suitable for installations of a given type. They also should possess high catalytic activity, selectivity in nitri-denitrification processes, mechanical properties, hydrolytic durability, service stability for 3-5 years. Such catalysts were synthesized by coordinative binding of catalytically active complex combinations, insoluble in reactionary medium (effluent) with functional groups of polymeric carrier in the role of polymeric macroligand.

An intensive oxygen absorption takes place in nitrification process within biological treatment, and therefore the concord of organic contamination's oxidation and nitrification in the same installation calls sharp oxygen shortage and leads to mutual inhibition of the processes.

The problem of increasing in concentration of the soluble oxygen in the present scheme of biological treatment is solved by increasing in air consumption, but simultaneously within intensive aeration of effluents the blow of highly volatile substances puffs into the atmosphere. The use of heterogeneous metal-organic catalyst in the process of biocatalytic treatment allowed to solve the problem without additional energy wastes, so as sorption oxygen being on the surface of hydrophobe catalyst, considerably increases its concentration in the effluents, both molecular O_2 and atomic oxygen in the form of ion-radicals $O^{2\cdot}$ and $O_2^{\cdot}$, $O_2^{2\cdot}$, which provide ion-radical mechanism of oxidation processes.

Heterogeneous catalysts operate with ferments according to mutual valent-energetic mechanism and in total the created catalytic system possesses higher energetic level, providing high catalytic activity of investigated system in comparatively wide range of temperature limits.

According to the results in infra-red - spectroscopy, active catalysts centers operate in oxidation processes as electron carriers from the oxidized substrate (S) to oxygen, being alternately regenerated by substrate ions and oxidized by molecular oxygen:

$$S \xrightarrow{e^-} M^{n+1} \leftrightarrow M^n \xrightarrow{e^-} O$$

Active centers in catalysts operate at the cost of their own energy, connected with their valent unsaturation. Due to this, lowering the profundity of wastewater treatment in poor-acid and acid mediums is connected with slower oxidation of catalyst active centers by oxygen in comparison to the process of regeneration by substrate ions.

Thus, we carried out catalytic system, which does not suppress activated sludge, but even visa versa, promotes its vital activity due to the process of interchangeable immobilization of ferments and micro-organisms. Due to it high efficiency on effluent treatment is reached within one-staged nitri-denitrification and minimum expenses on reconstruction of typical installations, considerably lower (about 4 times) specific air consumption per m^3 of regenerated effluents, activated sludge concentration 1,0 - 1,5 g/l aged 148 hours and catalyst concentration 41 kg/m^3.

The basic requirement which is necessary to keep to in biocatalytic processes of nitri-denitrification is the use of activated sludge of a definite age. Increasing in the activated sludge age up to 240 hours, the efficiency of nitrification and

oxidation on COD grows. But, judging by the degree of $N\text{-}NO^3$ reduction, the optimal age of activated sludge is 148 hours. With that age of sludge, residual concentration on COD forms 6-10 mgO_2/l, the effect of $N\text{-}NH_4^+$ removal formed 98 % for 4 hours and air consumption 7,5 m^3/m^3. The residual concentration on COD = 6-10 mg O_2/l provides high regeneration of nitrates up to 80% and of nitrites - up to 50 % in denitrification stage.

While exploitation of biocatalytic installations definite fluctuation in temperature and pH environment may occur. They define catalyst and activated sludge activity in oxidation processes.

Decreasing in limits of environment temperatures to 10-12° C does not practically change the kinetic of investigated processes. While lowering the medium temperature to 5-7°C the decreasing in treatment efficiency is observed in all ingredients 7-9%.

Maximum in pH makes pH interval 7,2-8,3 for nitrification.

Increase in alkalinity in denitrification calls the raise of pH to 8,5. By such pH meaning the final denitrification product of investigated biocatalytic system, in general, is gaseous N_2.

The operation of experimental-industrial biocatalytic installation for waste water treatment at the Joint-Stock Company Angarsk Petro-Chemical Company showed, that the profundity of waste water treatment from organic contaminations (by residual COD) formed 6-10 mg O_2/l with the efficiency 85%, on ammonium combinations - 0,2 -0,5 mg/l with 98 % efficiency with specific air consumption 7,5-8,5 m^3/m^3. The concentration of dissoluble oxidation in the process of biocatalytic treatment formed 4,5 -5,5 mg/l instead of 1,0-1,5 mg/l for the same specific air consumption during biological waste water treatment. The indicated efficiency for biocatalytic purification of effluents is reached within contact time 4 hours instead of 8 hours.

Implementation simplicity and wide usage of biological treatment as a medium for biocatalysis allows to recommend introducing the biocatalytic process into municipal sewage disposal and purification of wide range of effluents.

CLEARING OF WASTERWATERS OF WOOD CHEMICAL PROCESSING ENTERPRISES

Kocheva L.S., Demin V.A., Karmanov A.P.
Institute of Chemistry, Komi Scientific Centre, Russian Academy of Sciences, Syktyvkar, Russia

Enterprises of cellulose-paper industry are one of the larg-scale sources of polluted wasterwaters. Wasterwaters (WW) of wood chemical processing enterprises contain a greater amount of toxic dissolved organic substanses - phenoles, aldeghydes, ketones, chloro-derivatives, wich are capable of inflict a significant ecological damage to the surroundings and person's health. Applicated at present ways of WW clearing, in the first place - biological, do not bring about full removing of organic substances, formed at the wood procesing. In this connection, the search for new technological decision of problem of raising of efficiency industrial WW clearing represents a exceedingly actual aim.

We offer to use commercially available water-soluble titanium(IY) salts as the efficient reagent for the clearing of wood chemical processing enterprises WW. This salts form stable coordination substances practically with all classes of organic matters.

Laboratory and experienced-industrial tests, conducted on cellulose-paper and hydrolysis productions in Syktyvkar Timber Complex (Komi Republik, Russia), have show a high efficiency of proposed technological decision. Reduction of aromatic matters in circulating water in 2-5 times and increasing of cleaning degree of vastly-pollutrd WW before 65% were observed. Combinated action of titanium (IY) salts and other chemical subsidiary swubstances - neutralizing agents, sorbents, coagulants was studied also. One of the best effects was received under combinated using of titanium (IY) salts and sulphate aluminum, widely applicated in cellulose-paper production, in neutral medium.

Removing ofaromatic substances, which are not destruct in the process of biological treatmrnt, allows to vastly to shorten a getting them in reservoirs. Extraction of dissolved organic substances, which are products of wood destruction, and reduction of weighting-parts content enabl to reduce irrevocable losses of wood-fibred materials.

Received results allow to recommend water-soluble titanium (IY) salts as an efficient reagent for the wasterwater clearing in the industrial scale.

THE IMPROVEMENT OF MIXING EQUIPMENT FOR WASTE-WATER RECYCLING AND SEDIMENTARY PROCESSING

Kochurov A.V., Milovanov A.A.
Moscow enterprise "Promothodiy", Moscow, Russia
Boulatov M.A. Kibrik E.D.
Moscow state university of engineering ecology, Moscow, Russia

Coagulation is one of the main stages of the water treatment process. The probability of unreacted or partially flocculated material passing through the system is high when the aluminum coagulant is insufficiently mixed with incoming raw water, or there are short circuits in the flocculation and

sedimentation steps. If coagulant and its dose are chosen right it's necessary to realize:

- even mixing of different flows;
- protecting of flocs and providing conditions for their further growth.

Floc growth results from interparticle collisions promoted by agitation. Frequently, deaggregation occurs simultaneously with aggregation. Under these terms the peculiarities of hydrodynamic conditions in the reactor should be taken into the consideration. Tangent efforts in liquid shouldn't exeed strength limits of the interparticle bonding. Large velocity gradient tend to produce as the increasing of coagulation velocity as the growth of tagent efforts. So the mean velocity gradient should be decreased along the flow way according to the calculations. But the mixing process must satisfy gradient coagulation proceeding. An optimum combination of mixing intensity, given by the mean velocity gradient and duration of mixing, should be used for the best results.

The special mathematical model is working out. It will let us to describe hydrodynamic peculiarities of coagulation and to determine geometry of the apparatus according to the given limits. With the object of it we carried out the research in centrifuge field under compound tense conditions. Results of these research were used in design of the mixing reactors. We evaluated efficiency coagulation depending on the mixing intensity. The appraisal of binary interparticle bonding was made taking into account the attraction Van-Der-Vaals forces and the repulsive electrostatic forces. The numerical values of admissible extensive and shifting strength were obtained for model system. (fo spherecl particles).

In order to increas the cleaning efficiency and decrease the reagent dose at the same time we suggest to mix wastewater with coagulant solution in cross-torrents. We developed the mixing reactor and tested it at Voikovskie industrial water-treatment system (enterprise "Promothodiy"). We obtained the increase in cleaning effect for solid particles from 90 per cent up to 97 per cent.

RESEARCHES OF WASTE WATERS PURIFICATION BY PERVAPORATION THROUGH MEMBRANE

Komarova L.F., Sharikova T.G., Perevalova T.M., I.I.Polzunov
Altai State technical University, Russia

In various of industries at stages of technological processes will be formed waste waters, containing organic impurity. Purification of a water and organic with the purpose of secondary use is important problem. It can form the basis for organization of water cycles and to lower quantity of a fresh natural water for the use.

One of perspective methods of water purification is evaporation through a membrane - pervaporation. During process the polluted water is contacted to one party selective nontight of a membrane. Components, membrane past through leave as steam from the return party of a membrane.

For research of opportunities of process pervaporation we use the various marks of new membranes for pervaporation, manufactured AO "Polimersintez" (Vladimir, Russia). At division of mixes ethyl, propyl, isopropyl and butyl of alcohol with a water was obtained that for removal of alcohol from water the most suitable water-selective of a membrane on the basis interpolimere of a complex: from Polyamidosylphoacid (PASC) and polyelectrolit (PEC). For purification of a water can be rationally used organic-selective of a membrane on the basis alcohol-selective polymere, the representative of which is a film from a polythene of high pressure (PEVD). As a result of static and dynamic research aspects of water mixes of alcohol division by method pervaporation it is better of use of a membrane PASC for azeotropic area.

The problem of waste water purification from phenol is very important. The physical characteristics phenol (high temperature of boiling and low pressure saturated steam) make possible of use evaporation through a membrane for removal phenol from industrial waste water. For these purposes, membrane Lestosil, (polydimethylsiloxane) was tested, however Lestosil has shown low separation factor, that makes inefficient its use for extraction phenol. For the successful decision of this problem search new polymer films was made. As the result high selective material, reasonably steady in was investigated - polytrimrthylsilylpropyne (PTMSP) (film are made in A.V.Topchiev Institute of Petrochemical Synthesis, Russian Academy of Sciens, Moscow). At comparison of two membranes was found out, that for purification water use of a membrane Lestosil is possible, as it differs high flux. But for the removal of phenol from water it is better to use a film PTMSP, having to high selectivity. So, with one-step of membrane division it is possible to offer and two-step, where at the first step is used Lestosil for purification water, and on second - PTMSP for regeneration phenol .

A main problem is not only choice of membranes, but also design of equipment. Reliable methods of technological account, not requiring statements of preliminary experiments are at present away and there is no uniform concept of process pervaporation modeling. Therefore it is important of development technique, enabling to calculate main technological parameters and characteristics of process pervaporation. Us is developed technique on the basis of combination of equations of the material balance and dependence of specific productivity and structure steam phase of a phase from concentration of dissolved substances and conditions of realization of process pervaporation.

SURVEILLANCE OF INDUSTRIAL LIGNIN-POLLUTED WATERS. RAPID INTEGRAL TOXICITY BIOTESTING FOLLOWED BY DETOXIFICATION OF WATERS BY USING HARMLESS BIOTECHNOLOGIES

Kondrashenko V.M., Zhilenkov E.L., Novikov, I.A. Fomchenkov V.M., Stepanov A.V.
State Research Center for Applied Microbiology Innovation Enterprise TOO "Tsereus" Moscow region, Obolensk, Russia

Lignin is a by-product of the wood processing industry. As a rule, a great amount of lignin remains untapped and disposed outside plants that results in a severe pollution of the environment.

The work focuses on methods for monitoring of waste waters polluted with lignin fractions as well as on procedures for rapid measuring water integral toxicity.

In our research, methods such as UV-spectroscopy, fluorometry and potentiometry were used. It has been found that because of reactions, that take place between lignin and water, the water environment is getting polluted with water soluble aromatic fractions.

Water specimens polluted with lignin water extracts were screened for integral toxicity by using a battery of bioassays as well as soil microorganisms and photobacteria. The pollutant was found to quench photobacteria, suppress respiratory (reducing) function of soil bacteria and to disturb the barrier properties of cell membranes.

This fact necessitates the detoxification of lignin wastes. The State Research Center for Applied Microbiology has an ample collection of microorganisms and fungi. Species of bacteria and fungi were used in the study, which can change a chemical structure of lignin when interacting with lignin in vitro, detoxifying thus the water environment in a system lignin-fungus (microorganism)-water.

The effect of biodegradation is usually evidenced by the following parameters:

- pH of water environment;
- normalization of photobacteria luminescence and recover of the respiratory function of soil microbes;
- absence of disturbances in membrane barrier properties of test-cultures compared to controls.

Lignin detoxification is usually accompanied by a chemical modification of water soluble aromatic fractions as well as by reducing of their concentrations.

The results suggest that the above methods can be successfully used for lignin surveillance on sites where exploration, processing, transportation or utilization of wood takes place. They also allow rapid integral toxicity testing of water environments followed by detoxification. At present, a technology of lignin processing is under development.

WASTE WATER DISINFECTION BY ULTRAVIOLET LIGHT

Kostioutchenko S.V., Volkov S.V., Vasilyev S.A., Yakimenko A.V.
"LIT Technology", Moscow, Russi.

Current Russian regulatory rules on chlorine disinfection of secondary effluents specifies the residual amount of chlorine no less than 1.5 mg/l after 30 minutes of thecomtact.

Multiple researches both in Russia and in the world gave the result of high toxic effect of chlorine treated wastewater on the ecology of the basins that receive such wastewater. At the same time in practice the necessary quality of wastewater on microbiological parameters is not achieved some times, especially on bacteriophage (E. Coli).

Due to this fact there is no disinfection of wastewater at all in some of big cities, where consequences of chlorination are especially big.

In highly developed countries national standards require the absence or very low values of the residual chlorine in wastewater, that implies the requirements of the dechlorination stations implementation or the complete rejection of the wastewater chlorine disinfection.

The most perspective industrial disinfection method at present time is the treatment of wastewater by ultraviolet radiation (UV).

Multiple researches performed in the laboratories showed the complete absence of toxic disinfection by-products of and any negative actions on the organisms in the basins after ultraviolet irradiation of water.

First big industrial UV-installations were developed in the beginning of 70-s. There are few thousands of UV-disinfection systems working now in the world, including such big stations, as in Calgary (more than 1000000 m^3/day), Quebec (800000 m3/day), Minneapolis (850000 m^3/day) and other.

Long time operation of the UV-systems showed high efficiency of such disinfection. High popularity of this technology is connected with a set of factors.

Recent achievements in light technique and electrical engineering gave it possible to assure high degree of UV-complexes reliability.

Modern UV-systems, lamps and lamp control gear are in mass production and have long operation time resource.

Operating costs of UV-disinfection are comparable with chlorination and much lower than of ozone disinfection. This is due to low energy consumption (3-5 times less than for ozone), needless of the expensive chemicals, easy operation and needless of specially trained personnel with high salary, needless of special security procedures.

A lot of scientific and technological researches were performed in Russia during last 5 years with the participation of such organizations, as SRC RF VODGEO (Moscow, Russia), A.N.Sysin Research Institute of Human Ecology ant Environmental Health RAMS (Moscow, Russia), F.F.Erisman Hygienics Institute (Moscow, Russia) and "LIT Technology". Efficiency and innocence of UV-disinfection were studied both in laboratories and in about 20 stations of waste water treatment. "LIT Technology" performed multimonth tests of big (250-1000 m^3/h) serially produced systems in the cities of Zelenograd, Tolyatti, Samara. "LIT Technology" started several UV-disinfection stations, including big station in Tolyatti (290000 m3/day).

Preparation for publishing of the methodical recommendations on UV technology implementation for wastewater disinfection is performed now.

Considerable improvement of UV-technology achieved during last few years, positive experience of it's usage on big

stations of wastewater treatment, presence of serially produced Russian equipment, relatively low costs of construction and usage opens big possibilities for implementation of wastewater UV-disinfection in Russia.

SOME RECOMMENDATIONS FOR ACCOUNT OF STRUCTURES GIVING AIR FOR BIOLOGICAL CLEARING OF WASTE WATERS

Krotov A.P., Ivanov V.M., Rodivilina T.U., Fedorenko E.A.

The authors consider submission of air for biological clearing structures. The program of account of the specific charge of air at an aeration is made on the computer. Under this program the specific charge of air is calculated at various specific concentration of pollution of waste water depending on temperature both parity of the areas of a zone of an aeration and aeration basin.

Received results show, that the dependence of the specific charge of air on temperature and pollution of initial water is practically rectilinear, and the dependence on a parity of the areas of a zone of an aeration and aeration basin f/F is close to hyperbolic. In a smaller degree on the specific charge of air temperature, in a greater degree concentration of pollution in initial water BNOcomplete (biochemical need for oxygen for clearing the organic substances contained in waste waters). The change of the specific charge of air (initial BNOcomplete = 120 mg/l) at decrease f/F with 0,5 up to 0,3 occurs unsignificantly, in limits 0,16 - 0,17 m3/m3; with 0,3 up to 0,2 in limits 0,37 - 0,40 m3/m3; with 0,2 up to 0,1 in limits 0,48 - 0,57 m3/m3.

The similar picture is observed for other initial concentration of polluted water BNOcomplete and is characterized by significant change of the specific charge of air from pollution of initial water. This implies, what to reduce a parity of zones of an aeration and aeration basin f/F inexpedient because of sharp increase of the specific charge of air on an aeration. The specified circumstance is necessary for taking into account at development of new sprays.

Spent accounts have allowed to give the recommendations for possible decrease of the specific charge of air on an aeration with 4,6 m3/m3 on data of the technological rules. However these recommendations are necessary for proving also from the point of view of capital (area of spray plates or elements) and operational (electric power) expenses, that will be carried out at the following stage of work.

NATURAL AND SEWAGE WATER PURIFICATION AND CONDITIONING PROCESSES USING BACTERICIDE POLYMER

Kuznetsov O., Danilina N.
Water Problems Institute, Russian Academy of Sciences, Moscow, Russia

Polymer Fogucid (FC) is offered here to the readers attention, possessing unique properties. FC is a polycation and an antiseptic at the same time. These properties make the substance eligible for using in natural and sewage water purification techniques, the following directions specifically: the purifying and decontaminating of drinking water, urban and industrial sewage, water for swimming pools, water for equipment cooling systems, protecting pipe lines and other constructions against pathogenous bacteria and weed. FC makes chlorine treatment water completely unnecessary and diminishes the amount of coagulant used for purifying.

Using FC for the purifying and decontaminating of drinking water was allowed by the State Sanitary and Epidemic Supervision Committee of the Russian Federation in 1994 (the Hygienic Certificate # 1B-11/897).

Some parameters, describing bactericidal efficiency and toxicological safety of application FC, are submitted in the table.

Table. The microbicidal and toxicological data of Fogucid.

№	The measured parameter	Unit measure	Quantity
1.	Bacteriostatic activity concentration:		
1.1.	Staphylococcus aureus	mg/l	0.3
1.2.	Pseudomonas aeruginosa	mg/l	0.6
1.3.	Escherichia coli	mg/l	0.1
1.4.	Proteus	mg/l	0.6
1.5.	Legionella	mg/l	0.6
2.	LD peroral	mg/kg	2500
3.	LD cutan	mg/kg	13000
4.	Cumulation	-	weak
5.	Allergic action	-	absence
6.	Irritation level	mg/kg	190
7.	Common toxicity level	mg/kg	90
8.	Class of danger	-	4

FC has analogs abroad: Chlorhexidin (CHG) and Wantocile (WTC). FC is distinguished from these substances by its low toxic effect (the maximum allowed oral consumption doze for FC is 2500 to 3200 milligram per kilogram which is less than 1000 to 2000 mg/kg for CHG or WTC), its stronger bactericide action (3 to 5 times as strong) and the opportunity of synthesizing both samples dissolvable in water with molecular mass of 700 to 20,000 conditional units and not dissolvable forms.

Purifying water with FC is based on the polymer's flocculating ability. Due to its nature FC is a flocculate of cation type. When flocculating water, FC may be applied either independently or together with a coagulate. When used as flocculate, the best dozing for FC is 0.5 to 1.0 milligrams per liter in the presence of 5 to 20 mg/l of aluminum sulfate. Besides usual muddiness and color, FC removes such admixtures as petrochemicals, iron, heavy metals and residual aluminum or brings the concentrations within the allowed limits. FC is most efficient when used for flocculating water at filtering stations with granulated filling material (sand, anthracite or another). When used massively, FC is able to destabilize oil/water emulsions.

Decontaminating water and suppressing weed is based on bactericide action of the polymer's guanidine groups. The mechanism of the polymer's bactericide action includes the following stages: the adsorption of polycation on a cell's surface, diffusion through the cell's skin, adhesion with cytoplasmic membrane and tearing it apart, sedimentation the cell's contents and at last killing the cell. For example, using FC as a flocculate for purifying sewage water provides the diminishing of the general bacteria concentration from 10,000 or 1,000,000 cells per milliliter to 100 cells/ml. Complete elimination of E. coli bacteria is achieved within 30 to 60 minutes after injecting 0.5 to 1.0 milligram of the substance into 1 liter of the water processed. When contaminated again in two or three days after processing with the substance, water turns out pure in 20 to 30 minutes with no more substance added. In other words, the polymer provides prolonged bactericide action in water. The polymer was also found to have preventive and inhibiting effect on seaweed and shells. Weed is inhibited at FC concentrations of 0.2 to 0.5 mg/l in water medium. When it is necessary to get rid of weed that is already there, FC concentration should be increased 5 to 30-fold.

More one area of application FC is antibacterial stabilization of emulsions. The service life of emulsions, employees by lubricant-cooled liquids, is prolonged more than for one month without danger decay.

In industrial practice of natural and sewage water treatment is required prolonged antibacterial protection of surfaces of walls, ceiling and equipment. In this respect processing by 0,5-1,0 % aqueous solutions FC has well built up a reputation for self. In conditions of increased humidity for prevention destruction antibacterial film of polymer receptions of its fastening on processed surfaces are developed. The put film is colorless and not damaged at repeated damp cleaning. Similar antibacterial the processing with success is applied for disinfection of mineral waters in balneologic systems: pools, baths, capacities for storage and transportation of a mineral water.

TO THE PROBLEM OF THE COMPLEX USING MICA ROW MATERIAL, EVALUATION OF WATER OBJECTS STATE AND ANALYSIS OF INDUSTRIAL SEWAGE WATER IMPACT ON THE ENVIRONMENT

Leonov S. B., Rush E.A., Hizkaya N.V.
Irkutsk State Technical University, Irkutsk, Russia

Overloading of the East Siberian region with industrial enterprises of the five key branches as (I) wood processing, (II) fuel and heating, (III) metallurgy, (IV) oil-and gas refinery and (V) mining threatens the environment with pollution by industrial sewage into surface and ground waters, atmosphere and soil. Under intense growth of industry the environment protection and rational use of natural resources are the most vital objectives to be solved via application of lowwaste and waste-devoid technologies excluding a harmful effect of the environment and allowing industrial waste to be utilized in the medium-protective processes. Solution of the problems concerning environment protection, water objects in particular, are related to the efficiency of sewage water purification.

The existing local system of purification do not allow render sewage water to required quality standards according to the demands to discharge of sewage water, I and II categories, into surface water reservoirs. This leads to organized discharge and eventually to the existing decrease of self-purification capacity of water-reservoirs and irreversible changes.

With this in mind, it is vital to improve available technologies of industrial sewage water purification and to prevent pollution of surface water reservoirs of Irkutsk Oblast. This necessitated solution of the following problems:

- To search for new, more upgraded approaches to the study of surface water medium state;
- To study the techniques and technological procedures to analyze the composition of surface and industrial sewage water, to establish priority pollutants, processing results of physical-chemical analyses and their practical realization;

This necessitated solution of the following problems:

- To search for new, more upgraded approaches to the study of surface water and water medium state;
- To study the techniques and technological procedures to analyze the composition of surface and industrial sewage water, to establish priority pollutants, processing results of physical - chemical analyses and their practical realization.

To study prospects of industrial sewage water purification at the present stage with using industrial wastes.

The increasing of the capacity and complex using of the mineral raw material resources of the Eastern Siberia is one of the actual problems at present time. The decreasing of the mineral reserves, the means in supply to develop the new deposits make low the necessity to decide this problem of the complex using of row materials, the use of remains and second industrial plants products.

One of the directions of this problem in the use of the modified no- standard smallsized mica in the sorbtioned technology of the cleaning of fluoride having industrial sewage.

We studied the sorbtioned processes of industrial sewage with the use as a sorbent not traditional material got in the result of the smallsized no-standard mica of flogopyth.

At present of our chair of Deposit's Dressing and engineering Ecology of the Irkutsk State Technical University the principle technological scheme of cleaning fluorine having industrial sewage of the non-ferrous metallurgy's plants was worked out. This worked out cleaning sewage technological was tested at the number of objects of the non-ferrous metallurgy branch and the results were satisfied.

A METHOD OF RECOVERING AND SALVAGING OF CAPROLACTAM FROM LOCAL EFFLUENTS FROM POLYAMIDE PRODUCTION

Lisitskaya I.G., Lazareva L.P., Zhukova O.S.
Far-Eastern branch of Russian research institute for natural protection, Vladivostok, Russia.

Production of chemical fibers is one of the top industries of the chemical production sphere in water consumption and amount of discharged effluents. In Russia as well as abroad only high concentration lactam water is treated. It is vaporized and then returned to production line. Besides vaporization, a method of recovering of caprolactam and its oligomers from water solution by foam flotation is known (USA patent No. 4464266) but this method allows to reduce the concentration of caprolactam to 3 - 3.5 per cent, that is not enough. Available techniques do not make recovering and reuse of caprolactam in production be economically rational if its concentration in water is below 1%. As a result, water with low concentration of caprolactam is discharged to natural reservoirs. Although the concentration is low the amount of the effluents is large, thus the loss of caprolactam only at one plant may exceed 120 tons annually. Besides that, plants with high water consumption lack clean water more and more severely. The task of creating a closed cycle for water circulation is even more challenging for these companies than saving raw materials. Fulfillment of this task will help environmental situation.

Development of methods for effluents treatment at chemical fiber plants moves toward inventing new and improving existing techniques which allow salvaging of valuable products (caprolactam, rhodanides) and returning purified water back to production process. In Russia and worldwide the ratio between amount of water circulation and total water consumption actually varies from 25 to 82 per cent indicating that there is a certain reserve to work with. When putting together a plant's effluents treatment system one must provide a combination of local and plant-wide treatment systems and units since the local treatment allows to salvage valuable products, simplify purification process and decrease its cost.

A method of recovering and concentrating of caprolactam by electrosorption is introduced by the authors. The method is expected to be included in the technological line of caprolactam production at the stage of producing low caprolactam concentration water (0.04% - 0.05%) which is not to be concentrated by vaporization. This solution is concentrated up to 2 per cent to make its return to the production process be economically rational.

The distinguishing novelty of the method introduced is forcing desorption and concentrating of an organic substance and high degree sorbent regeneration by applying electrochemical potential to the carbon sorbent saturated with caprolactam. An application for patent on the method developed has been submitted (No. 97113865 dated July 30, 1997).

Concentrating of caprolactam by electrosorption is carried out cyclically and comprises two phases.

In the first phase recovering and accumulation of caprolactam in the surface layer of the carbon sorbent without application of an external source of electric current takes place; the purified water is returned to production process.

In the second phase the adsorbent with the caprolactam adsorbed is charged by anode current; this operation causes desorption of the organic substance from the sorbent's surface into a small volume of solution; the result is concentrating of caprolactam and restoration of sorbent's capability for adsorption.

The process can be repeated many times. It can be used for local purification of low concentration water. The amount of such water is 2-3 times the total amount of the other effluents and low concentration water is to be purified mostly from caprolactam whose concentration is low. Industrial deployment of the method will allow not only salvaging of caprolactam but producing water which certainly meets demands for use in a circulation supply system.

DISPOSAL OF SEWAGE SLUDGES

Lungwitz H.
Berliner Wasserbetriebe, Berlin. Germany

Sewage sludge is an inevitable residue resulting from sewage treatment. There are several ways of disposing of it:

- using it in agriculture/for composting,
- depositing it in landfills,
- incinerating it in mono-incineration plants or mixing it with the fuel used in power plants, cement factories or waste incineration plants,
- gasifying it together with other wastes and utilising the synthesis gas.

In each case a solution must be found with a view to the future and taking into consideration the environmental impact, the costs, the overall economic benefit and e.g. what to do with the residues resulting from the chosen process.

Whether the sludges may be used in agriculture depends on the final content of hazardous substances and the limits fixed for these.

In future in the Federal Republic of Germany only "substances similar to those of the earth's crust" will be allowed to be deposited as containing no hazardous substances and not requiring further treatment. Therefore this way of disposing of the sludges will have to include a thermal final stage.

The material utilisation of the sewage sludges on thermal basis is possible by means of gasifying it together with other wastes and utilising then the synthesis gas, e.g. for methanol production. The granulated residual material may be used in the building industry.

PRODUCTION OF FODDER PROTEIN PRODUCT ON THE BASE OF CALCIUM CITRATE FILTRATE -WASTE OF CITRIC ACID PRODUCTION

Lvova E.B., Krasikova N. V., Vubornova T. V.
All-Russia Research Institute of Food Aromatizers, Acids and Colours
(VNIIPAKK)

The most burdensome and multitonnage waste of the industrial citric acid production is calcium citrate filtrate (CCF) having chromaticity of 140-200 UOD (units of optical density) and obtained at the stage of separation of citric acid from culture liquid after fermentation of the molasses-based medium with fungus *Aspergillus niger*.

CCF characterized by rich set of nutrient substances including the main part of mineral and organic components of molasses as well as products of vital activity of acid-producing fungus, can be successfully used in biotechnology as nutrient medium for cultivating various groups of micro-organisms such as protein producers, vitamins, etc.

VNIIPAKK has developed a process of producing fodder protein product when using deep bed cultivation of mycelium of the highest basidium fungus *Pleur. ostreatus* with the use of CCF as a nutrient medium. Maximum yield of biomass makes up 20-25 g/ cu.dm of absolutely dry weight. Clarification is increased in 1.5-2 times.

Chemical oxygen absorption of secondary filtrate upon cultivating basidium fungus is reduced by 60-80%. As it was found, the secondary filtrate after cultivation of *Pl. ostreatus* has a stimulating effect on the activity of biosynthesis of citric acid by *Aspergillus niger* when partially substituting water during preparation of molasses solution for the main fermentation by the secondary filtrate. Zoohygienic analysis of biomass of fungus *Pleur.ostreatus* has been performed and specifications of "Mycelium of basidium fungi (fodder) " has been developed.

VALIDITY OF REQUIREMENTS TO QUALITY OF EFFLUENT - THE MAIN POINT FOR DEVELOPMENT OF SYSTEMS FOR WATER PROTECTION

Lykinyih N.B.
Municipal Water Supply & Treatment Research Institute, Moscow, Russia

1. A global problem of forthcoming XXI centuary will be a rational water consumption. The present situation with water resourses and water units is determining the necessaty of revising the existing methods of developing of water supply and water treatment systems. Espessially it is required for Russia, were contamination of water units is growing on due to existing disproportion in developing systems of water supply and waste water treatment and there is unsufficient quantaty of water reuse systems.

2. Rational water utilisation starts from economical consumption. It will demand modernisation of water delivery fittings, more strict control on water consumption, better culture of water utilisation, of course. All above mentioned measures will allow to reduce capasitiers of water supply systems and concentrate resourses to upgrade quality of water treatment.

3. In order to reduce fresh water consumption the construction of new and reconstruction of already running

sewage systems of municipal areas ought to be linked with reuse of treated water in industry, agriculter, municipal gardening etc.

4. The developing of water protection systems is required considerable capital investment. That is why the careful investigation should be done before taken any decision. Unfortunatly lack of proper independent experts control does not provide relevant quality of projects.

5. At present time united normative base is a main point to ensure efficiency of the adopted projects. In reality it is not enough for such big country as Russia. Normative base ought to be different for regions and linked with water bodies.

INTERACTION BETWEEN PEAT SOIL AND WASTE WATER UNDER ITS DISCHARGE INTO BOGS

Mamayeva L., Militsina O.,
RosNIIVKh, Yekaterinburg, Russia

Peat soil has been using for the domestic wastewater treatment for a long time. Since 1957 the following scheme of wastewater treatment has been using in Finland. Wastewater is directed into the channel and after its side seepage through peat soil it is exported into the another channel situated at the distance of 20 m from the first channel. After 14 exploiting years up to 82% of phosphorus, 90% of nitrogen, 99% of bacteria and 95% of BOD have been removed from wastewater.

The USA, Canada, Finland and Poland are using bogs for the wastewater treatment widely. The average load of domestic wastewater is 280 m^3 per day. It is directed to one of four septictanks and further to the natural pond-storage. At the pond outlet wastewater flows along the peat bog surface. Then it moves along the channel which is divided in 2 parallel channels in 25 m. When wastewater flows along the bog, BOD decreases by 95% and COD decreases by 75%.

On the basis of analysis of available information and results of our own research we have elaborated the following technological methods, using of which will allow to decrease the pollutants concentration in wastewater discharged into the bog.

1. Discharge of wastewater into the open channel in peat soil. When wastewater flows along the open channel during the spring-summer period the concentrations of suspended substances, all kinds of mineral nitrogen, organic nitrogen and phosphorus, phosphates, BOD, natrium and potassium decrease. The most decrease of wastewater pollutants concentration was fixed at the distance of 200 m. According to the Canadian scientists the open channel is a natural gear that increases a solved oxygen concentration and decreases BOD in wastewater. The main channel my be divided into 2 parallel channels in order to increase the infiltration area and speed the pollutants movement from wastewater to peat soil, that contains organic substances which will absorb pollutants.

2. Turning wastewater to the peat-soil botanical site. A natural botanical site overgrown by reed is formed along the wastewater flow track on the peat-soil surface. In summer this plant utilises 86 kg/ha of potassium, 60 kg/ha of nitrogen, 38 kg/ha of calcium and 12 kg/ha of phosphorus. Besides the concentrations of all kinds of mineral nitrogen, BOD, COD, synthetic surface-active substances, iron and phosphorus in wastewater decrease. The USA scientists confirm a possibility of the botanical site use for the wastewater advanced treatment. Wastewater was discharged into the botanical sites where high water plants grew on the sound-peat sites. In this case plants utilised 240-262 kg/ha of nitrogen and 36-42 kg/ha of phosphorus.

3. In order to achieve the ecological effect in the treatment under the acid mine water discharge into peat soil it is necessary to adhere to a number of conditions. Mine water (for the advanced treatment) may be discharged (through the distributing appliance) only into peat soil of the low bog covered by the natural bog vegetation. Under the interaction between wastewater and peat soil of the low bog an acid medium becomes neutral and the concentration of pollutants including metals decreases.

EXPERIENCE OF INSTALLATION OF ECOPOLYMER AERATION SYSTEMS IN REGIONAL SEWAGE TREATMENT PLANTS IN OHIO, USA

Meshengisser Y.M.
SIF "ECOPOLYMER", Belgorod - Kharkov, Russia, Ukraine
Lichstein A.B., Kravtsov M.A.
Ecopolymer, Inc., Deerfield, USA

Installation of Ecopolymer Aeration System (EAS) in the Warren (Ohio, USA) municipal sewage treatment plant was completed in December of 1995. The system was installed in 40' x 88' x 22' aeration tank for conventional activated sludge process replacing a Jet Aeration System with an impeller mixer. The average daily flow applied to the tank is 2.8 MGD. Airflow is provided by positive displacement blower with a flow rate of 1500 scfm.

Every six months the aeration system was checked by personnel of the sewage treatment plant as following: 1) aeration tank was drained; 2) tank basin and diffusers were

inspected for any sludge buildup; 3) diffusers were disconnected by random choice and visually checked.

The concentration of dissolved oxygen was measured by a dissolved oxygen meter gage installed in the tank. The average level of dissolved oxygen is 5 mg/l. This high level of DO shows that the EAS has a potential for higher organic treatment and loading.

Inspection of the bottom of the tank for the presence of dead zones and sludge accumulation showed that neither dead spots nor accumulation of activated sludge were present on any surface area.

The diffuser's working surfaces were inspected for the presence of biological film growing. Biological growth was not found. The diffusers working surfaces were in the same condition as at the time of installation.

Support tubular frames of diffusers were inspected for the presence of sludge. A minimal amount of dry sludge was accumulated on the bottom of frames. The reason for discovered accumulations of sludge occurred because of an inadequate airflow during restart procedure due to power outages. The presence of dried sludge had no affect on aeration and head loss of the system.

During operating EAS showed a high mixing capacity and high oxygen transfer efficiency. Operating of EAS allowed direct savings of power consumption due to the elimination of submersed electric motors and pumps that were particular to the jet aeration.

There were 10 (ten) cases of power failure during 6 months of operating EAS in MC WWTP. The result of each power failure was a termination of air supply to the system for an undefined period of time. Upon restoration of the power and air supply EAS returned to typical operating condition and performance within 15-20 minutes.

Conclusion:

1. EAS provides fine bubble aeration.
2. EAS has high oxygen transfer efficiency.
3. EAS has a high mixing capacity.
4. Biological film growing does not occur on working surfaces of diffusers.
5. EAS allows savings of power consumption comparatively to jet aeration system.

NEW DEVELOPMENT OF SIF "ECOPOLYMER" IN WASTEWATER TREATMENT TECHNOLOGY

Meshengisser Y.M.
SIF "ECOPOLYMER", Belgorod - Kharkov, Russia, Ukraine

The research-and-production firm (SIF) "ECOPOLYMER" is a multipurpose enterprise with main business activity in development, production, and implementation of modern highly effective equipment for natural and wastewater treatment technology.

There was an extensive experimental research conducted by the firm in the last several years. It studied a behavior of aerators during the operation period and collected data of changes in their hydraulic and mass transfer characteristics because of periodic on-off pressure-blowing units. The results of the research updated aerators design data as well as their production process.

The mathematical models for kinetic of mass transfer, oxidation of organic and nitrogen-contained substances are used for calculation and design of the aeration systems. That allows not only to satisfy customers requests for electric power savings but also determine opportunities for treated water quality improvement in existing treatment plants by developing optimum configuration of the aeration systems.

Since 1998 SIF "ECOPOLYMER" has been producing a new generation of aerators combining features of plate (flat) and tubular type of aerators in one unit. The new design modifications included a simplified fastening during installation and changes in the technology of disperse layer. There were some global changes affecting aeration systems such as their installation configuration methods, and combination of aeration elements. Only in the last year the company has patented 9 inventions related to constructive and technological aspects of its production.

Due to "ECOPOLYMER" aerators compatibility with submerged pumps and mixtures the nitrification-denitrification systems have become one of the fast growing direction of the firm's activity. The design and optimization of the technological process is based on the results of the dynamic modeling of the biological cleaning processes. The derived results are analyzed and calculated by the software purposely developed by the firm's experts. It helps to discover essential reserves in the electric power savings and the quality of cleaned wastewater.

Presently many structures for biological wastewater treatment represent dropped biological filters with loading of gravel or granite aggregate sprinkled by the system fountain. To reduce a loading volume and increase the efficiency of wastewater treatment SIF "ECOPOLYMER" performs reconstruction of biological filters using loading from polyethylene and polyvinylchloride goffered sheets. It allows to reduce the volume in 4-5 times and improve the quality of cleaned water.

Typical submergible aeration modules were developed and installed for the cases when, because of technical reasons, it was impossible to do installation in the activated sludge aeration tank.

The drainage systems of SIF "ECOPOLYMER" were maintained on rapid filters in wastewater treatment plant of City of Jelenograd. They have been recognized and highly evaluated by the specialists.

All above described firm's efforts resulted in significant operating costs savings and improvement quality of the cleaned wastewater.

ORGANOSILICON BIOSTIMULANT FOR SEWAGE TREATMENT

Michailova A.N., Varezhkin Yu.M., Polivanov A.N.
State Research Centre "GNIICHTEOS", Moscow, Russia

One of the current key problems is to maintain environmental equilibrium of natural water reservoirs to most of which treated sewage from commercial lines is supplied.

The most widely-spread and versatile method of sewage treatment is a biochemical one. However, when sewage treatment process is violated, the efficiency of treatment plant operation is decreased, i.e. the quality of the treated water is adversely affected, and large amount of contaminants is fed to natural water reservoirs. Simultaneously activated sludge becomes swollen, it is removed from aerotanks and active sludge microorganisms are often killed. Self-restorability of activated sludge microorganisms' vital activity proceeds within a long period (2-6 months).

With the purpose to facilitate biochemical treatment of industrial, domestic and mixed sewage, novel environmentally-safe biostimulant has been developed on the base of organosilicon compound of silazane structure (D-TBA). D-TBA bio-activity was initially found by means of modified methods for enzyme (catalase and dehydrogenases) and microbiological activity determination in concentration range 0.0001-0.10 mg/L on model sewage, corresponding to average sewage composition OSC-II of Chemical Plant in the city of Usol'ye-Sibirskoe and Chemical Plant in the town of Dankov, basic components involve: alcohols, ketones, aromatics, esters, organochlorine compounds, petrochemicals,

heavy metal (iron, copper, chromium, nickel, zinc, cobalt, mercury etc.) salts, chlorides and sulfates. Laboratory test results were confirmed under pilot-commercial conditions at the sewage biochemicaltre-atment station in the chemical plant of Dankov.

D-TBA promotes fast restorability of activated sludge microorganisms vital activity, increases biodegradation rate of organic impurities by 1.1-1.5 times. It allows to improve the quality of the treated liquid (during the same aeration period) or to shorten the aeration period (with the same treatment efficiency). The output of the treatment plants grows therewith without any capital investments, energy consumption is reduced, and sewage can be treated to MAC level.

Biostimulant consumption depends on sewage composition and is in the range of 0.01-0,1 mg/L. For every treatment plant biostimulant consumption per sewage unit is individually found.

The biostimulant is a transparent liquid, water solubility - 50 mg/L, maintains its activity within 24 hours in an aqueous solution and then decomposes without toxic product formations.

It was found out on the ground of medical and hygienic studies that D-TBA does not penetrate the undamaged skin, does not irritate skin and mucous membrane, has no locally irritating and skin-resorptive properties. Cumulative characteristics appear only slightly. D-TBA is low toxic LD_{50} - 2610 mg/kg (rats), LD_{50} - 2700 mg/kg (mice). The compound relates to Class IY of Hazards.

USE OF INTERPOLYELECTROLYTE COMPLEXES FOR PURIFYING WASTE WATERS

Mikheikin S.V., Smirnov A.Yu., Petrov M.R., Kovaleva V.L., Mikhailovskaya N.Yu.
SRC RF VNIINM. Moscow, Russia

Agents and Procedures for Binding Dispersed Systems

During the past 12 years in collaboration with the Moscow State University VNIINM has been developing agents and procedures to prevent the transfer of highly toxic pollutants, radioactive ones among them, in the environment. A start was made following the Chernobyl accident in 1986. By now a variety of polymeric agents has been synthesized and tested to confine radioactive contamination within topsoil. The procedure developed is based on interaction between high molecular polyions and charged surfaces of soil particles. The resulting water stable polymer aggregates are characterized by electrostatic interaction between cationic polyelectrolytes and soil particle surfaces of slight negative charge resulted from the silanol group dissociation. Addition of an anionic polyelectrolyte promotes the formation of a water insoluble interpolyelectrolyte complex (IPEC) which is firmly bonded to soil.

Further studies have shown that IPECs can be used for water systems containing dispersions, soils and silts among them, to form water stable soil-polymer aggregates of high sedimentation rate. This property of IPECs is used as the basis for a closed decontamination process by hydroclassification; process solutions from water clarification and fine fraction sedimentation as well as IPECs can be repeatedly used because of the IPEC's capability to change from water insoluble-to-water soluble state as a function of the low molecular electrolyte concentration.

Valuable components can be extracted from industrial effluents by IPECs which are then separated for reuse

IPEC-radionuclide interactions in water-salt media

Characteristics of UF-membranes used for radionuclide extraction from aqueous solutions were studied by ultrafiltration - complexing (UFC).

For comparison purposes a variety of membranes was used: polypropylene UPP, polysulfonamide UPM-P-450, acetatecellulose UAM-500 and acetatecellulose AC-300 of lower pore size.

Hidrolized pollyacrylnitrile (HYPAN) was used as a polymeric binder. Samples of permeate filtered through a UF-membrane were analysed for U-235 and Sr-90. The U-

235 content was radiometrically measured using a gamma-spectrometer equipped with a NaI(Tl) scintillation detector.

During the process of experiments the selectivity and permeability of membranes were determined at a U-235:complexone ratio of 1:10.

Table 1.

Membrane type	C_{init}, mg/l	$C_{permeat}$, mg/l	Y, %	G,l/m² h
UPP	24.92	0.43	98.1	63.0
UPM-P-450	25.12	1.21	95.7	110.2
AC-300	24.95	1.07	95.02	80.7

With HYPAN as a complexing agent, the selectivity of U-235 is high (95-98%) for all membrane types), a UPP being of the highest selectivity (98.1%) and an AC-300, of the lowest one. The permeability is the lowest for a UPP (63.0 l/m²h) and the highest for a UPM-P-450 (110,2 l/m²h).

The initial Sr-90 concentration was 4.17x10 Ci/l with HYPAN as a compexone (10 mg/l).

Table 2

Membrane type	C_{init}, Ci/l	$C_{permeat}$, Ci/l	Y, %	G, l/m² h
UPP	4.17 x 10	5.29 x 10	98.7	44.1
UPM-P-450	4.17 x 10	1.08 x 10	97.4	229.3
AC-300	4.17 x 10	5.52 x 10	98.7	88.2

Testing of membranes used for filtration of solutions containing Sr-90 and water-soluble polymers shows their high selectivity (97-99%).

Preliminary results suggest complexing in the U-HYPAN and Sr- HYPAN systems.

Conclusions

1. Studies and applications of IPECs for years show their high efficiency in cementing dispersed materials into water stable aggregates.

2. Preliminary results suggest the complexing of IPECs with metal ions.

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DEVELOPMENT OF THE ADVANCED TECHNOLOGY AND WASTEWATER TREATMENT FACILITIES

Mjasnikov I.N.,Potanina V.A.
G.N.C. R.F. NII VODGEO
Bukov Ju.E.
M.P.Vodokanal, Kaliningrad
Chmeliev Ju.A.
A.O.Vodukanalproject, Kharkov

The problem of water basins protection against contamination with industrial and municipal wastes can be solved by disinfectioning of those contominants at water treatment plants.

Along with the existing treatment schemes some new and more advanced facilities are used. They have been elaborated for mechanical, physicomechanical, biological treatment and final purification of water.

Modern types of settling tanks, flotators, biofilters of different loadings, compact combined constructions make it possible to ensure high efficiency of contominant removal and low operational costs as compared with convenient methods of treatment.

Reagent treatment of effluents is considered to be more efficient and perspective than biological one. By the present time some technology has been developed for coagulation of municipal wastewater which is contaminated with high concentration of organic substances, heavy metals, petroleum wastes, fats, oil processing products and so on. It helps to decrease all those products up to 65–75%. The period of liquid staying in the aeration tanks after treatment does not exceed 3–5 hours.

The coagulation process can be performed at the existing plants of mechanical treatment prior to aeration or after final clearing of biologically treated wastewater in the secondary settling tanks with an inner adjustment and filters.

Factory made facilities have been developed, they include a combined settling tank with an attached inner flocculation cell, a biofilter with plastic loading and a settling cell as well as a secondary settling tank with a flocculation cell and a quartz filter. This water treatment plant permits to clear wastewater containing COD 1200mg/l, BOD up to 600mg/l, fats up to 100 mg/l, petroleum wastes up to 15 mg/l, and surface active substances up to 5 mg/l. The quality of the treated water completely provides with the fish-breeding sanitary demands. The dewatering of the remaining sediment takes place at fabric chuck filters.

To clarify the wastewater under various conditions several advanced facilities have been presented such as: filters-flotators, electric coagulator-flotator with an attached floc-

clilation cell, the latter had been tested in industry and showed high efficiency of treatment.

These new facilities are being used in schemes for treatment of various industrial effluents. New factory-made constructions are very helpful in clearing sewage of relatively small works, oil bases, storages of petroleum products, car services etc. The operational capacity of them is 5 to 100 m^3/h of effluent. The abovementioned facilities make it possible to clarify the water according to the sanitary specifications for fish-breeding reservoirs, or municipal sewerages. A combination of settling tanks and filter-flotators ensure removal of oil products from 600-1000mg/l to 0,3-2 mg/l. In case when the water flows down into a fish-breeding pond the whole scheme can be supplied with a sorption filter. In this the final content of oil products reduces up to 0,05 mg/l. Utilization of oil products and disinfection of the forming sludge also take place at those facilities. All those constructions have been manufactured so that they could be easily transported and settled in the premises like hangars.

The abovementioned water treatment plants are used successfully in Estonia, Lithuania, Ukraine and Russia.

COMPUTER-AIDED MULTISTAGE CASCADE SCREENS

Mosin I., Khlystikov S. R., Ovchinnikova S. K., Deljukin A. S., Tregubov A. I., Semin E. G.

For the last decade, many new technologies, equipment and designs of treatment plants have been developed in the field of wastewater treatment. Their universal introduction will allow to decrease significantly the capital costs, operating expenses, materials and power consumption with provision of high-quality treatment.

The given paper describes new computer-aided multistage screens of cascade type PC developed by the company RIOTEK.

The computer-aided multistage screens of cascade type PC (plants for mechanical treatment of wastewater) are intended for removal roughly dispersible mechanical impurities with size being from 2 mm depending on dimensions of the bar openings between filtering plates . The availability of larger impurities in waste liquids is not a limiting factor for their application. The characteristics of step screens are indicated in Table 1. Plants may be applied both for treatment of industrial and domestic wastewater.

Besides, they may be also utilized for treatment of sticking and fibrous impurities. If required, the plants may be used for filtering the raw sludge from the primary sumps before their mechanical dehydration in the units sensitive to the rough and fibrous mpurities (centrifugal separators, pressure filter and centrifuges) contained in dewatered slurry.

By other words, the screens represent a universal device for treatment of different kinds of the wastewater pollution.

The plants represent a multistage screen consisting of a set of mobile and fixed step plates assembled in packages with fixed bar openings between plates of mobile and fixed packages.

Waste entrapped on the filtering plates will form an additional filtering layer providing the best effect of treatment. Due to the circular movements of the mobile step plates, impurities are lifted up stepwise and supplied further for collection and transportation.

All the moving units and parts of the drive mechanism e are mounted so that they never contact with waste liquids that increases reliability and durability of the drive.

The filtering plates, frame and other elements of the screen contacting the liquid are made of stainless steel.

Main operational advantage of multistage screens of cascade type PC is their reliability and durability. Utilization of the screens at the treatment plants for tanning production at the Joint Stock Company "A Radishchev" (two screens PC-630 used since 1992) demonstrated that each of the installed screens operated three years without overhaul and failures of the mechanical part. The screens operate in an automatic mode, attendance is minimized.

Use of the screens at the treatment plants installed in the town of Pushkin (step screen PC-630 operates since 1993 and three step screens PC-1560 operate since 1995) has shown a significant reduction of labor content of the repairs for maintaining their serviceability.

Use of multistage screens at the Central Aeration Station (CAS) of Saint-Petersburg (beginning in 1992, two screens PC-630 with press-transporter ПТГ-300, two screens PC-1000 also with press-transporter and six screens PC-1960 were successively put into operation) has shown that only one from two screens PC-630 operating practically continuously within four years under heavy conditions of filtering of raw sludge has been repaired with partial replacement of the bars.

The application of the multistage screens at the preliminary stage of the treatment allows to improve considerably the operating conditions of the consequent technological structures and equipment.

Use of screens PC-630 with bar openings 2 mm in the flow of a raw sludge and then screens PC-1000 with bar openings 2 mm in the flow of a mix of a raw sludge with compacted excessive active silt, has allowed the Central Aeration Station completely to decide a long-term problem of fibrous and raw waste clogging of the process equipment of the shop for dehydration of sludge (metering pumps, pipelines, gate valves, centrifuges and centrifugal presses) used for mechanical dewatering up to 4800 cu m/day of slurry.

Use of the screens at the treatment plants of the town of Pushkin has allowed to liquidate a constant clearing the rags from hydraulic elevators installed at the sand traps and centrifugal pumps when pumping the raw sludge from the primary sumps. Besides, screen PC-630 operated since 1993, is used for prevention of clogging the screw conveyers of the centrifuges when dewatering the sludge at the sewage works of the town of Pushkin.

In conformity with the prepared calculations, the annual economic benefit of introduction of the computer-aided multistage screens of cascade type PC-1960 in the main flow of the Central Aeration Station of Saint-Petersburg is equal to 287,199 thousand rubles annually or 524.6 rubles for 1000 cu m of waste liquids.

Conclusions.

On the basis of the aforementioned it seems to us expedient to proceed as follows:

- To organize production and universal introduction of computer-aided multistage screens of cascade type PC at all the aeration stations, water treatment plants of the factories, industrial enterprises and farm businesses of the Russian Federation;
- To ask the Municipal Services Academy and the Water Supply and Water Drain Russian Association to transfer experience of application of the computer-aided multistage screens of cascade type PC in the Russian Federation and abroad;
- To include the computer-aided multistage screens of cascade type PC in Building Code 2.04.03-85 " Sewerage. Exterior Networks and Structures "(Section 5. Pump- and Blowing Houses. And Section 6. Treatment Works).

Table 1. Technical characteristics of step screens of Company "RIOTEK"

Ser. No.	Parameter name			Symbol		Size		Product's index	
				PC-500	PC-630	PC-1000	PC-1560	PC-1930	PC-1960
1	Width of screen - width of duct (tank)	A	mm	500	630	1060	1560	1930	1960
2	Width of filtering part	Б	mm	350	440	840	1270	1645	1670
3	Total height	B	mm	1320	1580	2530	4420	4907	5050
4	Length	Г	mm	850	1160	1440	2420	2720	2820
5	Height of sludge unloading	Д	mm	750	890	1500	2960	3650	3650
6	Maximum depth of duct (tank)	E	mm	800	1000	1500	2070	2000	3000
7	Width of bar openings	S	mm	2	2	2	4	6	6
8	Thickness of filtering plates	T	mm	2	3	3	3	3	3
9	Nominal capacity as per liquid wastes	Qc	cu m/h	210	280	970	2500	4300	5900
10	Nominal capacity as per raw sludge	Qco	cu m/h	150	200	750			
11	Weight w/o tank	G	kg	255	615	2050	6640	7980	8020
12	Weight of tank, not more than	Gб	kg	125	175	330			
13	Liquid maximum level in front of screen	H	mm	500	660	1200	1400	1700	2200
14	Electric motor power	W	kW	0.37	1.5	1.5	2.2	2.2	2.2

WORKING OUT THE PROCESS AND METHOD OF MEMBRANE APPARATUS DESIGN FOR CELLULOSE-PAPER MANUFACTURES DRAINS PURIFICATION

Mynin V.N., Terpugov G. V.
D. Mendeleyev University of Chemical Technology of Moscow, Russia

Separation by baromembrane methods, which are reverse osmosis and ultrafiltration, provide effective purification of the different types of waste water. For instance, application of these methods allows to decrease the oxidity of the Baykal cellulose plant wastes to 15-17 mg of O_2 per liter and the chromaticity to 8-17°. Oxidity of the water after the purification according to the active technology is about 100 mg of O_2 per liter and its chromaticity is about 110°. The water purified by half-permeable membranes can be applied in the technological process. It will allow to create the closed system of water-consumption at the Baykal and the others cellulose-paper plants.

The concentration of substances in the divided solution is an important factor for the efficiency of waste waters and

solutions separation by baromembrane methods. The influence of the concentration of the dissolved substances and osmotic pressure of the waste waters in cellulose sulfite manufacture on the permeability and selectivity of polymer (composite) membranes is investigated in the present work. The dependence of the above mentioned factors and the pressure used on the permeability of the membranes has been obtained.

$$G=G_0-G_0 \cdot c \cdot \lg X_1 \qquad (1)$$

where: G - permeability of solution

G_0 - permeability of water

c - coefficient (dependent of the transmembrane pressure)

X_1 – solut concentration in the feed flow

We obtained the correlation equations(2-4) between the membrane selectivity on mineral (φ_{min}), organic (φ_{org}) and lignin (φ_{lig}) components of the waste waters and the membrane selectivity by standard solution of NaCl.

$$\varphi_{lig} = 99{,}25 + 0{,}0075 \cdot \varphi_{NaCl} \qquad (2)$$

$$\varphi_{org} = 96 + 0{,}04 \cdot \varphi_{NaCl} \qquad (3)$$

$$\varphi_{min} = 84 + 0{,}26 \cdot \varphi_{NaCl} \qquad (4)$$

where $\varphi_{NaCl} = 50 \div 100\%$

The selectivity by the standard solution of NaCl is pointed in the technical conditions of the membranes or the membrane apparatus exploitation.

The dependence mentioned above combined with material balance equations can be recommended for a technological design of membrane apparatus for processing waste waters in cellulose-paper manufacture and inorganic salt solutions.

For instance, the present method of membrane apparatus design was successfully applied in the project of water desalinization plant in Republic of South Africa.

The membrane apparatus will provide the manufacture of 10 000 cub m per 24 hours of sweat water from the salt water, containing Na^+, Mg^{2+}, Ca^{2+}, U^{2+}, Cl^-, SO_4^{2-} and other ions.

RESOURCE SAVING METHODS OF INDUSTRIAL WASTEWATER TREATMENT

Naidenko V.V., Gubanov L.N.
N.Novgorod State University of Architecture and Civil Engineering, N.Novgorod, Russia

The development of efficient resource saving technologies of water use for industrial application providing reduction of raw material losses in production and product recovery for further recycling has become very relevant nowadays.

There are many low-waste and non-waste water supply systems developed in our country and abroad for individual production processes and production lines aimed at solving this problem.

The problem is mostly solved in two ways.

The first direction consists in taking respective organizational and technological measures:

- change of process solutions and electrolytes (replacing toxic and concentrated solutions by less toxic and low concentration solutions);
- multiple reuse of solutions in technological process;
- introduction of flexible automated technological systems;
- rational water use in production and washing operations.

It is possible to achieve considerable saving of water and reduction of material losses in production at the organizational and technological development stage.

Thus, in an electroplating production process the amount of wastes getting into the sewer system can be reduced 1.5-2.5 times through implementing the above listed organizational and technological measures.

The efficiency in development of low-waste and non-waste technologies is greatly determined by the availability of timely information on the amount and quality of influent coming into the treatment plant in any period of time and at any treatment stage, and by optimization of water consuming production processes. N.Nogorod State University of Architecture and Civil Engineering has developed computer design methds giving comparative data on wash water use and changes in wash water concentration for any application to product washing technologies which permits selecting an optimum process option depending on specific conditions.

The second direction involves development of local (in-plant) law-waste and non-waste systems designed for product recovery, reactivation of waste solutions on the spot, at the source of wastewater.

N.Novgorod State University of Architecture and Civil Engineering has carried out a large volume of R & D work in creating local in-plant non-waste technologies covering the main production processes in machine-building industry - electroplating (degreasing, etching, plating); manufacture of semiconductors (machining, chemical treatment, photo-lithography processes, production of arsene, etc.); in food industry - manufacture of milk products, confectionery, bakery, alkoholic beveriges and soft drinks, etc.

In developing low-waste technologies preference is given to the methods based on removal of pollutants from wastewater which allows their extraction in a pure form avoiding changes in their physico-chemical condition and secondary pollution with chemical agents and destruction products - microfiltration, ultrafiltration, reverse osmosis, electrodialysis and other.

ANAEROBIC BIOLOGICAL PROCESSES AND PLANTS FOR WASTEWATER TREATMENT

Naidenko V.V., Kolesov Yu.F., Katrayeva I.V.
N.Novgorod State University of Architecture and Civil Engineering, N.Novgorod, Russia

There is an obvious trend to use anaerobic biological methods in the development and implementation of processes and equipment for industrial and domestic wastewater treatment. This is caused by the fact that, besides fulfilling conventional tasks, treatment plants have to meet the requirements which can not be satisfied by aerobic treatment processes, and can only be coped with by means of anaerobic processes. The latter include denitrification, dephosphating, desulphating, heavy metal removing and degradation of bioresistant organic compounds.

Howrver, wide-scale application of such plants is limited due to low rate of growtb and sedimentation of anaerobic sludge. Without special measures to keep anaerobic sludge in the reaction zone longer it is impossible to reach high plant capacity and effluent quality. This is most pronounced in treatment of domestic sewage carrying low organic load and where sludge carry over exceeds its growth.

Gravity type sludge thickeners, filters and biofilters, immobilized sludge can reduce sludge carry over down to 1,500-2,000 mg/l but even this cannot ensure raising MLSS up to 40-50 mg/l and creating favourable conditions for treatment of low concentration wastewater,

N.Novgorod State University of Architecture and Civil Engineering has developed a biosorption unit "Biosorb" designed for anaerobic wastewater tretment in a fluidized sludge blanket. The unit can treat wastewater of any concentrations due to sustained high anaerobic MLSS values, anaerobic sludge being aggregated in dense granules having high fall velocity. The unit consists of a cylindrical vertical column housing a coaxially located another column. The upper portion of the unit is fitted with a sludge flocculation zone. The inner cylinder contains recycling water and the influent undergoing treatment . The outer cylinder holding only the influent under treatment.

The structural designs of the column type unit "Biosorb" measure 1.5 m, 3.0 m and 3.4 m in diameter; 6 m, 12 m and 20 m high and 8 - 180 cu.m in volume. The capacity of the unit is 2-60 cu.m/hr. There are five installation of this type in operation at the moment used for treatment of wastewater from a number of milk plants, dye wastes, a knitting factory and domestic wastewater. All the installations feature 40-200 mg/l of suspended solids in the treated effluent and 20-50 g/l of MLSS in the biochemical reaction zone. The operation practice has shown that the installations are capable of stable operation with influent of variable quality (weeends are days off with zero wastewater discharge).

The advantages of the anaerobic process can best be realized in an anaerobic/aerobic process, the structural features of the anaerobic and aerobic treatment stages being the same.

The "Biosorb" installation wastes are in great demand. They are represented by biogas used for fuel and anaerobically mineralized sludge used as fertilizer. If the volume and sorts of wastes were to be taken as a criterion in evaluation of wastewater treatment plant construction projects, physico-chemical treatment processes would undoubtedly be rejected, particularly for degreasing and SS removal from wastewater in agricultural product processing industry. Concentrated wastes should directly go into biological treatment pjrocess to increase the production of the biogas and the fertilizer.

FACTORY BUILT PACKAGE UNITS FOR TREATMENT OF SEWAGE

Neparidze R.S.
Municipal Water Supply & Treatment Research Institute
Nikoladze G.I.
Moscow Stale Building University, Moscow. Russia

Sewarage

In recent years, inreased requirements as to quality of treated sewage effluent discharged into water bodies of public use have made it necessary to find out methods of additional treatment, complementing conventional secondary treatment. These requirements primarily refer to more effective removal of suspended and organic matter biogenic elements, a number of specific pollutants: synthetic detergents, oil products, heavy metals, etc.

When treated sewage is discharged into water bodies with small tranzit flow, strict regulations are applied to treatment level for phosphorus compounds. As a rule BOD and SS in treated water must be below 3 mg/l each. Depending on ecological situation, in some regions of the country even stricter regulations are applied. For example, according to "Norms of allowable effect on ecological system of the Lake Baikal" the regulations are considerably increased, and for some subatances the following Maximum allowable concentrations are established (mg/l):

- aluminium - 0,08 COD - 30
- iron - 0,05 oxygen dissolved - 6
- sodium - 12 (no less than)
- chlorides - 30 suspended solids - 5
- calcium - 20 ammonia - 0,05
- magnesium - 4 nitrite ion - 0,02
- sulfates - 10 nitrate ion - 5

• total salts - 100 phosphate ion - 0,04

• BODя45я0 - 2 synthetic detergents - 0

To ensure the required quality of treated sewage in BODя45я0,, ammonia nitrogen, hardness, total salts there are no universally known treatment plants.

In the process of these studies, it became evident that attaining the stated sewage treatment level was possible only by combining bio-logical, physical-chemical and ion-exchange methods in multi-stage treatment schemes using the "Rutchey-M", "Dephosphate", ion-exchage filters, and ozonators.

As a result of experimental studies, together with testing de-sign parameters of structures on pilot and commercial units, a technological treatment scheme was developed and recommended for use. The scheme includes the following processes and units:

• removal of floating pollutans and sand by screens and grit chambers,

• regulation of flow in a storage tank,

• two-stage biological treatment in aeration-and-settling tanks, phosphate removal in "Dephosphate" unit,

• intensive additional treatment in activated carbon filters,

• desalination in ion-exchange filters,

• disinfecting of water by ozone,

• sludge treatment in aerobic stabilizers and dewatering by filter-process.

The data obtained when implementing the above technological scheme satisfy high level of treatment and indicate that the level of residual organic pollutants in treated water does not exceed that in drinking water.

The technological scheme is developed in separate blocks, so that it is possible to ensure necessary treatment level with minimum capital expenditute and for any requirement as to treated effluent quality.

On the basis of this technological scheme, design documents for a factory built unit intensive sewage treatment have been worked out. The described technology has been commissioned at a plant in the Samara region, another plant is under construction near the Baikal Lake.

FINE BUBBLE AERATION SYSTEM "RUTCHEY"

Neparidze R.S.
Municipal Water Supply and Treatment Research Institute

Sewarage

When sewage in treated in aeration performs two main functions:

• first, it ensures saturation of biomass with oxygen;

• second, it guarantees sufficient and uniform mixing of mixed liquor at every point of the aeration tank.

Aeration in the most significant part of biological treatment process. The cost of aeration is a basic item in total operating cost of secondary treatment. Power used in aeration makes up 15 to 80 per cent of total power consumption that treatment. Meanwhile capital cost of an aeration system is but 1 to 2 per cent of total capital cost of the treatment plant.

An effective fine bubble disk aeration system developed by the Institute (Fig 1) ensures optimum economic effect, enables to distribute aerators over the whole area of an aeration tank. Owing to this, in comparison to other aeration systems (perforated pipes, porous tubes and plates and others), the new aerators ensure a decreased aeration intensity and a corresponding decrease in pomer consumption reaching 35 to 40 per cent.

Fine bubble aeration system, as compared to coarse bubble system, has considerable advantages achieving a more effective technological treatment process, namely:

• uniform and steady mixing of activated sludge throughout the whole aeration tank volume prevents breaking up of floc and does not deteriorate settling properties of the sludge,

• it ensures optimum mixing of activated sludge and uniform distribution of oxygen content,

• it eliminates bacterial aerosols above aeration tanks and at the plant territory,

• in winter conditions fine bubble aeration does not cause cooling of sludge and thus does not retard the biological process,

• it ensures optimum control parameters.

Fine bubble plastie aerators Rutchey have bcen developed as a result of long research and field work done by the Municipal Water Supply and Treatment Research Institute. The basie working element of the Rutchey aerators is porous polyethylene.

The first systems with these aerators were assembled at the Sochi treatment plant. They have been in operation for eight years with no faults. Long field testing of the aerations has shown thein functional reliability, flexibility in operation and simplicity of servicing.

Technical parameters of the Rutchey aerators are as follows:

• aerator diameter - 215 mm,

• air bubble size - 0.5-2.0 mm,

• air flow through an aerator - 5-8 m /hr,

• loss of head - 100-200 mm,

• air use coefficient - 15-25 per cent,

• operation period - not less than 20 years.

Compaved to conventional ceramie plates and perforated pipes the Rutchey aerators ensure a decrease in capital cost by 40 to 50 per cent, power use by 40 per cent, loss of head of air 1.5 to 2 times.

RETROFITTING OF CO-FLOW REGENERATED PLANTS USING UPCORE* TECHNOLOGY

Newell P.A., Medete A.

The use of co-flow regeneration for ion-exchange resins in Western European water treatment plants has over the last 25 years largely given way to counter-flow regeneration due to advantages in regeneration efficiency and savings in service water. However, more complicated system design and the failure of some earlier plants impaired the use of this technology in some regions of the world, such as the USA. As a result there are many old and new water treatment plants using co-flow regeneration in operation today.

The advent of packed bed systems in the 1980s served to further improve counter-flow regeneration technology by providing optimum usage of the ion exchange vessels.

The UPCORE system is one of these but is differentiated by having downflow service and upflow regeneration. During each regeneration cycle the solids filtered out by the top portion of the resin bed pass through an inert, floating granular material. This key operation enables the system to cope with higher levels of suspended solids than other packed bed systems and make it especially suited to the retrofit of co-flow regenerated plants. Existing vessels can be used and the amount of regenerant and service water drastically reduced while simplifying plant operations.

This paper outlines the experience of retrofitting 3 different plants in Italy, Hungary and France, showing the economic benefits and compares the before and after plant performance.

The first case is a petrochemical plant in Northern Italy where the water treatment plant, comprised 6 X 180 m3/h lines, was 25 years old and was retrofitted in 1988. With a need to increase demineralised water output a new line was first considered before finally retrofitting with UPCORE technology was chosen from a study of other counter-flow alternatives.

At first a single vessel was converted to confirm the claimed benefits. After 3 months of successful operation the other vessels were also retrofitted.The co-flow plant, which treats river water, comprised Strong cation - Weak anion - degas - Strong anion. The use of lime pretreatment was discontinued and the layout changed to Weak cation - Strong cation - degas - Layered Bed anion. The lines were modified two at a time to ensure an uninterrupted supply of water and the conversion was completed in six months.

Three changes were required - the interconnecting pipes for the vessels were rearranged, the regenerant lines were modified to allow counter-flow regeneration and a top distributor was added to replace the simple splash plate previously used.

The objectives of the retrofit were more than achieved:

- elimination of lime pretreatment,
- 33-38% reduction in HCl and NaOH,
- service water almost halved,
- 28% reduction in costs of power, steam, water and chemicals,
- savings overall of $926 M$/year (over a seven year period) vs an initial cost of $740 M$ for the retrofit - a payback time of under a year.

The second example is a fertiliser plant in Hungary with a 4 X 115 m3/h water treatment plant which converted one line in 1995 to an UPCORE system. The coflow plant, treating mainly well water, comprised Stong cation - Weak anion - Stong anion and is preceded by lime softening. Only the strong caton and strong anion vessels were retrofitted, leaving the weak anion in co-flow mode. The outcome of the retrofit was:

- an increase in net output from 115 to 160 m^3/h,
- a 60% reduction in both HCl and NaOH consumption,
- 55% reduction in service water needs,
- an improvement in treated water quality from 0.4 to 0.1 µS/cm and 60 to 13 ppb SiO_2,
- regenerant time was halved.

The third case is a fertiliser plant in France which was retrofitted in 1992. The water treatment plant was then 12 years old and comprised 3 X 75m3/h strong cation-Stratabed anion lines using nitric acid as the cation resin regenerant and lime pretreatment. The conversion was carried out in the one week annual plant shutdown and then finalised with added automation in the following four weeks, during which demineralised water was produced.

The final 2 X 100m3/h strong cation-degas- strong anion type II lines showed the following advantages:

- elimination of lime pretreatment,
- treated water quality from 2 µS/cm to 0.2-0.5 µS/cm and 10ppb to 2-5ppb SiO_2,
- acid and caustic regenerant cut by 35-40%,
- regeneration time cut from 5 hours to under 2 hours,
- net demineralised water per cycle for the plant increased from 1250m3 to 1660m^3.

Automation added resulted in manpower reductions from 5 to under one manyears and the cost of the retrofit was estimated by the OEM involved to be 60% of the cost of a new plant. The pay back time for the investment was under two years.

The above three cases are taken from a growing number of end users who are now benefitting from converting their old co-flow plants to packed bed counter-flow using UPCORE technology. The improvements in treated water quality and quantity are accompanied by appreciable savings in regenerants, service water and regeneration time. The process is relatively simple and lends itself readily to automation.

This retrofit option should seriously be considered by water treatment plant users who have a co-flow regenerated system and who need more water, a higher quality water or wish to save chemicals, before deciding to purchase a new plant.

THE NEW METHOD FOR METEOROLOGICAL WATER & SLUDGE TREATMENT

Paldjaeva N. P., Malinina I. V., Vaisfeld B. A., Palgounov P. P., Varjushina G. P.
MOSVODOKANALNIIPROJECT Moscow Institute for Water & Wastewater Research & Design, Moscow, Russia

MOSVODOKANALNIIPROJECT Moscow Institute for Water & Wastewater Research & Design has developed a new method for meteorological water (rain water, melt water), watering & wash wastewater and sludge treatment.

The concept of meteorological water treatment is as follows: all the precipitations from a given territory are collected into an intermediate storage reservoir and then the clarified water is pumped to a three-stage pressure filter operated in sequence. After treatment by means of grained bed and sorption bed filters of various fractional composition the water is accumulated in a clear-water reservoir. The sludge is pumped from the intermediate storage reservoir to a sand plot for dewatering. The efficiency of water treatment completely meets the existing standard requirements established for effluent water discharge into the water bodies of fishing quality. The effluent water may be used for territory and greenery watering, for the process needs of industrial enterprises as well as for boiler houses water supply. The treated sludge water content is 40 per cent and the fact meets the requirements established for the sludges to be conveyed by means of motor transport. The petroleum products are accumulated in petroleum separators and are periodically conveyed by means of motor transport for utilization.

The novelty of the approach proposed is corroborated by six patents; the method for meteorological, watering & wash wastewater and sludge treatment is agreed with and approved by MOSVODOSTOK, MOSKOMPRIRODA, MOSGOREXPERTIZA and the Sanitary Inspection Organs.

PURIFICATION OF WASTED SMOOTHING LIQUIDS BY MEANS OF MEMBRANE TECNOLOGY

Parusov D.V., Kagramanov G.G.
Mendeleev University of Chemical Technology, Moscow, Russia
Khanturgaev G.A.
Technological University of East Siberia, Ulan-Ude, Russia

Since the State Comitee of Enviromental Protection has restricted the amount and quality of industrial water to be wasted, there has been an increased demand for introdusing recycling methods of wasted water treatment in industry. It is especially important in areas close to Baikal Lake - the district of special enviromental concern, the oldest lake of Earth, where concentrated 20 % world water fresh supply.

A scheme designed on the base of our investigations with some contemporary methods of purification for wasted water. The sceme includes following:

1. Addition of coagulant (15% solution of Al2(SO4)3 in ratio 1:25 to the smoothing liquid.
2. Getting the solution mixed by air within 10-20 min.
3. Forming the sediment within 6-10 haurs.
4. Filtration the suspense through a cloth filter under pressure, removal of water - free sediment and pumping of the light liquid into a storege tank.
5. Micro - or - ultrafiltration of obtained liquid in a membrane unit.
6. Adsorbtion of organic admixtures on a carbon filter.
7. Reverse osmosis.
8. Stem-boiter bor the concentrate (see stage 7).

After coagulation and consecuent ultrafiltration it is passible to reduce chemical oxigen demand to 1500-1600 mg/l and obtain a solution with salt concentration in filtrate about 1,5-1,8 g/l. It enables filtrate to be used as a new portion to existing smoothing liquid. Then after 4 -5 cycles sulfates concentration in the filtrate reaches 5 -6 g/l, that prevents it from further exploitation. Our sceme presumes reverse osmosis apparatus with composite membranes to solve this problem. As an earlier stage before this apparatus it is recommended to install carbon filter bor protection membrane from organic phase. The best filtering material for this filter is semi-melted coal. After R.O. the concentrate is directed into a steam-boiler and the filtrate returns to cycle again. When being used the coal is utilized in a stove, so that its heat ability increases by 7-8%. The sediment obtained during coagulation can be also fired after getting dry and the ash, which obviously consists of iron and aluminium oxides, can be used as a filling to cement.

The investigations were caried out with following kinds of apparatus:

1. Pipe membrane unit filled by membranes made of oxide ceramics and covered by oxide aluminium and silicium selective layer. The process utilized circulation and constant filtrate removal. The operating conditions range from 1,5-2,5 bar of pressure differential and the temperature about 35-40oC. The process is caried out in turbulent regime, including periodic membrane backwash.
2. Microfiltrating co-curent unit utilizing roling metal-ceramic membranes. The composition of membranes is based on titanium or nikel. The unit is comhpact, has high flow rate and low membrane loading density at the same time. A vast range of membranes can be used in this

construction, such as metal ceramic, porous nikel and synthetic polimer films. In this particular case polimer films are sticked and supported by means of cylindric porous membrane, which serves as a base for selective layer.

Porous staintess steel membranes were exploited in a wide range of temperature - from 20 up to 80oC and in the pH intervals from 2 to 12 and working pressure from 0,05 to 0,4 MPa. The investigations and approbation on "Buriat Laundries Ltd" and the shipyards proved that microfiltration technology, utilizing porous stainless steel membranes is a proper choice when dealing with industrial waste waters in first stage of purification.

PROCESSING OF SEWAGE SLUDGES, CONTAINING INCREASED AMOUNT OF HEAVY METALS, WITH USE OF ACID REAGENTS

Petrov V. G., Makhnyev Ye. S., Trubachyev A. V.
Institute of the Applied Mechanics, Ural Branch of the Russian Academy of Sciences, Izhevsk, Russia

The salvaging of the sewage sludges (SS) is a serious ecological and technical problem, as far as their use as an organic fertilizer is excluded, despite of the great amount of valuable substances in SS [1], since the pollution and poisoning of the agricultural soils and production by heavy metals (KM) can occur. Besides, plenty of colour and rare metals are irrevocably lost. The content of macro- impurities of HM in SS, as a rule, changes from 0,1 up to 1%. Therefore the SS can be considered as weakly-beneficiated ores, for which hydrometallurgical schemes of processing with application of acid reagents are effectively used [2].

We have developed the technology of salvaging of the SS with the use of the solutions of sulfuric and nitric acids [3,4] for extraction of HM from the sludges. The extraction of metals from the SS makes 90 - 95 38. The sludge purified from metals is processed into organo-mineral fertilizer (OMF). The researches on the residual content of HM in OMF were conducted in All-Russia Research, Design and Project Technological Institute of Organic Fertilizers and Peat (VNIPTIOU, Vladimir). The results of the researches have allowed to make the conclusion, that the level of the contents of the mobile forms of HM in OMF is close to their background content in chernozem and gray wood agricultural soils of suburban regions and the general content of HM in OMF satisfies to the specification TU-9849-018-00483470-93. Taking this into consideration, it was recommended to use the OMF as the fertilizer in optimum agronomic dozes equal to 20 -30 tons of a dry precipitate per 1 hectare [5].The formulation of the production of the OMF was developed together with Izhevsk Academy of Agriculture and the test of the received OMF has been carried out by introducing it into the soils where technical cultures are grown in the educational facilities of Izhevsk Academy of Agriculture .The received results have allowed to make the conclusion, that the given OMF can be considered as a valuable fertilizer in agricultural production [6]. The method of granulation of the OMF has been developed.

Besides the OMF, the concentrates of metals and building material from Ss can be also produced on the basis of plaster binding. The concentrates of metals can be considered as a raw material in metallurgy. The receiving of the industrial production can be carried out at the specialized enterprises. The building material can be used as it is and also as additives to various kinds of cement.

The tests of the technology were conducted not only for the SS of Izhevsk but also for SS of the cities of Moscow, Chelyabinsk, Riga, Ryasan. In all cases the identical result was received as far as the extraction of metals from SS is concerned. However only in Chelyabinsk the level of pollution of the SS by HM was close to the level of pollution in the city of Izhevsk. In Moscow and Riga the content of HM in sludges was, as a rule, in 2-3 times lower taking into account certain macro-impurities of HM. In our opinion, it is expedient to use the developed technology for strongly polluted SS by HM of such big industrial centres as Izhevsk, Chelyabinsk and others. At present with regard to the developed technology the pilot-installation with the productivity of 30-40 kgs of OMF during one shift is created. The production of an experimental consignment of OMF equal to 30 tons is agreed with the Body of sanitary Inspection. The project of a pilot plant with the productivity of 1 ton of OMF during one shift has been developed.

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ENSURING ECOLOGICAL RELIABILITY WHILE OPERATING WATER-DRAINING SYSTEMS OF NOVOSIBIRSK

Pokhil U. N., Ivanov O. V., Nikitin A. M.
Municipal United Firm "Gorvodokanal", Russia

Preservation of clean water environment in conditions of inchasing antropogenetic and technogenetic influence can be achieved only under reliable water-draining system operation as a whole. Devided water-draining system with the length of networks and interceptors more then 1000 m is characteristic of Novosibirsk. Discharge water is pumped over by 33 pumping stations. The output of operating sewerage structures is 800.000 m3 per day while the designed output is 1.200.000 m3 per day. However there are cases of not purified or not fully purified discharge water dropping into the river of and it's tributaries.

For ensuring reliability of water draining systems operation and for excluding not purified discharge water dropping into the reservoirs Municipal United Firm "Gorvodokanal" worked out a direction including perspective development reconstruction and technical reequipment of water draining structures.

The main tasks of this direction are:

- construction of sewerage pumping stations, networks and interceptors including additional ducere across the river of;
- completion of construction of starting complex of water treatment structures of the second turn;
- reconstruction of mechanical and biological treatment structures and their reequipment including transition of airtanks in a small bubble system of aeration;
- realization of measures in dehydration of sludge, its deponering (storage) and utilization;
- improvement and computerization of water treatment structures work;
- introduction of automating system of technological processes control of water treatment structures;
- introduction of different methods of reconstructing networks without excavation;
- survey and protection of deep stratification interceptors from gas corrosion;
- diagnostics and washing of networks and interceptors to decrease breakdowns and to stop discharge water dropping.

Solution of above mentioned tasks and measures allows Municipal United Firm "Gorvodokanal" to increase reliability of water-drinking system operation and decrease probability of reservoirs pollution.

ELECTROCHEMICAL OXIDIZING TECHNOLOGY FOR NEUTRALIZATION OF ECOTOXICANTS

Potapova G.F., Putilov A.V., Klochihin V.L., Kozlova N.V., Shestakova O.V., Filatov D.I.
State Research Center of Russian Federation "L.Ya. Karpov Research Institute of Physical Chemistry", Moscow

In the State Researsh Center of Russian Federation "L.Ya. Karpov Research Institute of Physical Chemistry" investigations on technology and installations for electrochemical oxidizing of ecotoxicants are carrying out [1]. Industrial waste waters were exposed to ozone-peroxide-electrochemical processing in diaphragm-type electrolyser. The ozone-oxygen mix is generated on the glass carbon SU-20 anode with concentration of ozone up to 20-25 %, and on the glass carbon cathode of type SU-20 or on a graphite carbon fabric or on a graphite carbon fabric + a nickel net. Hydrogen peroxide with concentration up to 1-5 % was generated during cathode reduction of oxygen. We measured concentration of ozone in a gas phase at inlet and outlet of reactor, chemical oxygen demand (COD), quantity of formed carbon dioxide and change of optical density of a solution.

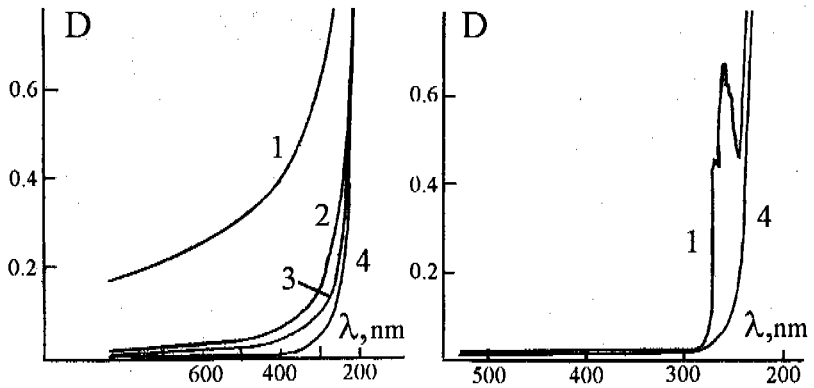

Fig. 1. Optical absorption spectra of initial waste water (1), after 40 min treatment (pH=10-12) by ozone only (2), peroxide-electrochemical treatment (3), and after combined ozone-peroxide-electrochemical treatment (4). Left - waste water of car-care center, right - a model mixture containing chlorobenzene

In the Fig. 1 the results of clearing of waste water of car-care center are presented. We see, that the rate of sinergetic destruction of organic pollution grows at the combined influence of an electrical current, ozone, hydrogen peroxide. The degree of neutralization (DN) is 82 % at peroxide-electrochemical treatment, 93% - at ozone-peroxide-electrochemical with a doze of ozone 27 mg/lh. Oxidation in a liquid phase by ozone only (490 mg/lh and DN = 72 %) is much less effective.

Ozone-peroxide-electrochemical method is effective one for render harmless of chlororganic compounds. A degree of purification of typical solution: 0.01 M of chlorobenzene + dimethylsulfoxide + sodium hydrate + water is 90,6 % after 40 minutes of electrolysis on a graphite carbon fabric + a nickel net. Obviously, the reduction process of dehalogenation of chloro-benzene to benzene is proceeding on cathode [2] and subsequently oxidizing splitting of an aromatic cycle by molecular ozone and hydrogen peroxide and products of their disintegration take place. The benzene band (274 nm) on D -l graph disappears after treatment.

In the Fig. 2 the kinetics of ozone-peroxide-electrochemical treatment of waste water (at pHK = 7) of plastic manufacture is given. Efficiency of ozone-peroxide-electrochemical method also is high. We see, that the quantity of formed carbon dioxide grows and COD of waste water decreases. After 60 minutes of processing DN = 82 %, though it equals 75 % at simple ozonation after 2 hours of processing. At ozone-peroxide-electrochemical treatment the oxidation rate appeared to be four times greater than at simple ozonation.

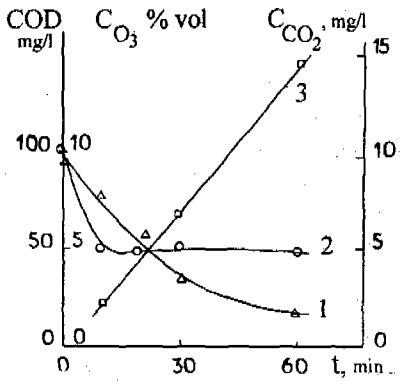

Fig. 2. The kinetics of ozone-peroxide-electrochemical clearing of waste water of plastics manufacture. 1- COD, 2- ozone volume concentration in ozone-oxigen mixture at outlet of reactor, 3- amount of carbon dioxide formed in an oxidation process.

It is necessary to note, that during the ozone-peroxide-electrochemical treatment of waste waters of various content the concentration of generated hydrogen peroxide is rather high, this allows one to prolong the purifying effect of ozone and save quality of treated water.

The utilization of the developed ozone-peroxide-electrochemical method in the water treatment technology and water-clearing installations will allow one to lower concentration of disinfectants, to reduce time of processing with the same anti-microbe effect. This technology is the perspective approach to minimize concentrations of ammonia, nitrate, nitrite and heavy metals too.

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HYDROCHLORIC ACID RECOVERY FROM SPENT PICKLING SOLUTION

Povorov A.A., Pavlova V.F., Erokhina L.V., Nacheva I.I., Krushatin A.V.
CJSC "Membranes", the city of Vladimir, Russia

The unit is designated for the production of the recovered hydrochloric acid with 20±4% mass. concentration from the spent pickling solutions (SPS) containg besides not consumed pickling acid (HCl) and iron chloride ($FeCl_2$) a large quantity of chlorous iron ($FeCl_3$) and organic surfactants (S).

SPS is charged through the prefiltration stage to the ultrafiltration module where under the pressure of 0.2-0.4 MPa the surfactant fraction is removed from the picking products. The ultrafiltration module is equipped with UFFK type fluoroplastic membrane having 0.5-0.6 MPa buble point. After organic additions major quantities removal the SPS is charged into the diaphragm electrolyzer where under the action of atomic oxygen anode deposition the electrochemical oxidation of ferrons iron into ferric one takes place.

MFFK microfiltration fluoroplastic membrane having 0.07±0.02 MPa buble point is used as a diaphragm. Ferric iron ($FeCl_3$) solution obtained is concentrated in the evaporator after water excess quantity removal and is charged into the hydrolyzer for the remained product hydrolysis. The developed hydrogen chloride is removed

from the system with water vapours not consumed in the hydrolysis reaction. The condensed and cooled product - hydrochloric acid (with the concentration up to 20±4% mass.) is recycled to the production - to the pickling both. Hydrolysis technological parameters variation allows to obtain either much concentrated or "poor" less than 15% acid solutions. For the condensation of not condensed during hydrolysis of hydrogen chloride vapours. An absorption stage is provided in the sceme.

Hydrolysis dry residue, containing, basically, iron hydroxydes is delivered to utilization. Ultrafiltration retentate presenting a surfactant fraction can be recycled to the pickling bath or can be realized in some other way.

The technology provides the development of energy beneficial production with concentrated hydrochloric acid and water closed loop recycle which is environmentally friendly. The unit has been commercialized in the town of Maloyaroslavetz (Kaluga region). Feed SPS output is 300 l/h.

INTEGRATED MEMBRANE TECHNOLOGY FOR LEATHER MANUFACTURE WASTE WATER TREATMENT

Povorov A.A., Dubyaga V.P., Erokhina L.V., Shinencova N.A.
CJSC "Membranes", Vladimir, Russia

An integrated membrane technology using nanofiltration (NF) membranes for leather manufacture effluents processing which combines ultrafiltration (UF) stages of the working solution presoaking, softening,pickling and tanning as well as those of reagent treatment, electrocoagulation, filtration, adsorption and desalination has been developed at CJSC "Membranes".

UF units with tubular ultrafiltration BTU 0.5/2 elements equipped with fluroplastic membranes have proved excellent for local treatment of the working presoaking, softening, pickling and tanning solutions.

Plant performance:

filtrate flux, m^3/h	- min. 0.3
membrane pore size range, A°	- 500-700
surface required, m^2	- 6
operating pressure, Mpa	- 0.3 - 0.45
working medium temperature, oegrees	- max. 50
flow rate over the membrane, m/sec	- 4 - 6
installed capacity, kw	- 3

Of interest for desalination stage is the application of new polymer NF membranes having different selectivity in respect to mono-bivalent ions.

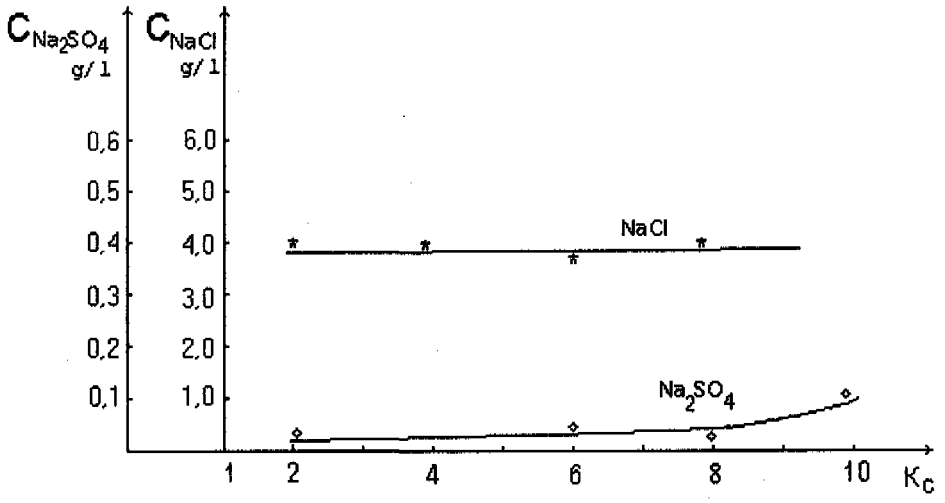


Fig. NaCl and Na_2SO_4 concentrations in permeate (c) against concentration coefficient (K_c). Operating pressure 2.0 MPa, temperature of the solution being separated - 18°C, feed solution NaCl concentration - 4,25% and that of Na_2SO_4 - 0.58%, K_c - the ratio of the concentration of the components being removed (NaCl and Na_2SO_4) in the retentate and their concentration in feed solution.

The figure shows the dependence of sodium chloride and sodium sulfate concentrations in permeate (c) on concentration coefficient(K_c) while using polyvinyl alcohol based NF membrane. 0.15% NaCl solution selectivity of the membrane at t = 25°C and p =1.5 MPa totals 30% and that of 0.2% $MgSO_4$ solution - 95%.

Thus, polymer NF membranes high (more than 95%) bivalent and low (less than 30%) monovalentions selectivity, allows to remove sodium chloride from the effluents and recycle it in the production.

New developed integrated technology makes leather manufacture process environmentally friendly and provides close loop water usage thus excluding environmental pollution and saves 70% of the reagents used at separate technological stages.

CHROMIUM-PLATING SPENT ELECTROLYTE ELECTROCHEMICAL RECOVERY

Povorov A.A., Pavlova V.F., Nacheva I.I., Grachev E.S.
CJSC "Membranes", Vladimir, Russia

A unit for chromium-plating spent electrolyte recovery with iron contaminants and ferric iron ions removal by electrochemical method which prolongs the electrolyte service life not decreasing the quality of piston rings chromium coating is described.

The process is conducted in a diaphragm 3-compartments titanium electrolyzer with textolite lining.

MFFK type microfiltration fluoroplastic membrane having 0.07±0.02 MPa buble point is used as a diaphragm. The cathods are made of titanium and the anodes - of ORTA. Placed in the anode compartment the electrode electric heaters are used to heat the electrolyte by alternating current.

At first iron contaminants are removed from the electrolyte which results in their concentration decrease to 2-3 g/l as against 11-15 g/l. Iron content concentration decrease is achieved during 20-22 at the temperature of 80-85° C. The metals of iron group recovered on the cathode under the action of the direct current are further used in metallurgy.

3-valents chromium ions are oxidized in the anode space to Cr(IV) with the temperature decrease down to 50° C, with current density of 10-13 A/dm^2 during 8 hours. Recovered chromium-plating electrolyte is recycled.

The unit developed on the basis of the above mentioned technology having 0.3 m^3/h output has been commercialized.

INTEGRATED MEMBRANE TECHNOLOGY FOR PROCESSING COPPER-CONTAINING ELECTROPLATING EFFLUENTS

Povorov A.A., Pavlova V.F., Erokhina L.V., Kolomeitseva O.N., Nacheva I.I.
CJSC "Membranes", Vladimir, Russia

Heavy metal environment pollution during the last years becomes a global problem.

The present-day water treatment methods do not provide the solution of the main task - the development of electroplating wastless technology.

An integrated membrane technology for processing copper-containing effluents which allows to process up to the required values and recycle:

- spent copper-containing washing waters;
- printed-curcuit card spent pickling solutions, containing ferrous and ferric iron;
- spent working solutions not containing iron.

The technology comprises washing waters Reverse Osmosis (RO) heavy metals concentrating with water processed up to the required values which allow it to be recycled, the retentate reagent treatment in order to deposit as heavy metal sludge followed by the product water evaporation up to the dry salts, the spent working solutions and sludge electrochemical treatment. RO separation is effected by two-stage scheme with the application of OPM-K type composite membranes having heavy metal selectivity min. 97.5% and mono-valent salts - min. 95%, stages operating pressure is 1.6-2.0 MPa.

The application of the electrolysis for the processing of the printed-circuit card spent pickling solutions containing copper, zinc, chlorous iron and iron chloride provides the isolation as metals of copper and zinc, oxidation of Fe(+2) into Fe(+3) in the electrolyser without the introduction of any extra substances which allows to recycle the working solutions.

The developed integrated technology allows:

- to recycle up to 95% of the product water in this case mineral salts retention rate amounts to 90-95%, that of heavy metals - 95%;
- to recycle to production spent recovered solutions;
- to obtain wastes as non-ferrous metal scrap and dry salts.

MANAGEMENT OF RESOURCES IN WATER MANAGEMENT

Radke
Berliner Wasserbetriebe, Berlin, Germany

The metropolis of Berlin is located at the junction of the rivers Spree and Havel in an area with many lakes. On the first glance these seem to be favourable hydrological conditions for supplying water and disposing sewage for more than 3.4 million people on an area of approx. 900 km^2. However, the situation is not that favourable because the mean annual precipitation is less than 600 mm and the mean surface run off below the city is only approx. 75m^3/s.

Yet, the work of the Berliner Wasserbetriebe is mainly based on the idea that adjacent regions or others which are farther away must not suffer due to our efforts to guaranty a proper water supply and sewage treatment. We refuse to transport water or sewage over long distances. With only one exception the eleven water abstraction installations are all located in Berlin. Most of the sewage treatment plants are located in the adjacent state of Brandenburg but the effluent is drained into the Berlin water system.

As precautional measure the Berliner Wasserbetriebe rely exclusively on using groundwater as raw water for drinking water supply. We use exclusively ecological treatment methods.

Due to the hydrogeological situation most of this groundwater (approx. 250 million m^3/a) results from bank filtration (57 per cent). We also use the method of artificial groundwater replenishment by means of pre-treated surface water (18 per cent). The remaining 25 per cent are the result of natural groundwater recharge.

On the other hand the Berlin surface waters are subject to other very intense forms of utilisation which are not always harmonising with the interests of water supply: navigation, process water abstraction for cooling purposes, outlet for releasing treated sewage and rainwater, etc.

The facts that groundwater abstraction is also done from bank filtration and that groundwater has to be replenished show how difficult the situation actually is for water supply.

Therefore the Berliner Wasserbetriebe will only be able to satisfy the demand for water supply and sewage disposal on the long run only in case they carry out a sustainable resource management. In doing so both quantitative and qualitative aspects have to be considered as being one entity.

Although the water authorities of each Federal State are responsible for balancing and protecting the groundwater resources according to the legal regulations of the Federal Republic of Germany it is the vital interest of the statutory company itself to manage the resources in a way that does not lead to its depletion.

This is why the Berliner Wasserbetriebe are at present introducing a new from of comprehensive resource management. In doing so they mainly rely on their own specialised staff but they are also using special services provided by a number of engineers' practices.

The water resource management system of the Berliner Wasserbetriebe has the following three main levels:

The basis is formed by Groundwater Monitoring Systems which are established for each abstraction area. By means of relational data bases we are storing all fixed and variable data which are related to groundwater of wells and piezometers and also other installations used for water management and we process these data to be able to use them for solving tasks related to water management. As part of the monitoring systems we are elaborating models of hydrogeological structures which include all geological and hydrological data in their horizontal and vertical distribution in visualised schemes.

These data bases and models of hydrogeological structures are forming the basis for the second level of resource management: the Permanently Available Models. These are three-dimensional, non-stationary, numerical groundwater flow models developed on the basis of uniform criteria for each water abstraction location. These individual models are forming part of a so-called regional model which is used as instrument for prognoses and as support in decision making processes for water management planning, for developing utilisation strategies, for assessing measures that will have an impact on the groundwater, for designing defence concepts against risks and for elaborating a proper geohydraulic basis for determining drinking water protection areas.

The plant related Control And Regulation Models are defined as third level. They are developed on the basis of the Permanently Available Models by means of so-called model reduction and therefore they require less powerful PCs. In contrast to the Permanently Available Models such a Control And Regulation Model usually refers only to that part of a water abstraction area that can be directly controlled by the relevant water works and thus it is to be understood as model of a detail. The calculation results form the basis for decisions concerning the actual operation of the relevant water works.

By means of applying the above mentioned three levels of water resource management the Berliner Wasserbetriebe will be able to fulfil the controlling requirements of the water authorities with respect to sustainable groundwater utilisation on the one hand. On the other hand the application of these three levels will enable them to achieve a better harmony of their economic interests and their duty of supply and thus to save costs. Long-term changes of the quality or quantity of the resource will be realised easier and their consequences can be better assessed. This also refers to the possibilities of controlling groundwater contaminations.

Finally, a comprehensive management system will be helpful in gathering evidence for the effects of groundwater utilisation. Thus the statutory company will find it easier to refute unjustified claims raised by third parties.

APPLICATION OF THE COMPLEX OF MATHEMATICAL MODELS FOR ESTIMATION OF THE NITRATE POLLUTION LEVEL OF DRAYAGE WATERS

Rainin V.E., Dobrachev U.P., Lazich P.U.
All-Russian Research Institute of Hydraulic Engineering and Land Reclamation

The influence of industrial activity in agriculture on ecological conditions of the environment is widely investigated in many countries of the world in recent years. The inculcation of reclamation systems and intensive field management has resulted on the one hand on the improvement of conditions for agricultural plants, and on the other - on the intensification of the migration of soluble nutritives, that, getting in open water systems, including due to artificial drenage, resulted in pollution of river waters.

Traditionally the most widespread agricultural pollutants are nitrates. The forecasting of nitrate pollution is one of major aims for the preservation of the environment. The modern effective method of the decision of this aim is a method of computer mathematical modelling.

We investigated an opportunity to forecast the nitrate contents in soddy podzolic sand soils under reclamation and in ground waters with help of the mathematical models "ANIMO" (with block "SWACROP") (Feddes R.A., Kabat P.,

Rijtema P.E., Kroes J.G., Holland, 1988) and "AMPRA" (Dobrachev U.P., Russia, 1981), and also joining them in united program complex.

The information base for the investigation was collected on actual supervision in the pilot farm "Polkovo" Meschers-kaya branch of VNIIGiM of Ryazan region. Results of the special lyzimeter investigations and generally available standard information about ground water depth, terms and norms of irrigation, meteorological information, and about application dozes of organic and inorganic fertilizers were used for modelling.

In result of the modelling on "ANIMO" it is received two periods with great increase of nitrate concentration in ground waters. The first period is displayed in 25 - 27 days after the first application of fertilizers; the second - after the harvesting.

In result of the modelling on "AMPRA" the three peaks of increase of nitrate leaching volume in ground water are received. The first peak is observed in spring time after the melting of the snow, the second one - during rain period. The third peak occurs after the harvesting.

The data about nitrate leaching and concentration, received with help of mathematical modelling, were compared to results of the nitrate content measurements that were received on the pilot area. The comparison has shown, that those resultes are close to each other and correlate with high degree of reliability.

The advantage of the given joint modelling on "ANIMO" and "AMPRA" consists of possibility to look after dynamics of nitrate concentration in ground waters and to calculate the amount of nitrate leaching for unit of the area.

To lead the results on "ANIMO" and "AMPRA" in comparable form it was made calculation of the nitrate leaching on the basis of received results of modelling on "ANIMO". The correlation analysis of the results of nitrate leaching that were received on models "ANIMO" and "AMPRA" has shown the high level of convergence between results with correlation factor 0,91.

PACKAGE PLANT FOR TREATMENT WASTER WATER IN SMALL COMMUNITIES

Razumovskii E.
Municipal Academy
Neparidze R.
Municipal Water Supply & Treatment Research Institute

1.Biological (secondery) treatment is a universal method for removal of dissolved pollutans (mainly organic).

2.Basing on new technology, Institute has developed new generation of treatment units of the types ROUTCHEY. These are based fully on biological treatment methods. For process intensification fixed cultures of microorganisms are used, enabling to increase biomass in treatment units and thus decrease their volume, as well as to obtain better effluents quality. The use of biofilm favours a decrease of biogenic elements.

3.The new technology allows to attain profound treatment using conventional technology. Thus it can be used for reconstruction of operating plants as well as for building new ones. The construction of units using new technology is similar to that using conventional one with aeration tanks, but differs in the use of a fixed medium in bioreactors which simplifiers their commissioning.

4.Biological process in units follows total oxidation condition ,i.e. are held at very low loads on age sludge. This allows to carry out profound nitrification process and to have mineralized sludge, rapidly drying on drying beds and emitting no unpleasant odours.

5.Specific construction of the units includes the use of combined settling and aeration tanks with thin layer module in the settling zone.

6.Special feature of the units stated in pts. 2-5 ensure their compactness and simplicity of assembly and operation.

7.The ROUTCHEY units have capacities from 6 to 1500 m^3/d.Their basic elements are the sand-trap, the aeration tank for tertiary treatment and the sludge-stabilizing unit. All plant elements are assembled in bloc-containers.

8.The units are design to lower BOD down to 3 mg/l, suspended solid to 5 mg/l, ammonia nitrogen to 2 mg/l, nitrates to 9 mg/l and total pfospforus to 1.5 mg/l.

9.The Institute has waked out units with higher treatment effect, which can be delivered to customers and which are mainly intended for communities discharging waste waters to the lace Baical.

MANAGE OPERATION'S MODELS OF PRIMARY SETTLING TANKS

Repin B.N., Moijes O.V.
Moscow Institute of Social Economy and Designing, Moscow, Russia

The theory of gravitational settling for the time being is applying for projection of primary settling tanks. Our model of primary settling tanks will decide tanks of exploitation of working reactors in real situation and will define effect sedimentation as a function of time: $E=f(t_h)$. Effect sedimentation as a function of time can be determined from a material mass balance as follow:

Rate of accumulation of solids within the volume element = rate of flow of solids into the volume element _ rate of flow of solids out of the volume element

The mathematical description of continuous flow settlement:

$$\partial C/\partial t=-v\partial C/\partial x-kC, \quad (1)$$

where $\partial C/\partial t$ - change in concentration of solids with time;
C - concentration of settling solids;
k - constant of sedimentation velocity;
v - rate of flow;
$\partial C/\partial x$ - change in concentration of solids with distance;
x - distance.
The decision of equation (1) is ($\partial C/\partial t=0$):

$$C_t/C_0=(1-a)\exp(-kt_{k0}t_h/t_k)+a, \quad (2)$$

where t_{k0} - settling time in the batch column;
t_k - settling time in continuous flow sedimentation;
t_h - detention time;
a - nonsettleable solids;
k - constant of sedimentation velocity:
$k=k_{max}$,
where K_{max} - maximum constant of sedimentation velocity;
C_0 - initial solids concentration;
K_c - constant of flocculation.
Effect of sedimentation as a function of time can be dermined from eq/-2:

$$E= 1-[(1-a)\exp(-kt_{k0}t_h/t_k)+a] \quad (3)$$

Settling time in batch reactor:

$$t_{k0}=H_{set}K_{set,h}/3,6U_0, \quad (4)$$

where U_0 - settling velocity in batch reactor.
Settling time in continuous flow:

$$t_k=H_{set}K_{set,h}/3,6\underline{U_2}, \quad (5)$$

Setting velocity in continuous flow is sum of settling velocity in batch reactor (U_0) and fluid velocity v:

$$\underline{U_2}=U_0- v, \text{ or} \quad (6)$$
$$\underline{U_2} = U_0 - w(v), \quad (7)$$

where w(v) - vertical rate of turbulency.
From (6), (7) effect of sedimentation in primary settling tanks in real situation:

$$E= 1-[(1-a)\exp(-k\underline{U_2}t_h/U_0)+a] \quad (8)$$

The concentration of suspended solids in waste water can vary significantly throughout the day.
Our model can be used to describe the change in concentration of suspended matter. We have decide the equation (1) for case of impulse, step and cycle changes in concentration of suspended matter.

METHODS AND UNITS FOR DECHLORINATION OF WATER

Rojkov A. N., Kvitka L. A.
Moscow State University of Building Nature, Moscow, Russia

A problems of dechlorination often appear at a practic: after dezinfection pipes and constraction in water supply and canalization; after using high dose of chlore for intensification treatment and dezinfection and for other same case.

We are not to throw off waste water with high consentration of clore in a water source, because chlore destructs a community of water organisms, inhibits and discontinuats photosynthesis aeration and biological self-cleaning water source, out lets in water secondary pollutions. Quality of a water is deteriorated essentially.

Other factor - it is formed chlororganic compounds, witch are dangerous combinations for human.

Biological treatment processes of waste water are broke, if we discharge water with large quantuty of chlorine and constractions are out of action.

Many methods of dechlorination exist now. At the laboratory of Moscow State University of Building nature for porpers a sorbent was worket out. A price of it is lowly then active coals in five time. Investigations were made on this sorbent. Consentration of chlorine was 40-60 mg/l. Kinetics, statics and dinamics of process were studed.

After laboratoric and model researches moving unit (1500 m3/day) was proposed. This unit will find application at water supply and canalization for dechlorination water after desinfection pipes and constructions and for dechlorination waste water before discharge them into a water source.

THE POSSIBILITY OF HALOPHITES USE FOR THE UTILISATION OF COLLECTOR-DRAINAGE WATERS

Rudneva L.V

Irrigarion in the complicated soil-meliorative conditions of arid and semiarid zones using water with higher salt contens (1,1-2,1 h/l) and unfavourable chemic composition results in almost in superable problem of utilization of mineralized (4,1-6,5 h/l) collector-drainage waters.

In Kalmykia such waters are practically used for watering of salt-resistable fodder crops, wich allows to increase noticably the volume of the stored up fodder, but along with it there appears drainage flow of larger volume and mineralisation (up to 8 h/l) and it increases more the danger of subsoil waters pollution.

A great perspective in the sollution of this problem is the irrigation of halophites by fault waters, because of the fact, that saline soil solution is their natural habitat. The goal of our research was to find out salt-accumulative halophites among wild-growing flora in Kalmykia and to test the possibility of watering them by fault waters in the conditions of the field experiment.

Chosen more then 20 species of halophites in natural conditions grew in the soils with salt content of 1,8-3,0% and were characterized by clear timing to different types of salinity. In the upland mass of halophites there were from 7,6 up to 14,1% of sodium and 10,8-19,7% of chlorine, 5,9-6,7 of magnesium. In the roots the content of the elements was less, accordingly as far as 3-12; 5-6; 3-20 times.

For watering drainage-fault water of chlorine-sodium composition with mineralization of 4,1-4,7 h/l was used. To preveut the penetration of salts into deep horizons of soil and on into subsoil waters, watering norm was given to keep the soil humidity 70-75% HB only in the main rootgrowing zone (0-0,4 m).

During vegetational period with irrigative norm 2,5-3,0 thousand m^3/ha there appeared 5-6 t/ha of harmful salts (Na, Cl, Mg) on the surface of soil. Halophites formed up to 15 t/ha in calculation per hectar absolutely dry mass by the end of the season, and up to 5,5-6,5 t/ha of these salts were taken away from the soil by this mass. According to the analysis, halophites except for taking away salts from water also promote lower salinity of soil in root zone.

The consideration of resulting data allows to define further ways of research: they must be turned to the elaboration of the irrigation regime, taking into accaunt exposed biological characteristics of halophites, selectibility concerning chemism of absorbed salts and their distribution in the upland part and in root sistem of plants, the possibility of application of more accessible way of upland mass use of halophites, directed first of all to the use as fodder for livestock and row material to get different types of useful production.

The most perspective ones for further research from the studied halophites are: Salicornia europaea, Suaeda altissima, Halocnemum strobillaceum, Chenopodium glaucun, Atriplex macrantha and Atriplex calotheca.

DISINFECTION OF SEWAGE

Rusanova N.A., Medrish G.L., Ovechkina G.V.
Municipal Water Supply and Treatment Research Institute

According to normative documents used in Russia, it is allowed to discharge into water bodies sewage having Coli-index and Coliphage index of not more than $1x10^3$. If sewage is disinfected by chlorine, the residual chlorine content in effluent sewage must have a concentration of not less than 1.5mg/l after 30-min contact.

Investigations carried out at operating plants have shown that the stated conditions not necessarily ensure the required quality of sewage effluent. A considerable number of sewage samples after disinfection (residual chlorine being 1,5-2,3 mg/l and contact time 30 min.) did not comply with Coli-index criterion and more often - with that of Coliphage index. To get the proper effect it was necessary to raise chlorine dosage; in some cases residual chlorine had to be kept at 7.0 - 7,5 mg/l.

The effect of disinfection increased with stable improvement in quality of sewage to be disinfected (especially with decreased content of ammonia nitrogen and suspended solids), with lowering of pH and with optimization of preparing, feeding and mixing of chlorine with treated sewage effluent.

The necessity of keeping high concentrations of residual chlorine in some cases requires to dechlorinate the effluent before discharging it in a water body.

Disinfection of sewage by ozone may be considered as an alternative to chlorination. Experimental data showed that, depending on sewage quality, to lower microbiological parameters to normative levels the absorbed dose of ozone had to be 13.0-20.0mg/l with 12 min. contact time.

Regime and conditions of sewage disinfection must be corrected in process of plant operation.

A long-term trend, requiring yet to be studied, is sewage disinfection using no chemicals. Methods of disinfection by electric impulse discharge and high-frequency electric impuls discharge used in experimental units have shown high effectiveness, however, their use was marked with deterioration in physico-chemical parameters of sewage, particularly in increasing COD and SS. Serious attention must be given to this fact when evaluating a possibility of using in practice new methods of sewage disinfection.

TO THE PROBLEM OF THE COMPLEX USING MICA ROW MATERIAL

Rush E.A., Leonov S.B.
Irkutsk State Technikal University, Irkutsk, Russia

The increasing of the capacity and complex using of the mineral raw material resources of the Eastern Siberia of oue of the actual problem at present time. The decreasing of the mineral reserves, the means in short supply yo develop the new deposits make Lawe the necessity to decide this problem of the complex using of row materials, the use of remains and second industrial plants products.

One of the directions of this problem in the use of the modified no-standard small-sized mica in the sorption technology of the cleaning of fluoride having industrial sewage.

We studied the sorption processes of industrial sewage with the use as a sorbent not traditional material got in the result of the small-sized no-standard mica of flogopyth.

At present of our chair of Deposit's Dressing and engineering Ecology of the Irkutsk State Technical University the principle technologial scheme of cleaning fluorine having industrial sewage of the non-ferrous metallurgy's plants was worked out. This worked out cleaning sewage technology was tested at the number of objects of the non ferrous metallurgy branch and the results satisfied.

PURIFICATION AND UTILISATION OF FLOW FORMED AT DUMPS OF NON-FERROUS METALLURGY ENTERPRISES

Rybakov Yu.S., Yakovlev S.G., Komin A.V.
RosNIIVKh, Yekaterinburg, Russia

The sharp increase of the minerals extracting volumes causes the forming of a big number of the technogenic formations, 90% of them represent the rock dumps and poor ores. The most volume of dumps is formed by the enterprises of non-ferrous metallurgy. The flow formed at these technogenic formations is polluted by metals, sulphate- and chlorine-ions and other ingredients. Annually over 0.5 mln tonns of chemical substances are discharged by dump and mining waters in Russia, including extreme harmful heavy and rare non-ferrous metals that cause the significant pollution of water bodies.

Available methods of the water sources protection against such the pollution provide the purification of the flow but not the purification of dumps where the flow formed. Therefore the urgent objective is the intensification of the slow natural process of pollutants solving, management of the formed flow in order to emit pollutants from it (and to transform them, if possible, into the commodity output) and to use them in various technological processes. Redundant water should be purified achieving maximum permissible concentrations and discharged into the open river network. The methods of the dump lixiviation are the most suitable for the achievement of these goals.

We investigated the areas of dumps at 31 deposits of copper, copper-zinc, lead-zinc and molybdenum ores of CIS. We divided rocks and ores of investigated non-ferrous metals deposits into 10 classes as regards the intensification of the pollutants emission and extent of the environment impact:

- copper ores being deposited in acid rocks, clayey rocks, basic and carbonate rocks;
- copper-zinc metacolloidal ores being deposited in acid and basic ores;
- lead-zinc ores being deposited in acid rocks, basic and carbonate rocks;
- molybdenum oxidised and sulphide ores.

Using the experience of our researches we have worked out the methodology of the assessment of the polluting impact of ore and mineral dumps on the water bodies in conditions of the natural lixiviation. Besides we have worked out the methodology of the choice of ways and technological schemes of their chemical recultivation.

We have fixed that the lixiviation process of copper and zinc under the chemical recultivation can be divided into 3-5 steps; it is connected with the dissolving of different mineral forms contained these metals.

We have fixed the dependences between the speed of dissolving of basic pollutants from ores and rocks and the basic technological parameters of the process, pause between irrigations, concentration of lixiviation reagents, that enable to forecast the quality of the flow formed at the dumps in conditions of the natural lixiviation as well as the compulsory lixiviation.

Using the method of the mathematical planning of the experiments we have worked out the optimum technological regimes and parameters of the lixiviation of the basic pollutants under chemical melioration of each class of ores and mineral rocks.

We have revealed that the compulsory lixiviation did not solve the problem of the water bodies protection against pollution. Therefore it is necessary to carry out the second step of the chemical recultivation: sulphidising of dissoluble compounds of non-ferrous metals remained in dumps.

The investigations showed that the most clean (without additional pollution) and efficient method was the sorbtion at ion-exchanging resins.

Besides in order to intensify the lixiviation process we worked out the way to speed the process by means of the combined electric impact on the system "ore-solution" (simultaneous supply of high-frequency and direct current), which accelerates the lixiviation in 1.5-1.6 times in comparison with the other types of the electric impact and in 3-5

times in comparison with the usual sulphate lixiviation in the optimum regime.

On the base of our researches we worked out the technological schemes of the dumps purification, purification and utilisation of the flow formed there, transformation of pollutants into the commodity output, that enable to protect the water bodies against pollution. By the way the cover of expenditure on these technological schemes is 2-5 years.

INFLUENCE OF LARGE BASHKORTOSTAN ENTERPRISES WAST WATERS ON THE CONTENT OF VOLATILE CHLORINATED HYDROCARBONS IN BELAYA RIVER

Safarova V.I., Fatjanova A.D., Teplova G.I., Shiheva L.K., Djatlova T.N.
Administration state analitical control by ministry of extreme situations and ecology security, Ufa Bashkir Republic, Russia

By GC and GC/MS metods was demonstrated the waste waters influence of large republic enterprisis on the content of tetrachlorocarbone, tetracloroethene, 1,2 - dichloroethane, 1,2 - dichloropropane, 1,2,3 - trichloroethane in Belaya river.

Acquired data on waste waters control of produced VOC plants and municipal treated sewage (Ufa) during 1994 - 1996 years.

It was shown that according to the facts the danger of Belaya river contomination increases in the course of a winter, because ice cover prevents evaporation of chlorinated hydrocarbons.

RANKING OF TOXICITY SEWER ENTERPRISES AND STRATEGY OF PROTECT NATURE

Schykin V., Masytenko A.

One of the massive problems in strategies of protection reservoirs is a formation research well-founded programs, include priority actions, intimate to realization to the account of ecological fund.

Aplicable methods of evaluation influence chemical factors on the condition reservoirs are often subjective, carry volumetric, quantitative or gross character and do not allow validly to plan of a of protect nature action.

More motivated decision of given question possible, if conduct a benchmark analysis generalise ecological damage, inflict by each enterprise, subdivision, city as a whole to the account of unset of each component in the sewer.

For deciding a given approach necessary integral evaluation of toxicity concrete sewer take ecological danger of into account each component.

As an ecological danger factor, allowing match between itself sewers and be kept in them components of separate enterprises, subdivisions and in the end result of city, can be used rank factor, being integrate feature, take level of into account disadvantage influence of different concentrations and long influence. For the possibility of integrate evaluation of influence total sewer, given factor can be bring about one value level.

Calculations of rank factor for enterprises of North industrial element g.Togliatti, enabling to define correlations of levels danger of unsets components of different enterprises for reservoirs and population, allowing more validly plan protect of nature action, realized to the account of ecological fund.

THE USE OF SELF-DECOMPOSING SORPTION FILTER MATERIALS IN PURIFICATION PLANTS

Segal H.
State Scientific Research institute "Vodpolimer"
Faitelson V.
Latvian Scientific Research Institute of Building

In small sewage water purification plants the technology of sewage water purification is based mostly on its sedimentation (settling) with further filtration. The material must have:

- sufficient trapping ability with reference to hard component of flow;
- not high hydraulic resistance;
- long term of exploitation conditioned by mechanic strength and resistance when working in aggressive medium;
- ability of easy clearing (by penetration regeneration);
- possibility of simple and quick change;
- not high cost.

In filter elements of purification plants (poured in, block, fibre, plane ones) are used: fractional sand, gravel, crushed stone, slag, expanded clay aggregate, tuf, foamglass,

foamed polystyrol granules, fibre polymer materials, concrete of high porosity, poroelast (filtering polymerconcrete on thermoplastic binder), sheet polymer materials, polymer pipes cuts etc. One of the methods to modernize filters' work is the use of materials with increased absorbtional ability, utilization of which after work does not create additional threats to environment pollution. With this aim it is offered to use compositions on the basis of organic vegetable raw material containing cellulose – not expensive capillary porous material. Specific surface of such material is about 32 m^2 per 1 gm. Low density, availability and unscarceness are their positive properties. Compositions on their basis have developed and possible to regulate (by choosing the kind, size and correlating the proportions of components, technological characteristics) when manufacturing specific surface, good air and water penetrability.

Filter elements can be made, practically, of any configuration that gives possibility to deeper sewage water purification.

Utilization (burial) of used self-decomposing filter elements does not make any harm to environment. The offered composite materials can be used for the production of:

- septic filter partitions;
- elements of underground irrigation system and underground filtration trenches, including draining strewing);
- changes of filter wells (including multy-layer ones) and biological filters (with -volumetrical and flat charges, including disks of submergence biofilters).

Out of produced at present composite materials on the basis of vegetable raw material the following ones can be used: fibre mat, arbolit, compositions when cane, rice straw etc. are used. Filter elements of the above mentioned materials can be installed in new, as well as already having been exploited, sewage water purification plants.

Deep research of the mentioned material class will favour the creation of simple, available at their cost and convenient in mounting and exploitation constructions that ensure sewage water purification high quality.

At the initial stage of the research capacity of some mentioned materials has been studied:

- fibre mat, produced according to Netherland technology, thickness 2,5 - 15,0 cm
- fibre mat, produced according to Netherland technology, thickness 7,5 cm
- fibre mat of "Multibau" firm, thickness 3,5 - 5,0 cm - poroelast on gravel, grain size 3-5, 5-7 and 10-12 mm, thickness 4-9 cm.

Because of for all studied materials water discharge (capacity) dependence from existing head is described by equation of the same type like:

$$Q = A\sqrt{H}, \qquad (1)$$

the possibility to compare appears (see table).

Table. Comparative capacity of different filter materials

Materials	Relative capacity, %
1. Poroelast on gravel 3-5 mm thickness 7 cm	22
2. Poroelast on gravel 5-7 mm thickness 9 cm	33
3. Arbolit thickness 3,5 - 5,0 cm	100
4. Poroelast on gravel 10-12 mm thickness 4 cm	116
5. Fibre mat (Netherland technol.), thickness 5 cm	137
6. Fibre mat (tradit. Technol.), thickness 7,5 cm	191
7. Fibre mat (Netherl. technol.), thickness 2,5 cm	217

Capacity for arbolit is taken for 100% because it is the most perspective among composite materials on the basis of vegetable raw material for use in sewage water purification plants.

As it is seen, the studied materials capacity is high enough. The real quantity of gassing water in dependence from head can be calculated by formulae for arbolit

$$Q = 44{,}3\sqrt{H} \qquad (2),$$

where Q - capacity of 1 m^2 of the material in, HP

H - existing head in m., multiplying the obtained result on corresponding per cent from the Table.

Of course, the data in the table are approximate ones, because the materials from vegetable raw material are not homogeneous.

Their further studying for the use in sewage water purification plants seems for us very perspective.

NORM-SETTING FOR SEWAGE

Seleznev V.A., Selezneva A.V.
Institute of Ecology of the Volga River Basin of the Russian Academy of Sciences, Togliatti, Russia

Long-term application of the "Technique for calculating the maximum allowable discharges (MAD) of contaminants with sewage" into large man-made impoundments of the Volga river cascade has necessitated its updating. Basic shortcomings of this technique appeared to be as follows:

- allowable concentration of contaminants in waste waters is primarily calculated based on the unified all-Russia maximum allowable concentrations (MAC) for fisheries-purpose water bodies with no regard to: (i) actual concentrations of contaminants in any given waste water, (ii) hydrodynamic conditions at the site of its outfall

and (iii) background parameters of the water quality in any respective water storage reservoir;

- MAD norms appear, therefore, to be very tough; moreover, in case of the input of several contaminants with an identical limiting attribute of harmfulness, they become even absurd and their conformity even in the long run seems to be infeasible;
- limits for temporarily agreed discharge (TAD) of contaminants into reservoirs are not calculated based on certain quantitative criteria, but are simply set based on a rather vague notion ("according to best possible results to be achieved at a given enterprise") which does not exclude a factor of subjectivity in this aspect.

Application of this system of norm-setting does not promote water abstractors' aspiration for developing a programme aimed at the achievement of reasonable MAD-levels because of the ecologo-economic inexpediency of the work involved. They mainly strive for obtaining mildest possible MAD norms from the respective territorial environmental protection bodies.

During the last few years, Institute of Ecology of the Volga River Basin of the RAS has been involved in the development of novel approaches to the calculation of MAD norms and TAD limits for substances coming with sewage into reservoirs. They are based on the estimation of the extent of impact of an individual water abstractor or a group of the ones upon the quality of water in a reservoir in different seasons of the year.

The extent of impact of the inflowing waste waters upon the state of any given reservoir or its section is determined based on the results of numerical calculations, using a hydroecological model of the "CARDINAL". This model has been verified based on the data of field experiments at the sites of sewage outfalls from large towns at the Nizhnekamskoye, Kuibyshevskoye, Saratovskoye and Volgogradskoye reservoirs. The zones of spreading and transformation of waste waters under the actual conditions were determined with the help of a "HYTON", an information-measuring system for "in situ" control on board an expedition boat.

Background indices for the water quality at the sites of waste water outfalls were taken as criteria when assessing their influence upon any given reservoir. The background of water quality in any given section of the reservoir is characterized by a mean value, dispersion and a function of distribution for each of its parameter within the frame of a concrete season of the year. Maximum allowable discharge of substances with sewage into a reservoir should not cause a change in the background values (certain frequency) beyond the control contour of impact by more than a magnitude of a square-root mean-error. Parameters of the temporarily agreed discharge of substances are determined based on the already available norms of MAD, as well as on the extent of the actual impact of any given abstractor upon the reservoir's state.

When determining the MADs and TADs a particular attention is to be given to the calculation of actual concentrations of chemical substances in the sewage. The discharge of municipal, industrial and rainstorm waste waters into reservoirs is believed to be a non-stationary probabilistic process.

Novel approaches to the norm-setting for sewage discharge into a reservoir have been verified with the basic water abstractors in the towns of Saratov (Vodokanal, Kreking, SPZ-3, Nitron) and Togliatti (AVTOVAZ, TOAZ, SK) which substantially differ in their systems of water disposal. Comparison has been made of the MAD norms and TAD limits obtained with the use of a conventional technque and with a due regard to the novel approach discussed.

EFFICIENCY INCREASE OF AEROBIC BIOLOGICAL PURIFICATION BY INTENSIFICATION OF FLOCCULATING ABILITY OF ACTIVE SILT BIOCOENOSIS

Semizhon A.V.
sovkhoz "Borusovskij", Minsk region, Belarus
Denissov AA.
Institute of Biological Industry, Moscow, Russia

Experimental investigations showed that the efficiency of aerobic biological sewage purification systems may be increased due to perceptibility improvement of the mixtures coming to a primary settler when using surplus active silt as acoagulant. Therewith a technological scheme of the biological purification system must additionally include tanks to mix silt suspension with the source sewage coming to the settler. Active silt adding and its mixing in mixtures before their supply for settling enables to intensify the flocculating process and improve the settling of the mixture in the settler. As a result, there may be considerably lowered the organic impurities load on an aerotank and achieved a more effective purification of sewage on the outlet from the system of a biological purification.

Therewith experiments showed that a preliminary physical - mechanical treatment of silt suspension before mixing and its adding to the settler enables to raise the efficiency of precipitation due to increase of off-cellular biopolymers concentration in it, which contribute to active flocculation of suspended matter.

Bacteria of the active silt constantly segregate organic matter of albumen origin - bioflocculaters on the surface of their cells in the process of their vital functions. Preliminary physical - mechanical effect on the active silt provides conditions when this natural process is artificially intensified and therefore conditions of maximum improving the process of precipitation is provided.

The task is to determine the conditions of optimal process control of the active silt bioflocculating by its physical -

mechanical treatment and thus to elaborate recommendations of its practical application when developing systems of biological sewage purification.

Experimental investigations on sewage of a pig farm and a shop of meat industry processing showed that the concentration of suspended matter and biological limited concentration may be lowered on 40-60% in clarified sewage on the outlet from the primary settler due to supply of the preliminary treated silt suspension in it. An optimal quantity of suspended components per volume unit of silt suspension in sewage take place at mechanical treatment with constant intensity. It is ascertained that as the intensify of mechanical effect on the active silt grows the efficiency of a preliminary load removing in the primary settler considerably increases. In the conducted tests various means were used in conformity with the principle of hydrodynamic efforts* excitation as physical-mechanical units: centrifugal pumps, throttling orifices, Venture jets.

Reaction of bacterial cells on mechanical excitation is comprised of the following: firstly, continuous taking off biopolymer jackets and polymers transportation into intercellular liquid. Therewith, secondly, a cell is forced to a continuous restock of the taken offsurface biopolymers due to the consumption of accumulated albumen matter in it. Both these processes (striping and restocking surface biopolymer structures) ensure favorable conditions to increase maximally polymer concentration in the silt suspension and therefore make prerequisites for intensification ofbioflocculation and settling in settlers.

The above said mechanism is confirmed by the transformation data of albumen compositions. Besides the investigation of microbiological composition of media taking part in the technological process show a decisive effect of biopolymer compounds, which segregate during the process, in the intensification of mixture flocculation in the settler.

The resulted experimental data are approximated per analytical relations enabling to develop scientifically proved recommendations for the increase of purification effectiveness when new purification units are designing, the available ones are reconstructing, as well as during their commissioning and industrial exploitation.

THE MEANS OF CALCULATION IN SYSTEMS OF WATER SUPPLY AND SEWERAGE THREE METHODS TO MEASURE THE FLOW OF WASTE-WATER

Shafranovsky M.
"Signur" company

Nowadays, when the conversion to the market system takes place, the problem of the calculation in systems of water supply and sewerage has become especially actual.

"Signur" company specializes at the developing and producing of devices of calculation for the systems of water supply and sewerage. We suggest our devices for realization of three methods to calculate the flow of wastewater.

The first method is calculation in open canals. This one was elaborated by VNIIVODGEO for measurement of the flow of water in open sewerage collectors with a square section. The instructions for measurement are issued in The Methodical instructions MI 2122-90. The method is based on measurement of the level of water in the section of canal and recounting it to instantaneous value of the flow.

The second method is calculation in free-flow pipelines with round section or in U-formed chutes. This method was elaborated by NIIKVOV. The instructions for measurement are issued in The Methodical instructions MI 2220-96. Concerning to these instructions the head-and-flowrate characteristic of the pipeline or the U-formed chute is considered using experimental data.

For the realization of these methods "Signur" company has created and produces ultrasonic flowmeter ECHO-R-01. The apparatus was included into The State List of measuring means and it is used for determining of the flowing liquid's volume including waste-water in the open canals to 4 m wide and to 3 m deep provided with standard measuring chutes and in free-flow pipelines from 0,1 to 3 m in diameter.

The principle of flowmeter's work is based on non-contact measurement of the level of liquid flowing in the waterline, recounting it to the instantaneous value of the flow and following integration.

The ECHO-R-01 instrument is the only flowmeter being produced in CIS which makes possible to organize the automatic calculation of waste-water in open canals and free-flow pipelines.

The third method is calculation in flow systems. To solve this problem "Signur" company has elaborated and produces ultrasonic flowmeters with superimposed transducers ACRON. The apparatus was included into The State List of measuring means and is used for determining of the flow and quantity of the sound-making liquids including waste-water.

The principle of the flowmeter's work is based on the measurement of the difference of time of ultrasonic wave's going along the flow and in the opposite trend of the controlled liquid and recounting this difference to the instantaneous value of the flow and following integration.

Using of the flowmeter ACRON gives the opportunity to organize calculation in the flow systems without additional capital expenditures on it's mounting.

The major advantage of offered ways of measurement is high reliability because of the lack of the devices' sensible elements' contact with controlled materials.

For accomplishing of the technological control "Signur" company has elaborated and produces ultrasonic levelmeters ECHO-AS used for measurement of the level of various materials to 20 m diapason in different climatic conditions, and signalling apparatus SO-1 intended for working in settling tanks of cleaning equipment.

SAFETY PROBLEMS OF SURFACE WATER OBJECTS AT JSC

Shchekoldin N.A.
SC «LUKoil-PNOS»

"LUKoil-PNOS",is one of the largest refineries of Russia with the annual processing volume of 13 min tomes of oil. The main kinds of commercial output are high-octane petrols, diesel fuel, various kinds of oils. In connection with this the main contaminants of sewage are petroleum products, phenols, high-molecular aromatic compounds. Now a lot of attention is paid to the technical reequipment of our enterprise, ecological safety of industry, maximum involvement of pollutants, thrown out into environment, to technological cycles, the development of system of tight control for the environment condition- Considerable attention as to the questions of environmental protection is paid to the safety of surface water objects.

It is convenient for the sources of pollution of surface water objects, stipulated by enterprise's operations, to be divided into three groups:

- concentrated, regulated;
- diffusional, not concentrated;
- potential, capable of arising in different alarm situations.

Methods of their control are essentially different, depending on the type of a source.

A principally new system of chemical cleaning of sewage, named "VEMCO", has been started for decreasing both some objects of water consumption, and some object of water disposal, standard quality control of removed sewage. It allows returning up to 50% sewage to processes, and the remaining sewage, sent to further Gleaning, are characterized by low pollution indices, particularly, their oil products volume do not exceed 5 mg/l. Here oil products, obtained by the process of cleaning, are returned for Industrial processing.

Diffusing sources played the most important role In contamination of the river Pyzh. Basic oil pipe-lines, supplying our enterprise, are laid In this river basin. Alarm spreads, taken place earlier, led to a significant pollution of underground waters on the water catchment area by oil products. A serious pollution of this water course, being an object of commercial fishery, takes place during their running into water courses. The drains, which cut off polluted filtering streams, were placed parallel to the river bed at the depth of9.5 meters for the cardinal solution of this problem. Here the collected water is pumped to sewage works. Oil products, separated by them, are sent to the recycling, and purified drainage waters after an additional biochemical cleaning are used for replenishing circulating water supply.

The definite specific nature of our enterprise is the fact that biological sewage works with the capacity of385.000 cubic meters per day (the first stage) are used for sewage cleaning of the whole city of Perm. Package of measures, put into effect, directed for increase in cleaning efficiency, allowed reaching the standard quality of carried outside discharges as to the most part of polluting Ingredients. At present the problem of utilizing wasted biological slurry is of the most urgency. This problem becomes especially critical in connection with the specific nature of industrial enterprises of our city, the sewage of which contains a lot of heavy metals (Cr, Ni, Cd, V, Fe Pb, Cu and some others).

The given ingredients are not susceptible to biochemical decomposition, and they can actively migrate in the system:

- "LUKoil-PNOS", and the dehydration unit for biological slurries, providing 809/0 of dehydration as to the content of dry substance, was bought. The given dehydration allows using wasted slurry for preparing artificial soil when recultivating spoiled ones. In the future it is assumed that the unit for drying and granulating will be constructed, and this unit allows using the precipitate both as a fertilizer for growing technical cultures and as a filler for building materials, and also as a low-caloric fuel.
- For the operative solution of a problem of control and regulating systems of water disposal at the JSC "UK-oil-PNOS"and its users the computer control simulator is being developed, and it contains not only the data base of water disposal pattern, technical characteristics of water outlets, sewage volume and composition, but also some computer simulators, which allow predicting the quality of drained sewage both within the regulated water course conditions, and in various alarm situations, and they also allow to conduct effectively normalizing drained sewage quality depending on the condition of water course-receiver and on the efficiency of sewage works.

The basic technical solutions of the above-mentioned measures will be presented in the report.

STRATEGY OF INDUSTRIAL SEWAGE CLEANING

Shcherbakov B.Y., Chilikin A.Y.
A.A.Bochvar All-Russia Research Institute of Inorganic Materials, Moscow, Russia

At present tens of thousands of harmful chemical substances are disclosed in industrial sewage. However there are no cleaning station which could clean sewage from all of them, and rivers is continuously polluted. As rivers are the main source of drinking - water and pollution of them is a danger to people health, strategy of industrial sewage cleaning must be changed. It is necessary for this aim:

1. To organize at factories preliminary cleaning of industrial sewage from harmful chemical substances before throwing down into regional cleaning station;

2. To organize at factories continuous all-day-round control of sewage with using of automatic samplers to prevent uncontrolled throwing down of dirty sewage both into regional cleaning station and directly in rivers;

3. To allow factories to spend for these aims money which they spend for fines now;

4. To work out appropriate regulatory documents.

COMPARATIVE ASSESSMENT OF ECOPOLYMER TUBULAR AEATORS AND DISK MEMBRANE DIFFUSERS

Shetinin A.I.
SIF Ecopolymer, Belgorod - Kharkov, Russia - Ukraine

The aeration is the most energy consumed process in biological treatment of wastewater. The cost of aeration consists of 50-80 % of energy consumption on wastewater treatment and processing of solid waste deposit.

One of the most common problems of wastewater treatment plants located in the countries of former USSR is unsatisfactory performance of aeration systems in aeration tanks. As a result, on the one hand, there is an insufficient level of wastewater treatment and pollution of open water bodies, while on the other hand, there is excessive energy consumption on aeration.

Among two kinds of aeration: mechanical and pneumatic, the last one is the most reliable and effective. Within all possible designs of pneumatic diffusers the preference has been given to fine-bubble aerators, which allow to support high mass transfer characteristics in biological treatment process.

Distinctive feature of Ecopolymer diffusers is their high reliability and maximal adaptation to typical operating conditions accepted in the territory of the former USSR.

The analysis of modern aeration systems design methods show that majority of them are based on determination of oxygen transfer efficiency from air to liquid in standard conditions (Standard Oxygen Transfer Efficiency - SOTE). In conformity with the developed in the US standard "A Standard for the Measurement of oxygen Transfer in Clean Water", experts of SIF "Ecopolymer" derived and collected some experimental data. It was processed and analyzed. The research allowed receiving a criteria equation, similar to the equation proposed by B.M.Khudenko and I.A.Shpirte at the end of 60-th and the beginning of 70-th years (Aerators for wastewater treatment. M., Construction publication, 1973, 112 p.). The derived data has allowed developing a method of calculations based on the SOTE definition and used for Ecopolymer aeration systems.

The table provided in this document includes the data presenting characteristics of the Ecopolymer diffusers which design was based on the above said equation, and characteristics of disk membrane diffusers using rubber membranes. The characteristics of disk diffusers were derived from the advertising materials of Sanitaire, USA, as the most recognized in America and Europe disk diffuser manufacturer.

As it is seen from the table, the mass transfer characteristics of Ecopolymer diffusers do not concede to those for disks with rubber membranes. It is important to note that diffusers with the perforated membrane from synthetic rubber are extremely sensitive to inside clogging by corrosive products of black metals, and also to increasing air discharge higher than 6 m3/hr(disk. It results in extension of pores and also blocks them from closing after discontinuance of aeration.

Table: Standard Oxygen Transfer Efficiency (SOTE) for diffusers of "Ecopolymer" (EP) and dick diffusers of "SanitaireΦ (S) in dependence of immersing depth (h) and submitted air discharge (q)

q,	m3/hr.m	3.4	6.8		8.5	10.2	13.6	17.0
	m3/hr.disk		1.0	2.0	3.0	4.0	5.0	6.0
h = 3 m	EP		22.15	19.56	18.79	18.18	17.26	16.58
	S		21.6	19.1	17.8	16.7	16.1	15.9
h = 4 m	EP		28.00	24.72	23.74	22.98	21.82	20.96
	S		27.4	25.1	23.1	22.1	21.7	21.1
h = 5 m	EP		33.84	29.87	28.69	27.77	26.37	25.33
	S		34.1	31.1	28.4	27.1	26.2	25.3

Ecopolymer diffusers have a complex two-layer cover that prevents clogging of external dispergative layer from inside. The increase of air discharge more than

30 m3/hr(m results in insignificant reduction of SOTE and increase of resistance, but does not infringe integrity of dispergative covers. The absence of the complex air distribution system on the bottom of the tanks eases system installation and tanks cleaning during maintenance procedures.

Thus, the comparison of Ecopolymer tubular and disk diffusers with rubber membranes has shown that, while mass transfer characteristics are almost identical, the Ecopolymer products have essential advantages in operating parameters and exploitation.

NATURE PROTECTION TECHNOLOGY DEVELOPMENTS OF RECYCLE WATER SUPPLY OF CONCENTRATING FACTORIES

Shevtsov M.N.
Khabarovsk State University of Technology, Russia.
Pancratov B.P.
Water Basin Resources Committee of Khabarovsk Territory

Recycle watersupply utilization and protection of the environment from wastewater pollution is one of the main problems for concentrating factories. Tailing storage's is while main problems for tailing pulp setting. Pulp setting depends upon fraction composition and suspended matter density, physical and chemical properties of liquid phase and used for intensification of the process. Water after tailing pulp setting in tailing storage is entirely or partially reused at such enterprises of the Far East of Russia as mining concentrating plants "Solnechny" and "Khinganolovo". For example, at the Solnechny mining concentrating plant, a wastewater are polluted during pig concentrate table flotation by such as: butyl-xanthogenate, diesel fuel, pine oil, sulfuric acid and to some extant ions iron, copper, lead, zinc, arsenic and grain dispersed slag's. For a Central concentrating factory wastewapper treatment, there has been suggested such structures as: an unit for general tailing purification by limestone milk, iron vitrol liquid phase treatment out off arsenic and heavy metal ions and clarifying tailing improvement and tailing storage. Grain tin floatation technology realization out of slag's changes runoff composition. Grain tin floatation wastewater composition studies and treatment researches were carried out at first on sulfide sulfates and grain tin floatation from the Festivalnoye deposit on a laboratory basic.

The pollutants can be divided into 2 groups: metal ions of which treatment can be carried out entirely by means of runoff liming pretreatment and organic matters that a difficult to treat. As it is pointed by the authors, much attentions was paid to tailing treatment by isooctanol problem studies and decrease of chemical oxygen demand runoff. The best results were received while anodic oxidation of wastewater's and isooctanol sorption on activated carbon. This purifying process takes much time (2-6 hours) and residual alcohol concentration is much higher than the limit of permissible rates. Tailing clarifying is not satisfactory. After a long setting of suspended matter composition in tailing liquid phase is 3-5 gr/l. Wastewater treatment impossibility in the limit of permissible rates called for necessitate studying of reusing liquid phase tailing unit for grain tin floatation. The experiments on grain tin floatation with recycle water adding flocculate into liquid tailing were carried out for improving clarification and isooctanol expense control. These experiments showed that dosage of poliacrylamide needed for a full completed sample clarifying depends upon processed ore type and varies in the limits of 10-70 gr/l on the account of the technological product.

Research, being carried out at the Khabarovsk State University of Technology, showed that wastewater pretreatment is to be carried out reasonably in special hydrocyclones in order to decrease reagent expense but ion metal recovery and organic matter process can be intensified with the help of active sorption material directly in the body of filtered media filter. That's why, new filter design usage will increase treating efficiency.

Non-reagent and agent combination methods will improved technical and economical results of wastewater treatment layout.

Non-reagent technology realization will decrease wastewater technological treatment discharge and perhaps also will lower water resource pollution while breaking down and extreme situations. Modern technology utilization and perspective building structures of primary and fine wastewater treatment will let Solnechny mining concentrating plant decrease negative effluence's on environment. Such measures have priority meaning complex to solve ecology problem, and, first of all, reservoirs protection while mining and treating ore deposits.

ECOLOGICAL SAFETY LAND RECLAMATION SYSTEM FOR NON-CHERNOZEM AREA OF RUSSIA

Shtyckov V.I.
Scientific center "Northern research Institute of hydraulic engineering and land reclamation" (SevNIiGiM)

Drainage-aerational and drainage-ventilational systems possess high ecological safety. Employment of this systems is most effective for the drainage of fields, irrigated by sewage. The aeration device using wind dynamic pressure may be applied for air feeding to drainage-collectional net. One air catcher can operate a system having optimal square nearly 3-6 ha. Drainage-aerational systems are used for light soils while drainage-ventilational systems are used mostly for coherent soils. Analysis of drainage water showed as compared with control systems (without air feeding) that content of oxygen increased 80% and content of ammonia nitrogen decreased at least 20-30%.

Cavity-free drains have high self-purifying characteristics. Drain is called cavity-free if it's cavity is filled with coarse-grained, highly filtered material. Quality tests of sewage from systems with cavity-free drains showed that quantity of dissolved oxygen increased 15-18%, phosphorus combinaitions decreased 55-65%, ammonia decreased 45-60%, iron protoxide decreased 50-90%, iron total decreased 30-35%.

Mouth biofilters, mounted under the mouth of closed collector, possess aerational and purification abilities simultaneously. As the body of the biofilter may be used short reinforced concrete gutter and as the feed may be used crushed

stone or gravel with the size nearly 20-40mm. In the outlet of biofilter content of dissolved oxygen increases 2-4 times, BPK_5 (biological oxygen demand) decreases 50-80%, content of ammonia decreases 20-30%, phosphorous combinations 25-55%, iron total 30-90%.

Biological settling ponds in opened drainage net are expedient for preventation of carring over drawing alluviations and suspended matters to water-receiver and for purification field waters from biogenical combinations. They consist of two parts: settling part for purification from suspended matters and assimilational part which is occupied by higher water plant. Pollutants in assimilational part, consolidated by roots of plants, account for 80% of the total content. The final withdrawal of pollutants takes place during periodical (once in 10-15 years) pond purification from silt and surplus roots.

Scattered outlet in shape of inclined rectangular grounds is used for additional purification and discharge of drainage waters if soils isn't liable to erosion and flood-plain of water-receiver has well-turfed slope no less 50 m long and inclination 0,002-0,01. The width of the scattered outlet ground is selected depending on slope and accounts 6-36 m. Hydraulic load is nearly 500-700 $m^3/_{ha}$ per day. Recommended load: BPK full - 40-100, N - 4-6, P - 3-5, K - 4-6 $^{kg}/_{ha}$ per day.

Water protection measures may be used to improve the quality of field waters from drainage system. They are subdivided into organizing - economical, agrotechnical, antierosion forest reclamation and shore water protection zones.

THE USE OF CATION EXCHANGE FOR SELECTIVE SOLUTION OF HEAVY METALS IONS FROM WASTE WATERS

Sinjakova M., Kulikova N., Wolf I.
SPBGTURP

The pollution of water bodies by heavy metals ions has in our country universal expansion. Therefore the water purification from them is very actual problem. The ion exchange is without doubt one of the most effective methods for this purpose.

We investigated the selectivity of sorption of copper (II) and chromium (III) by different cation exchangers: carboxylic cation exchangers KB-4-P2 and KB-4-6, strong acidic cation exchanger KU-2-8 and self-made cation exchanger KLS on the base oflignin contained wastes.

The last cation exchanger is a polyfunctional one: it contains some quantity of $-SO_3H$ groups and large quantity of -COOH groups.

Our experimental study of the sorption selectivity which were fulfilled in static conditions had a purpose to find out the dependence of division coefficients $K_d^{Cu/Na}$ and $K_d^{Cr/Na}$ from relation of ions exchanging and from their concentration. Besides it was investigated the possibility of multistage sorption copper (II) and chromium (III) by carboxylic cation exchangers and by cation exchanger KLS.

It was proved that carboxylic cationts have the greatest selectivity to copper (II) and chromium (III), KU-2-8 - the least selectivity and KLS - the intermediate selectivity.

The increase of degree of preliminary transformation of carboxylic cation exchangers and KLS from H-form into Na-form lead to increase of copper (II) and chromium (III) sorption.

The decrease of relation of concentrations $[Cu^{2+}]/[Na^+]$ or $[Cr^{3+}]/[Na^+]$ in solution leads to increasing of division coefficients for carboxylic cation exchangers. This gives a possibility of carboxylic cation exchangers using for removing of copper (II) and chromium (III) even from solutions with high concentration of sodium ions. It was proved a possibility of using for that purpose also of comparatively cheap cation exchangers on the base of industrial wastes. It was proved also a possibility of multistage sorption of copper (II) and chromium (III) by scheme: sorption - water washing - transforming cation exchanger into Na-form - water washing - second sorption and so on. The original mechanism of copper (II) and chromium (III) sorption by carboxylic cation exchangers is discussed. The copper (II) and chromium (III) sorbed can be easily extracted from cation exchanger by diluted HCl. After that the carboxylic cation exchanger must be transformed into working Na-form.

The results of fulfilled investigations point out on good perspective of using of carboxylic cation exchangers and cation exchangers on the base of industrial wastes for selective sorption of heavy metals ions from natural and waste waters.

NEW SORBENT FOR TREATMENT AND MINERALIZATION OF WASTE WATER

Sizih M.R., Manieva V.I., Ryazantsev A.A.
BINS SD RAS, Ulan-Ude, Russia
Korsun L.N.
BCSM and S, Ulan-Ude, Russia

The treatment of strongly polluted industrial waste water with the help of natural sorbents is becoming increasingly important, as it allows to achieve good results at relative cheapness and availability of these reagents and adaptability of the processes.

We have developed ironcontaining coagulant on the basis of natural montmorillonite, modified by Fe(III) according to original technique with the help of ultrasound.

High efficiency of application of Fe-montmorillonite in the processes of water preparation was proved after studying its sorptional capacity in relation to anionic dyes. For example, the application of this sorbent in the treatment of the black mix of dyeing solutions of oxidizing dyeing ($C_{ин}$= 1200 mg/l) allows to clarify a solution by 98% using doze of 600 mg per 1 g of dye. The maximum degree of purification while processung the same solutions with iron chloride (III) is 89% at reagent consumption of 1050 mg/l. It is necessaryto note, that there is no Cr (VI) in the processed waste water, whech binds not only wiht the molecules of dyes, but also forms strong connections with iron on the surfase of the modified clay.

Fe-montmorillonite modified by ultrasound can be used for demineralization of industrial waste water. The efficiency of the this process (in comparison with newly deposited $Fe(OH)_3$ was tested at treatment mine waters. Deposition of 1 mole of SO_4^{2-} required 2.7 mole of Fe^{3+} (1.5 g of sorbent), that considerably exceeds the results acqwyred with hydroxide of iron (30 mole Fe^{3+} for 1 mole SO_4^{2-}).

Sorptional capacity of Fe-montmorillonite in relation to phosphates was studied depending on pH of solutions and the doze of coagulant. The initial model solution of KH_2PO_4 contained 500 mg/l of phosphates in terms of PO_4^{3-} ions. Maximum capacity of Fe-montmorillonite (with a doze 0.2 g/l) reaches 340 mg/l at pH=7, that corresponds to 50 meqv of PO_4^{3-} ions on 1 mequiv Fe.

High sorptional capacity of Fe-montmorillonite is explained by the features of spatial structure of bentonite, which becomes accessible to iron ions in a greater degree when US-treated. The large value of sorptional capacity of Fe-montmorillonite can be connected also with the formation of polynuclear iron sulfate or phosphate complexes in the interlayer space of bentonite, which are weakly retained by activated OH-groups of aluminosilicate.

Another way of modifying montmorillonite with formation of clay, fixed by iron oxides, has been studied. They have advanced micro- and mezoporous structure. This property as well as presence of acid centres of various force and nature give on opportunity to use the named matireals as adsorbents, heterogeneous catalysts, or carriers of catalysts.

The efficiency of application of fixed Fe-montmorillonite (in comparison with the data available in the literature concerning adsorptional properties of clays, modified by aluminium polyoxichloride) was tested on solutions of anionic direct pure-light-blue dye in a wide range of concentration (before and after CCM). The analysis of isotherms of adsorption has shown6 that the sorptional ability of Fe-fixed montmorillonite synthesized by us is mich higher. Its sorptional capacity was 42 mmole/100g and taken for comparison 2 mmole/100g, with equilibrum concentration of dye 0.2 mmole/l. Thus fixed Fe-montmorillonite is a promising sorbent for removal of dyes from waste water of industrial enterprises.

ECOLOGICAL PROBLEMS IN PROCESSING INDUSTRIES OF AGROINDUSTRIAL COMPLEX

Snitsar A.I.
All-Russian Meat Research Institute

Since the ecological situation throughout the world has been worsened, and the threat of natural resources exhausting has appeared, the ecological problems in processing industries of Agroindustrial Complex have gained priority significance and need systems approach to the solution.

When processing livestock raw materials and producing food grade fats in meat-packing plants useful protein and adipose matters get into the waste water.

Modern meat-processing and packing plants use a large amount of water, about 95% of which is removed from process water as highly contaminated effluents.

Cleaning of process water and extracting valuable protein and adipose pollutions is a matter of great economic importance. Introduction of advanced methods and means of local cleaning at meat plants allows to extract up to 98% protein and adipose matters from process water.

In this connection the problem of putting into practice of effective methods of process water cleaning together with protein and adipose extracting and utilizing is a very urgent one. The All-Russian Meat Research Institute has developed the technology and technical means for process water cleaning and protein and adipose waste products utilizing.

According to this technology a concentrate extracted by flotation (protein-adipose mass) was received, then it was melted, fat and cracklings were obtained. Animal origin feed meal made from flotation extracted concentrate is recommended for use as a partial substitute for meat-bone meal in pig diets.

Cleaning of ventilation exhausts with bad odour at the meat-packing plants and meat-processing plants has become an actual problem. When producing meat-bone meal and other technical products in vacuum tanks a great amount of toxic and bad smelling matters is formed. They pollute environment and create specific stink in shops. The glass-reinforced plastic absorbers have been developed and commercially produced. They have been tested at the plant for cleaning ventilation exhausts of meat plant technical products shop. Biological methods of cleaning gases from stinking substanses is a matter of great interest. Thermal and absorption methods of cleaning ventilation exhausts using hydrogen peroxide and ozon have found application in industry.

DECONTAMINATION AND UTILIZATION OF SALT LIQUID RADIOACTIVE WASTE AT RUSSIAN CENTER OF ATOMIC SHIP BUILDING

Sobolev I.A., Demkin V.I., Panteleev V.I., Adamovich D.V., Timopheev E.M., Slastennikov Yu.T., Sumenko A.V., Flit V.Yu.
Moscow SIA "Radon", Moscow, Russia

During repair and maintenance of atomic ships in Severodvinsk (Arkchangelsk region of Russia) at GMP "Zhvezdochka" under Russian Center of Atomic Ship Building large amounts of salt liquid low - level radioactive waste (LLRW) are generated.

In 1996 the Moscow SIA "Radon" was recruited for decontamination of these liquid waste. Moscow SIA 'Radon" specialists have developed and constructed a mobile facility "Eco - 3" for decontamination and utilization of salt liquid low - level radioactive waste. In 1996 - 1997 for 800 hours facility operation waste in volume 400 m^3 was decontaminated and discharged to White Sea water area and resulting concentrate was solidified by the use of cementation method. The final product was obtained in the form of monolith in volume 2,5 m^3.

Through the use of this facility the sorption - membrane technology of LLRW decontamination and concentration followed by concentrate conditioning in drums 200 l in volume and disposal in repositories is implemented.

The facility involves 2 units for LLRW decontamination:

- sorption unit,
- electrochemical membrane unit.

Initial LLRW at GMP "Zhvezdochka" is a salt low - level radioactive solution in which concentrations of 4 radionuclides exceed maximum permissible concentrations (MPC) for these radionuclides. The concentration of Cs-137 is more than MPC for this radionuclide by a factor of 70; the concentration of Cs-134 - by a factor of 3,5; the concentration of Sr-90 - by a factor of 35; the concentration of tritium - by a factor of 10.

The total a - activity of solutions is below permissible concentration of any one of radionuclides. Among the β - radionuclides, C - 14 and Ni -63 are also found.

Choice .of sorbents for preliminary decontamination of salt LLRW was determined by the following factors:

- radionuclide composition of initial LLRW;
- the need for eliminating sedimentation in electrodialysis and electroosmotic equipment;
- maximum reduction of dose rate at facility equipment.

Using the radionuclide composition as the base, the following sorbents were chosen: for cesium - ferrocyanide sorbent "Phoenix-A".; for strontium - highly - acid cationite KA-11 in the sodium form possessing selectivity in relation to cobalt ions; for cesium, strontium, cobalt - natural mineral clinoptilonite.

With the aim of reduction of dose rate at facility equipment cesium was eliminated at first stage of the process by two filter - containers filled with inorganic sorbent 30 l in volume. This allowed two problems to be solved:

- to remove 98% of Cs-137 and prevent further Cs-137 accumulation at the other equipment of the facility;
- to exclude the further management of waste as these filters reside just in the containers which are delivered immediately to disposal site without reloading.

Using the sorption technology the decontamination factor equal to 1000 was achieved for Cs-137, and decontamination factor for Sr-90 was 100. A lower decontamination factor was achieved for Co-60 as cobalt was in the form of stable complexes.

Initial LLRW with increased total salt content contains various chemical compounds such as chlorides, nitrates, sulfates, phosphates, ammonia which concentrations exceed permissible ones for LLRW to be discharged. Therefore, preliminary decontaminated LLRW was further treated by the use of 2 electrochemical membrane apparatuses.

Technical characteristics of membrane apparatuses and technological parameters of its operation are given in the report. The total specific electric power consumption was not over 10 kW-h/m^3.

A feature of this facility is the electroosmotic apparatus provided with non - flow - type brine chambers for concentration. This apparatus provides increase of concentration of LLRW in the cases of small amounts of LLRW as well as increase of operation reliability of salt eliminating electrodialyzer. Dialyzate loop of this apparatus is a by- pass pipeline of pump for circulation of LLRW through electrodialyzer brine loop. As a result the salt LLRW solution with concentration about 200 g/l is produced which subsequently solidified by the use of cementation method.

The facility flow - sheet, results of radiometric and spectrometric measures as well as results of chemical analyses of initial and decontaminated LLRW are given in the report. The decontamination factors and concentration degrees for various radionuclides are given as well.

The sorption - membrane technology designed to reprocess salt LLRW using electromembrane equipment in combination with inorganic sorbents and proved for actual waste is a unique and allows in the case of small amounts of LLRW to abandone the traditional method of LLRW evaporation.

PROBLEMS OF CLEARING URBAN STORM WATER RUNOFF ON ENTERPRISES OF A MACHINE-BUILDING PROFILE LOCATED IN A MODERATE CLIMATIC ZONE

Sokolov N.V., Nakalov P.R.
Institute of water problems RAS, MSTU by N. E. Bauman, Moscow, Russia

Surface runoff of rain represents essential ecological danger in conditions of urban territories. This runoff is considerably more than the drain from ambient territories. We know that the contaminations contain in such drain in the exceeding norm limits. In this water can be found out the particles of oil and fuel. The surface runoff also pulls many various mechanical particles. Usually the special substances from factory fall on nearer streets and enter rain-water drain.

The level of technique we'v reached and existing process engineering allows effectively protect an environment from surface contaminations by means of the engineering solutions. Obviously, the technological schemes of a system of clearing should correspond to the requirements on quality of clearing. It must take into account interests of the industrial enterprise and use singularities of loss of atmospheric precipitation in specific region and degree of plant territory contamination. The filtering is offered to consider as basic process of clearing of a surface runoff receiving the listed above data. The combined filtering bed is supposed to be optimum for the solution of this problem. Our researches in this sphere took place in laboratories of two machine-building enterprises by means of our original experimental set-up. The theoretical and statistical analysis of the empirical data lead to approximation of a kinetic equation of filtering with satisfactory conformity to conditions of our problem. As an outcome of this activity, there we'v developed the filter with multilayer bed which was tested one of plants in Moscow. The loading consists of four layers. The first and second layers of a bed serve for acquisition of mechanical particles. Third and fourth layers protect from contamination inherent for the specific plant. Testing of our scheme showed it's good characteristics. For example the filtering processes at small water head and all volume of a runoff is treated completely, and the resource of a system allows to supply reliable activity of the filter. In this respect, the quality of clearing achieved by this method corresponds to required level. All the materials of this filter is already used in other areas of engineering. The regeneration of a filtering loading is possible, but this problem requires additional researches. The development of this technology will allow to essentially reduce the cost of a runoff clearing. It also will submit a capability for actuation of the cleared waters in a system of reverse water supply of the enterprise. This operation is especially useful under the condition of in modern ecological and economic situation.

PROSPECTS UTILITY OF ALGOBACTERIUM COMPLEXES IN WATER PURIFICATION

Soprunova O.
Astrakhan state technical university, Astrakhan, Russia

The problem of purification sewage water of complex composition is the most important in environmental protection. Systems of biological purification, based on self purification of water are not satisfactory now. That's why, problem of developing this process is the most important.

As it knowing, the autotrophic microorganisms are the main agents of purification. The activating agent, in soiling and complex toxic water with decomposing organic matters is algobacterium complex.

Investigation of its vital activity in various water showed that not only the main structure - forming agents with mixotrophic function are important in purification but microorganisms satellites with geterothrophig function play an important role in destruction all the water pollutions. Besides that, the microorganisms - satellites enhances stability of autothrophic bacterium in adverse conditions.

Variety of species and physiological groups of microorganisms, and oxidant presence (hydrogen peroxide, nitrites and nitrates ions, carbon dioxide and soon) proceed and affirm unbounded abilities of cyanobacterium complex while recovering of water pollutions.

Control of vital activity of algobacterium biocenoses in sewage water permit us to study problem of intensification of purification.

REGIONAL STANDARDIZATION OF SEWAGE OF SUBSCRIBERS, ADMITTED TO THE SEWERAGE SYSTEMS OF SAINT PETERSBURG

Stepanenko T.F., Lysova T.I., Navotny V.V.
SUE "Vodokanal of Saint Pet", Saint-Petersburg, Russia

In accordance with the requirement of the legislative and normative documents in force in the field of water control and use when effecting the discharge into water objects organizations of water supply and sewerage economy must observe the normative quality of sewage in the limits of tolerable discharge (TD), affirmed according to the stated order, and be responsible for their observation. The discharge of sewage into water object exceeding the TD stated (according to the decision of the Soviet of Ministers of Russian Federation No.532 of 28.08.92 "About the affirmation of the order of payment determination and its maximum amount for the pollution of environment, wastes placement, other kinds of harmful influence") "is punished" by the payments from the profit, remaining at the disposal of water supply and sewerage economy enterprises, and therefore a damage is inflicted to the water supply and sewerage economy organizations.

At the same time it is generally known that water supply and sewerage economy organizations themselves do not produce the pollution which make the harm to sewerage systems and water objects, and often have no possibility not only to influence the source of ingress of one or another pollutant into sewage, but also to decrease the volumes of sewage entering sewerage systems.

In this connection the decision No.1310 of 31.12.95 "About collection of payments for the discharge of sewage and pollutants into sewerage systems of settlements", adopted by the Government of Russian Federation, is to be considered as a very important legislative act, which allows to consider the measures of economic influence for the damage inflicted to sewerage systems and environment, including those which appear because of the exceed of discharge normative. Moreover, the action of this decision can be expanded on all kinds of sewage of all categories of subscribers.

The methods of sewage standardization as a part of "The rules of the receiving of industrial sewage into sewage systems of settlements", adopted by the Ministry of Housing and Communal Services of Russian Federation as far back as 1984, even if could be used, for industrial sewage only (i.e. sewage from industrial, construction and transport organizations), which according to the Rules belong to the main "pollutants" of the sewerage systems of settlements and naturally water surroundings.

However the structure of water discharge in the sewerage systems of settlements, really formed at the present moment, is characterized by the following:

- structural reconstruction of economy and decrease of industrial production caused the decrease of the volumes of "industrial" water discharge. In particular, in Saint Petersburg - up to 10-15 % from the total passing of sewage instead of previously observed 40-60 %) with the simultaneous increase of water discharge of "other" subscribers up to 50 %;
- the decrease of the volumes of industrial sewage discharge "involved" also the decrease of the amount of the discharge of the amount of specific polluters into sewerage systems;
- technical rearmament, the change of existing technologies for new ones, in many cases being of absolutely different profiles, led to the quality change of the composition of industrial sewage;
- the increase of the water discharge of the "other" subscribers of non-industrial sphere, also caused by the reconstruction of their activity profile or giving in rent premises as production shops and work shops, takes the place simultaneously with the quality composition of sewage of this category, which is characterized by the increase of specific "industrial" pollution.

Moreover, the territorial bodies of the State antimonopoly policy and the support of new economic structures committee of Russian Federation put the standards of the quality of subscribers sewage into dependence (and it is correct) from not only stated tolerable discharge (as a part of discharge limits at the settlements' sewerage systems discharges into water objects), which are being discharged into water objects, but also from the amount of payments of water supply and sewerage economy enterprises for the pollution of environment exceeding standard.

Therefore, in the conditions of market economy making inventory of the quality of subscribers sewage becomes not only inauthentic, but also impossible.

the investigations of the quality composition of the city and suburb domestic discharge, carried out by the SUE *"Vodokanal of Saint Petersburg" in 1994-1996 exposed "the naivetй"* of the present Rules as to "classical" composition of the domestic discharge of subscribers, which have housing fund under their authority.

Domestic discharge is a serious «polluter» and this is to be taken into account while carrying out the standardization of subscribers' sewage.

As it is known, the projecting of the constructions of biological purification is carried out according to the Construction Norms and Rules 2.04.03.-85 "Sewerage. External nets and constructions". The effectiveness of the work of purification constructions being calculated according to the two main indexes for domestic discharge: BOD and suspended substances with due regard to the content in the discharge nitrogen and phosphorus not as "pollutants" but as biogenetic elements (necessary for the technological regime of biological purification).

In accordance with the environmental legislation for the stated indexes of domestic discharge (BOD, suspended substances, nitrogen, phosphorous) water supply and sewerage economy organization is obliged to provide purification, which will be satisfactory to tolerable discharge standards at the discharge into water object. The real quantity of purified sewage fully keeps within project parameters of purified sewage as to BOD and suspended substances (up to 15 mg/dm3), but is very much behind the standards, stated as a part of tolerable discharge.

So the contradiction between the adopted in Russia state standards for the projecting and construction of the classical schemes of sewage biological purification and the requirements of environmental legislation to the discharge into water objects is present.

In our opinion, in the conditions of the necessity of the fulfillment of obligations concerning unconditional acceptance of domestic discharge into the sewerage system (according to "The Rules of the use of municipal water supply and sewerage systems in Russian Federation") by water supply and sewerage economy enterprises, from one side, the observance of corresponding project loading for purification constructions as to BOD, nitrogen and phosphorous (for the observation of the technological purification regulation), from the other side, and the observation of antimonopoly legislation, from the third side, water supply and sewerage economy organization has no right to demand from subscribers the observation of tolerable concentration (TC) as to BOD, nitrogen, and phosphorous, calculated proceeding from the observation of the standards of tolerable discharge.

Thus, during the calculation of subscribers sewage quality standards the necessity of taking into account the necessary degree of additional purification as to the substances typical for "classical" domestic discharge (BOD, nitrogen group, phosphorous and sometimes suspended substances) occurs.

Taking into account the above mentioned, the conclusion concerning the necessity of the change of the conception of subscribers' sewage quality standardization in the following way suggests itself:

- the introduction of the mechanism of the standardization of the sewage quality of two categories of subscribers - "housing fund" and "others" (including industrial enterprises);
- the determination of the list of pollutants, subject to standardization, proceeding from the list of substances, which are normalized as a part of adopted TD on the discharges of water supply and sewerage economy organizations into water objects, and also the substances influencing the regime of the work of sewerage nets and constructions;
- the registration of the real quality of domestic discharge from the subscribers of housing fund as the source of pollution;
- the registration of the necessary degree of additional purification of sewage according to such indexes of domestic discharge as BOD, nitrogen, phosphorous and in some times suspended substances.

New methodology was adopted on the basis of this conception in Saint Petersburg during the development of the standards of discharge as to the quality of subscribers sewage (as a part of "The conditions of the receiving of pollutants into sewage, discharging by subscribers into sewerage systems of Saint Petersburg").

In the first approach the real averaged concentration of pollutant as a part of domestic discharge (Chous) is taken as the standard of tolerable concentration of pollutants for sewage of subscribers of "housing fund" category (TC hous), i.e. TChous=Chous.

The standards of tolerable concentrations of pollutants for sewage of all "other" subscribers (TCother) are determined according to the formula:

$$TCother = \frac{Q}{Qother} (Cps - Chous) + Chous,$$

where:

Q - is one year expenditure of sewage coming to pollution constructions, (thous.m3/year);

Qother - one year expenditure of sewage of «other» subscribers. (thous.m3/year);

Cps - the tolerable concentration of pollutant in sewage, coming to pollution constructions, (mg/dm3).

It is determined according to the minimum meaning of the concentration, providing the normal exploitation of sewerage nets and constructions proceeding from the conditions of the prevention of overflow and aggressive influence on sewerage nets; calculated tolerable concentration, which is determined according to the standards of tolerable concentrations at the discharge into water objects and the effectiveness of purification at sewerage purification constructions (SPC), stated by the bodies of the Environmental Committee.

Taking into account "the severity" of sanctions of normative concentrations upon some pollutants as a part of the affirmed TD at the discharges of the SUE "Vodokanal of Saint Petersburg" into water objects, high content of homogeneous pollutants in domestic discharge (i.e. the absence of dilute ability upon them), in spite of the adopted meaning of the parameter of purification effectiveness according to the normative, but not to the real meaning, calculated quantities of TCother for such substances are often expressed by the meanings, which are < than Chous (and even negative). For these substances (in Saint Petersburg - oil products, iron, zinc, aluminum, manganese and in separate sewer basins - copper) the calculated standards of TCother and TChous are stated at the level of Cps, i.e. TChous = TCother = Cps.

Thus, the necessity of standardization of domestic discharge for subscribers of housing fund was revealed upon these substances.

Further, exceeding from the necessity of the observation of antimonopoly legislation, the meanings of the above stated tolerable concentrations, received in the result of the calculations, were analyzed with the purpose of their comparison with the real conditions of water discharge into sewer basins.

Thus, the analysis of the observation of the adopted standards of TD in the discharge into water objects by the natural users of the SUE "Vodokanal of Saint Petersburg" (SPC) revealed some important aspects:

Some substances, present in the sewage of subscribers (fluorides, titan, cyanides, methanol, formaldehyde), are not included into the schemes-graphics of SPC sewage control adopted by the bodies of Environmental Committee, and also into the list of substances, which are being normalized as the part of TD, because they are not found out in the composition of sewage in the discharge into water objects.

That is why the decision concerning the exclusion of such substances from the list of normalized substances in the sewage of subscribers was adopted.

At the same time some substances in the composition of sewage of subscribers, which are also not included in the adopted TD and the schemes-graphics of the SPC laboratory control, affect the order of sewerage systems work.

Thus, the list of the normalized pollutants as a part of subscribers' sewage is determined according to the two components:

- the pollutants, upon which the TD standards of the discharge into water object are stated by the Environmental Committee;
- the pollutants, influencing sewerage nets and constructions working regime.

The estimation of the observation of TD standards, normalized as a part of TD standards by sewerage purification constructions shows that they (pollutants) conditionally can be divided into three groups:

- I group - the substance, upon which the exceed of the real quality (Cf) relatively to the determined standards (Cst) in the structure of TD at the discharge into water object is always observed.
- II group - the substances, upon which the exceed of the determined TD standards is observed from time to time.
- III group - the substances, upon which the TD standards at the discharge into water objects are always observed.

Table. The indicated estimation for Saint Petersburg conditions (upon the Central Station of Aeration) is given underneath in the table.

No.	Name of pollutants	The standard of the pollutant concentration at the discharge into reservoir (as a part of TD), Cst., mg/dm3	Real concentrations at the discharge into reservoir for the period of 1995, mg/dm3		TD standards of pollutants in the sewage of subscribers, mg/dm3	
			maximum	average	calculated	affirmed
1	2	3	4	5	6	7
I group - the substances, for which the correlation Cf>Cst is always observed						
1	BOD totally	3.0	25.0	11.4	370.0	1000.0
2	Chemical OD	30.0	58.0	46.0	550.0	HPK:BPK
3	Nitrogen ammonium	1.22	7.7	4.3	18.0	18.0
4	Oil products	0.05	2.7	0.92	0.3	0.3
5	Phenols	0.001	0.022	0.011	0.04	0.04
6	Iron general	0.1	0.96	0.32	0.5	0.5
7	Zinc	0.014	0.27	0.14	0.05	0.05
8	Aluminum	0.04	0.5	0.14	0.2	0.2
9	Manganese	0.01	0.12	0.058	0.03	0.03
10	Phosphorous phosphate	0.72	1.36	0.82	2.7	2.7
II group - the substances, for which the correlation Cf>Cst is observed from time to time						
11	Suspended substances	7.5	12.4	7.5	280.0	280.0
12	Synthetic Surface-active subst.(anion)	0.1	0.125	0.07	1.0	1.0
13	Copper	0.005	0.016	0.007	0.04	0.04
14	Nickel	0.01	0.029	0.012	0.04	0.04
15	Mercury	0.00005	0.00016	0.00009	0.0002	0.0002
16	Cadmium	0.001	0.0007	0.0003	0.003	0.003
III group - the substances, for which the correlation Cf<Cst. is always observed						
17	Chlorides	200.0	88.0	57.0	340.0	1000.0
18	Sulphates	66.0	63.0	44.0	100.0	500.0
19	Dry residuum	500.0	391.0	285.0	690.0	as to Cl and SO4
20	Chrome +3	0.07	0.0081	0.007	0.7	0.7
21	Chrome +6	0.02	0.0009	0.0008	0.2	0.2
22	Cobalt	0.01	0.01	0.007	0.04	0.1
23	Lead	0.03	0.027	0.006	0.1	0.3

It is obvious that upon the substances of the III group there is a reserve between real discharge and TD, which allows to state "soft", relatively to calculated, normative of TC for subscribers.

As to the substances of groups I and II, no "softening" of calculated meanings of TC are mainly possible for them, because the SUE "Vodokanal of Saint Petersburg" is responsible for every (even episodic) violation of TD in the discharge into water object as to these substances.

The exclusions are the indexes, affecting the order of the work of biological purification constructions, i.e. as it was stated above, BOD, nitrogen, phosphorous and sometimes suspended substances. The correction of the calculated meanings of TC in the direction of increase is effected here only for those Sewerage Purification Constructions, which are underloaded as to project parameters in the coming discharge.

In the opinion of the SUE "Vodokanal of Saint Petersburg" the above indicated method of the TC calculation (taking into account the estimation of the real conditions of water discharge) allows to determine technically substantiated standards of the tolerable concentration of pollutants to subscribers.

WASTE WATERS QUANTITY IMPROVING AT THE UFA REFINERY

Sukhorukov A.M., Shamsutdinov I.N., Galeev R.G., Afanasev I.N.
The Ufa Refinery, The Institute of Problems Refining and Petrochemistry Problems of the Academy of Sciences of the Republic of Bashkortostan, Ufa, Russia

During the last five years at the Ufa Refinery a number of for waste waters quantity improvement and loweing of surface and subsoil waters of White and Shugurovka rivers basins pollutions. The works order wasdefined with taking into account for Refinery type and works duration (near 60 years), relief features and Refinery territory disposition, also it was connected with renovation and reconstruction of basic works.

There was a working out of complect water-supply and sewerage scheme with waste waters treatment that included surface and subsoil waters. A technological regulations for rotational water treatment is elaborating. A stationary observation at the nature of underground waters and soil pollution spreading are carring out with use of borehole system at the Ufa Refinery territory include White and Shugurovka riverside. An investigation of undersurface refinery territory has began for expose petroleum products leakage, for localisation and liquidation petroleum pollution on the soil waters surface. Also there are any large projects in working out. They are: "The system of collection, treatment and return to rotation of Refinery territory precipitation", "The working out of works plant for waste waters sequence and utilization project", "An emulsion waste waters mechanical system treatment reconstruction". The large work was developed for study of G-43-107 M/1 catalysis cracing waste waters quantity.

So,the Ufa Refinery waste waters was improved considerably.

APPLYING OF NEW REAGENTS-HYDROSOLES IN ORDER TO DECIDE TECHNOLOGICAL WATER PROBLEMS

Sviridov V.V., Sviridov A.V., Ulasovets E.A., Obadin D.N., Yermakov D.V.
Joint-stock company "Eco plus", Yekaterinburg, Russia

The search of high-performance reagent methods of natural and waste water treatment, sludge and slime dewatering, liquidation of water emergencies is a most urgent problem. There is an objective yet: to increase the efficiency of technological processes and reduce expenditures on realisation and application of reagent methods under the complete utilisation of wastes and maximum water-circle in the industrial systems.

The reagents of the "Ecosole" line meet the requirements mentioned above. They were worked out and introduced by the enterprises "ECO PLUS", "ECO-PROJECT", "The Ural cementnik" which are the members of the Ural engineering-ecological association and included in the system of the Russian Academy of Natural Sciences. The reagents represent the superfine water-insoluble colloid hydrosoles, their specific surface is 40-60 m^2/g. Various aluminosilicates of the Ural region are the raw materials for hydrosoles synthesis. In the synthesis process raw materials are subjected to the chemical modification along with the regulation of sorption capacity (in regard to the various compounds of the organic and inorganic nature), selectivity of watering (hydrophilic-oleophilic properties), electric-surface parameters and rheological characteristics. Due to the directed synthesis the reagents of poli-functional operation were created which perform the role of colloid sorbents and, simultaneously, hardphase flocculants under the treatment and conditioning of natural and waste water as well as the functions of inorganic sludge and slime dewatering, oil and oil-products collecting and radionuclides collecting under their emission into the water sources.

Using reagents of the "Ecosole" line together with aluminium sulphates or oxychlorides the indicators of drinking water quality meeting State standards are achieved stably. This is caused by the high sorption capacity of reagents as well as their property to intensify the processes of the formation and aggregation of nucleuses of coagulants hydroxides, processes of the flocculation and settling. The use of reagents together with organic flocculants under the industrial wastewater treatment enables to reach standards in regard to almost all components.

Reagents have a property of superstoichiometric sorption in relation to radionuclides (distribution coefficient concerning strontium and caesium is 50-60 thnd), that enables to treat the big volumes of radiat on-po.luted water under emergency.

Special hydrophobising hydrosoles assist to solve one more important problem: to increase sharply the dewatering efficiency of galvanic slime, slime of the neutralisation stations of industrial enterprises, poor and other slime. A speed of the slime filtration in the process of its dewatering increases in 2-2.5 times under the residuary moisture of 40-50%. Besides the "floating" hydrosoles have been created and tested, they are the collectors of oil-products and oil from the water bodies and grounds surface and have the high sorption capacity (7-9 g of oil per 1 g of colloid sorbent). As regards the efficiency and effectivity such the collectors of oil-products exceed the available domestic and foreign similar ones.

An additional advantage of hydrosole reagents mentioned above is the fact that they are completely utilised (together with the component discovered) in the cement industry or easily subjected to the vitrification (after radionuclides sorption) by the available technologies.

THE PROBLEMS OF SURFACE WATER DISPOSAL AND TREATMENT AND THE DEVELOPMENT OF MOSVODOSTOK ENTERPRISE

Tcherenkov A. K., Razorjonov A. A., Petchnikov V. G., Karpova N. B.

The problem of the collection, transportation and treatment of the wastewater (comprising atmospheric precipitation, drain water, the water used for washing and street watering and some part of the industrial enterprises water considered to be pure from the point of view of the relevant Standards) from the territory of the City is an important municipal problem the condition of which considerably determines the condition of the water objects of the City.

The surface water disposal system is comparable to the Moscow system of municipal sewage and industrial wastewater disposal system from the point of view of the volume of the water handled, the amount of the pollutants entering it and the amount of sludges produced.

The basic principle developed for the designing of the surface water disposal systems envisages the usage of the rivers on the territory of the City as the surface water receiving water bodies and their incorporation into the surface water disposal network of Moscow.

The problems of rain water disposal and treatment in the City of Moscow are tackled by MOSVODOSTOK Municipal Enterprise which was established in 1975 as an operating service of the City. Since 1991 the Enterprise tackles also the problems of the environmental protection.

The surface water disposal systems of the City of Moscow include the following:

- storm water and surface water disposal network;
- small rivers and springs both in open channels and enclosed in tubes;
- watering systems, the Waterworks on the Yauza River;
- ponds and water bodies including the water bodies of channel type flow-through ponds and regulators equipped with complex water engineering elements and dams;
- the treatment facilities located at the end parts of the surface water disposal network before the water discharge into open waterways.

The Enterprises are in charge of 82 treatment facilities including 33 settling ponds, 33 facilities of chamber type, 10 grit chambers and 6 screen booms in the channels of the Moskva River and the Yauza River. About one half of the wastewater disposed from the territory of the City flows through these facilities which differ from each other from the point of view of their operation principle, discharge capacity and treatment efficiency. But they all have one and the same feature - the imperfection of the technical approach to their design and as a result of that - the insufficient (according to the existing requirements) level of pollutants removal from the wastewater. These facilities envisage wastewater treatment concerning two ingredients only - the suspended solids and the petroleum products.

That is why their reconstruction is planned for the nearest future. Meanwhile we propose to increase wastewater treatment efficiency by means of its intensification based on the implementation of the new treatment technologies, new filtering materials, etc.

The ecological condition of the small rivers and streamlets of the City troubles us greatly since the existing treatment facilities envisage the treatment of only some part of the surface run-off. As a result of the existing surface water disposal system the river water quality considerably exceeds the pollutants levels required.

The lack of a well-grounded scientific concept for surface water disposal and treatment has resulted in the wrong decisions making which were used for the construction of the water disposal system of the City.

We propose to make efforts firstly to improve the City territories, to plant them with trees and gardens and to carry out the grass sowing of the lawns. As a result of these efforts the surface run-off will be much less polluted and large expenses for surface water tertiary treatment will not be needed.

The system of payments for surface water reception into the storm sewers system will be the main tool for the City territory improvement and maintenance. The mechanism of the payment system is being developed by our Enterprise.

ADVANCED OXIDATION PROCESSES AS AN OPPORTUNITY FOR PURIFICATION OF WASTEWATER FROM ESTONIAN OIL-SHALE INDUSTRY

Trapido M., Munter R., Veressinina Y.
Institute of Chemistry, Tallinn, Estonia

The wastewaters from oil-shale industry contain significant amount of different phenols. For example, the wastewater of oil shale thermal treatment and leachate from ash dump contains xylenols (up to 200-250 mg/l), cresols (up to 110 mg/l) and resorcinols, especially 5-methylresorcinol, where as phenol forms only 25 % or less from the total amount of phenols. Phenols are degraded by bacteria, but as they are highly toxic, the conditions for biological degradation are unfavourable.

Typical homogeneous AOP systems, such as O_3/UV; UV/H_2O_2; US; O_3/US; H_2O_2/Fe^{2+} and also photo-Fenton were applied for the treatment of different phenols. High performance liquid chromatography has been used to follow the reduction of phenol concentration and the formation of some by-products during AOP treatment. The main target of this study was to compare the efficiency of these processes for the degradation of phenols. AOP were found to be quite

effective in decomposing different phenols. Several AOPs enabled to achieve 90 % conversion in quite reasonable time. In general, the efficiency of different AOP for degradation of phenols followed the order $H_2O_2/Fe^{2+}/UV > O_3/US > O_3$ i $O_3/UV > H_2O_2/Fe^{2+} >$ US i $UV/H_2O_2 >$ UV.

A very strict maximum permissible concentration (MPC) for total phenols has been established by the Helsinki Committee - 0.5 mg/l for the treated effluents before discharge to the Baltic Sea. Such a low concentration of phenols is not achieved by biological treatment of phenolic wastewater and leachate from oil shale thermal treatment in Kohtla-Jдrve. Ozonation and AOP may be the alternative methods for the purification of phenolic leachate and as an effective post-treatment method for the biologically treated phenolic effluents. Deep post-treatment of effluents can afford the possibility of water recycling. Different advanced oxidation methods (O_3; H_2O_2; UV; O_3/H_2O_2; O_3/UV; H_2O_2/UV; $O_3/H_2O_2/UV$) have been tested to reduce the final concentration of phenols in biologically treated phenolic effluent of Estonian oil shale chemical industry. Ordinary ozonation was found to be preferable for post-treatment of the biologically treated phenolic effluent.

As it has been ascertained that the ozonation is the most effective and the cheapest chemical treatment method for degradation of phenols, it has been used for the treatment of the leachate from ash dump from Kohtla-Jдrve. This wastewater is derived from flushing water and atmospheric precipitation from the semi-coke storage area. The total concentration of phenols was 294.2 mg/l. 10 minutes of ozonation enabled to achieve about 4-fold decrease of the total concentration of phenols. 30 minutes of ozonation led to the ultimate degradation of all phenols. Among the constituents, dimethylphenols were degraded quite easily. The degradation of phenol, cresols and resorcinols needed longer treatment time. The ozone consumption was about 2 moles of ozone per one mole of phenol degraded which indicates that the process may be also cost-effective. The toxicity of the ozonized leachate was studied. According to *Daphnia magna* test the ultimate detoxication of the treated water was achieved during 30 minutes of ozonation. So, ozonation may be recommended as the treatment or pre-treatment method for purification of the toxic leachate from the ash dumps.

The results of the present study can be quite useful for working out the treatment methods for phenolic wastewater from coke manufacture, paper mills and coal conversion.

IMPACT OF SSAM ON THE QUALITY OF SEWAGES AFTER DEGREASING OF SHEEPSKIN

Tzyrenov C.Zh., Dumnov V.S., Ineshina E.G., Shalbouev Dm.V.

Improving the thecnological processes of treatment sheepskin has caused the appearance of new toxic chemicals in sewages. Synthetic Surface Active Materials (SSAM) are mostly undesirable. The SSAM are widely used in degreasing of sheepskin by emulsification.

The SSAM middle concentration in sewages after degreasing process is up to 3150 mg/l, due to the slowing down of biochemical processes in airotanks and bio-filters and intensification of foam-making. Besides, these substances had a bad influence on living organism by chanching the oxygen regime of natural waters and destroying plankton - basic fodder.

That is why joint usage of the ecobiotechnological consortium of the micro-organisms and "biologically soft" SSAM have practical interest with the purpose of more soft degreasing sheepskin and improving of sewages quality to degreasing of nature waters pollution.

Synthetic Surface Active Materials (SSAM) has different chemical structure. It brings the necessity to pick out bacterium-destruction. That is why we have had a series of experiments, where composition of degreas-drenches have been changed by successive introduction of different kinds SSAM: anionactive "Sulfanol NP-3", "Tzynamy I", pasta "Novost"), cationactive ("Sintanol V-7"), neionogen ("Sandocen NIL", "Prevocell W-OF-7") and amfotern ("Albegal B").

Technological parameters of degreasing corresponded to the Unified Technology (1988).

To define the impact of different SSAM concentration and fatting substances on the rate of growth of micro-organisms sewage after degreasing was poured to bottle and placed to thermostat.

One milliliter of probes was transfered to sterile bulb to sowing. The bacterium was grown on the meat-peptone agar (MPA). The number of micro-organisms was defined by the chemical cup method.

We have defined that micro-organisms have the maximum inhibition effected by "Sintecal V-7" and their number has intensively grown -"Albegal B" and "Tzynamy I" and equal COU (colony forming unit) = $1.45*10^7$ and COU=$1.32*10^7$ accordingly.

"Novost", "Sulfanol NP-3", "Prevocell W-OF-3" and "Sandocen NIL" have middle inhibitions effecting the grow of micro-organisms and maximum significance is 7.4; 3.7; 4.2 and $8.2*10^6$ accordingly.

Assessment of sewages quality was defined by physical (concentration of Suspended Solids), chemical (COD) and representative (SSAM concentration) properties.

Degreas-drenches with "Sandocen NIL", "Tzynamy I" and "Albegal B" have maximum concentration of suspended substances - 690; 636 and 652 accordingly. It shows at a higher clean property of those SSAM. For all of mixtures are characterised by higher level of COD from 4310.5 to 4940.5 mgO/l. COD decreased in the time thermostation that shows at the destruction of organic substances. COD has greatly decreased the level from 4482 to 1538.4 mgO/l for the mixture with "Tzynamy I". SSAM has maximum destruction for degreas-drenches having "Sandocen NIL" and "Tzynamy I". The concentration of those SSAM decreased lower than 96.18 and 67.76% after 96 hours of thermostation.

The sewage being degreased according of the Unified Technology is characterised by a very slow decrease of the level of COD (from 4655.34 to 3273.1 mgO/l) and SSAM (5.17%) after 96 hours thermostation.

15 microbe isolators from various sewages were found. Microbe's indication was conducted by usual methods with the following study of their physiological and biochemical properties.

Thus, impact of different SSAM on the rate of growth of micro-organisms was investigated in our work. Minimum degree of sewages pollution was defined for mixtures with "Sandocen NIL", "Tzynamy I" and "Albegal B". Those SSAM can be used for creation of ecobiotechnological consortiums with following usage in degreasing of sheepskin. It will allow to decrease the level of the anthropogenic influence on the environment.

PURIFICATION OF EFFLUENTS AHD MINERALIZED WATERS FROM SULFATE-IONS AND SALTS OF HARDNESS BY REAGENT METHOD

Usikov D.V., Kovzel V.H., Shvyryov H.P., Rodina I.V.
SVERD - Ecochimtech

As practice shows, sulfate-ions and salts of hardness con tent of effluents in many productions exceeds the PDK norms by several fold and we are faced with the problem of their purification from these impurities.

A number of regions (the Urals, Western Siberia and Kazakhstan) have also an acute problem of purification of mineralized natural waters from sulfate-ions and salts of hardness when using them for daily and economic needs.

At present the methods of distillation and chemical sedimentation applying reagents (Aluminium oxychloride) are mostly used. Disadvantage of the first method consists in high consumption of utilities (electricity, steam, cooling water) and high capital investments. The second one is cheaper and rather efficient but requires the reagent modification (basicity), which depends on the qualitative composition of the waters, to be carefully selected. Furthermore, Aluminium oxychloride is rather expensive.

We have developed the technology and equipment for effluents and mineralized waters purification which is based on the removal of sulfate-ions and salts of hardness from solutions due to the formation of hardly soluble compounds in the reactor (Calcium hydrosulfaaluminates).

The implemented process is simple and easy to operate and maintain.

The main feature of the developed method consists in using Aluminium-containing solution formed in the reactor as one of the reagents.

The apparatus is a rotatable drum to be loaded with coke and aluminium scrap in the definite ratio. Water with the definite pH value is passed through it. The activity of the reagent produced is considerably higher than that of the reagents used" for water purification nowadays.

The results of purification of effluents from Chemical water treatment departments according to the suggested technology achieved under conditions of stand laboratories are given in the table below

Table

impurities	Composition of effluents, g/dm3		Purification efficiency
	Before purification	After purification	
SO_4^{2-}	2,00	0,03	98,5
Ca^{2+}	0,77	0,02	97,0
Mg^{2+}	0,167	not found	100,0

The experiments on sulfates and salts of hardness sedimentation were performed under the following conditions: treatment time did not exceed 30 minutes, the process ran in the alkaline medium, the reagent was fed in the form of solution.

One can see from the table that the use of Aluminium-containing reagent formed in the reactor allows deep water purification to be realized.

It should be noted, that this technology allows the water not only from sulfate-ions and salts of hardness but also from ions of non-ferrous metals to be purified.

The above technology is a base for the process flow diagram of effluents purification in Chemical Water Treatment boiler of Instrument Engineering plant (city of Trekhgornyi).

The water resulted from the purification can be used in water recycle and discharged into the pond. Sediments of non-soluble compounds can be completely utilized, for instance, in cement and construction materials production.

COMPARATIVE EVALUATION OF SEWAGE TOXICITY IN REGARD OF DAIRY AND MEAT INDUSTRY FATS CONTENT

Varezhkin Yu.M., Michallova A.N.
State Research Centre "GNIICHTEOS", Moscow, Russia
Aleshin V.A., Miroshnichenko N.A., Tarasova Z.I.
Murmanskii Mechanical Bakery, Murmansk, Russia

Evaluation of industrial sewage or its separate ingredients,supplied to the biochemical treatment station is an urgent problem,regarding natural water reservoirs protection.

Appropriate solution of this problem by means of biotesting allows to integrally evaluate sewage toxicity, amplifying contamination control of water reserves in terms of chemical, biological and hygienic indexes and is the stage of basic strategy regarding the environment safety and careful use of water resources.

Toxicity of industrial sewage, supplied to biochemical treatment plants of Murmanskii Mechanical Bakery (MMB) from integrated meat and dairy works was studied by means of biotesting (enzyme and microbiological ones) in regard of fat contents and their mass ratio.

Fat contents in the effluents varied from 30 to 260 mg/L, and mass ratio between the fats from the meat packing plant and the mechanical dairy varied in the range of 8.2-8.6 at similar effluent volumes.

It was found by biotesting methods that dairy processing fats impart higher toxicity to the sewage, than meat processing ones. This is proved by the fact that the effluents from the meat packing plant, involving 100 mg/L of fats (COD =1142 mg O_2/L, are less toxic than the effluents, supplied from the mechanical dairy with the same fat contents (100mg/L, COD = 461,5 mg O_2/L. The toxicity in terms of microbiological test as more sensitive of the two, was 20.2%, whereas meatpacking plant effluents toxicity was 3% only. When COD values were both equal to 800 mg O2/L for meat and dairy industry effluents but with various fat concentrations (meat - 71 mg/L; dairy - 173 mg/L) the similar result was observed: meat packing works effluents toxicity (5,9%) was much lower than that of dairy effluents (37.3%).

Study of meat and dairy industry fat content effect at 30-260 mg/L concentrations on total effluents toxicity at the identical mass ratio (8.6) showed, that at fat concentrations of 30-68 mg/L total effluents are not toxic; 69-76 mg/L - are low toxic, and higher - are acutely toxic (see Table).

Table

Industrial fat concentrations, mg/L			Microbiologic toxicity, %
meat	dairy	total	
26,87	3,13	30	non-toxic
60,90	7,10	68	non-toxic
61,80	7,20	69	4,6
68,07	7,93	76	8,5
232,86	27,14	260	25,9

When fat mass ratio is changed in total effluents (from 8.6 to 8.2) towards dairy fat content increase, the total effluents become already toxic at fat concentration of 68 mg/L.

Thus, on joint discharge of meat and dairy sewage at the biochemical treatment station, fat contents and mass ratio of meat and dairy industry fats must be strictly controlled in total effluents.

PLANT FOR PRODUCTION AND USE OF FLOCCULANT "PERCOL+ " WHEN DEHYDRATING THE WASTEWATER SLUDGES AT THE CENTRAL AERATION STATION OF ST.- PETERSBURG

Vasiliev B.V., Malyshev A.V., Gumen S.G., Bolshemennikov J.A., Tsvetkova V. I.

The Allied Colloids Company developed a method and manufactured a plant for production of cationic flocculant "Percol +" using a known Mannich reaction; in that case, the finished product may be received with the pre-specified molecular characteristics of the flocculant by change of a ratio of the initial components.

The present development allows to increase essentially the output of the reaction and improve considerably the quality of the final product from the view point of its ecological safety, that is to decrease a residual amount of toxic dimethylamine and formaldehyde included into the composition of flocculant "Percol +" as an initial raw material.

Besides, "Percol +" as well as the other flocculants received according to Mannich reaction has two main advantages in comparison with powdery components:

- Higher average molecular mass a polymer that allows to increase a concentration of a cake by between 1 and 3 per cent of an absolutely dry substance;
- Capability of change of a value of a cationic charge during synthesis that provides practically optimum composition for the given sludge and decreases the cost of the flocculant.

From an economic point of view, the flocculant "Percol +" is a more preferable than the powdery co-polymers due to its more simple and inexpensive technology and production.

These reasons provided the basis for purchasing of two plants "Fab Dual" manufactured at the "Allied Colloids" Company for production of flocculant "Percol +" by the State Unitary Enterprise "Vodokanal of Saint-Petersburg" in order to install them at the Central Aeration Station.

According to the Company's data, capacity of each plant is about 40 kg of 100-per-cent-activity flocculant produced during one operation with duration being about 2 hours. In order to increase the capacity of two plants " Fab Dual " up to 340 t/year (more than 900 kg/day) of flocculant of 100-per-cent-activity, the Akrus Closed Joint Stock Company was developed the project of reconstruction of the plants and their installation at free floor-areas of the Mechanical Dehydration Shop of the Central Aeration Station within the framework of a turnkey contract with the State Unitary Enterprise "Vodokanal of Saint-Petersburg".

Two main components required for synthesis of flocculant "Percol +" at the plants

"Fab Dual " are as follows:

- Flocculant " Magnaflog 351 " produced by the Allied Colloids; it is less expensive than flocculant "Tsetag-89" used at the Central Aeration Station for dehydration; and
- Product "Modificator"; it is now manufactured at the Saint-Petersburg's Russian Research Center "Prikladnaya Khimija" in conformity with the agreement with the State Unitary Enterprise "Vodokanal of Saint-Petersburg".

Product "Modificator" is produced at the plant "Gidrozhidkost" at two chemical stages during one technological cycle. The manufacturing process includes interaction of liquid dimethylamine with liquid formaldehyde in equimolar ratio at 15 - 20°C and on 1 hour standing. The second stage includes interaction of urea with dimethylaminomethanol at 20-30°C on 1 hour standing and in stoichiometrical ratio. Thermal effect is 0.5-1.0 kcal/h. Output is 98%. Finished product "Modificator" represents a water solution of double urea (dimethylaminomethyl). The solution of a product is stable thermally and chemically and freezes at below -20°C. It is not combustible. The process of manufacturing of product "Modificator" is not accompanied by side processes. Product "Modificator" is supplied to the Central Aeration Station in special containers with volume of 1 cu m and has a certificate in accordance with a form established for shipment.

The technological process for production of flocculant "Percol +" at the Central Aeration Station is as follows:

- Receipt of initial raw material ("Magnafloc 351 "and "Modificator");
- Preparation of 3.5-per-cent-water solution of flocculant "Percol +";
- Standing of 3.5-per-cent-solution for 20-24 hours,
- Preparation of 0.5-per-cent-water solution with supply of the product to the user.

Product Magnaflog 351 is supplied to the plant in polyethylene sacks 25 kg each and then unloaded into a bunker with a worm weigher equipped with exhaust cabinet.

To produce 1 t of flocculant "Percol +," it is necessary to have 0.8 t of flocculant "Magnaflog 351" and 0.76 t of product "Modificator." It was determined during operation that optimum cationic charge of flocculant " Percol + " shall be 3.1 + 0.1 mg-equiv./g for sludge used at the Central Aeration Station and limiting number of viscosity shall be not less than 19 dl/g, in that case, the reaction yield is 60-65% that results in decreasing the residual toxic amounts of ingredients in the finished product. Flocculant "Percol +" represents a viscous colorless or yellowish gel-like liquid in appearance.

Mode of operation of plants " Fab Dual " is three 8-hour-shifts for 300 days annually.

Required energy resources per 1 ton of finished flocculant are as follows:

• Power consumption	1650 kW·h
• Heat	3.5 Gcal
• Domestic-and-potable water	26 cu m
• Service water	170 cu m

Summary:

Plants "Fab Dual" are successfully operated at the Central Aeration Station as from the end of February 1997 and at pres ent they completely provide the Sludge Dehydration Shop at the Central Aeration Station with the required amount of flocculant "Percol +".

BIOLOGICAL REMOVAL OF NITROGEN AND PHOSPHORUS FROM WASTEWATER OF SAINT-PETERSBURG

Vasiljev B.V., Malyshev A.V.
The State Unitary Enterprise "Vodokanal of Saint-Petersburg", Saint-Petersburg, Russia
Alekseyev M.I., Mishukov B.G., Ivanenko I. I.
The Saint-Petersburg's State Architectural University, Saint-Petersburg, Russia

Technology of biological removal of nitrogen and phosphorus may be applied both independently and in combination with reagent aftertreatment if minimum concentrations of the biogenic elements are required.

The capabilities of the biological denitrification and dephosphorization method are stipulated by ratio between quantity of biogenic elements and stock of organic substances suitable for utilization in clarified or non-clarified wastewater.

Rational utilization of an organic substrate will be achieved in the schemes with three anoxide-anaerobic zones in particular as per technology of Cape Town University and the city of Johannesburg (UST or UHV).

The State Unitary Enterprise "Vodokanal of Saint-Petersburg" together with the YIT Corporation Company

from Finland have created a computer-aided plant for biological removal of nitrogen and phosphorus on the basis of the Krasnoselskaya aeration station of Saint-Petersburg supported by the Ministry of Environmental Protection from Finland. The technology of treatment provides availability of one anaerobic and two anoxide zones with return of active silt originally into anoxide zone and then into anaerobic one. The plant is designed for treatment of clarified wastewater with capacity of 2 000 - 4 000 cu m/day.

Supplied wastes include pollution from the users of the housing resources, industry and agroindustrial complex. The parameters of content of the supplied wastes and treated water are given in the table below.

Polluting components	Unit	Wastewater supplied for treatment		Treated water	
		Range of concentration change	Average concentrations	Range of concentration change	Average concentrations
Suspended matters	mg/l	110-270	170	< 5 -13	6
BOD_5	mg/l	70-150	115	1. 8-5.8	3.4
COD	mg/l	150-350	290	3.0-130	50
Total nitrogen	mg/l	18-33	28	6.3-15	9
Total phosphorus	mg/l	2.7- 6	4.4	0.23-2.3	1.3
Aluminum	mg/l	0.61-2.2	1.34	0.057-0.19	0.12
Total iron	mg/l	1.5-3.5	2.4	0.21-0.45	0.3
Manganese	µg/l	130-380	230	27-48	30
Nickel	µg/l	8.7-82	27.2	1-7.1	4.8
Lead	µg/l	3.5-24	11.4	0.18-4.1	1.2

As indicated in the table, the removal of total nitrogen was 60-70 % and total phosphorus was 70-80%. The availability of anaerobic and anoxide zones provided the removal of salts of the heavy metals, amount of which is below than the maximum permissible concentrations for a hatchery reservoir.

Average load on silt was about 90 mg of BOD_5 per 1 g of silt per day.

The aforementioned data demonstrate the capabilities of the reagentless removal of nitrogen and phosphorus up to limits expected in the future.

SIPHON WITH AIR CAVITY IN SUBVAULT SPACE AND CONNECTIONS EN ROUTE

Vasiliev V. M.
The Saint-Petersburg's State Architectural University, Saint-Petersburg, Russia
Goukhberg M. S.
The State Unitary Enterprise "Vodokanal of Saint-Petersburg", Saint-Petersburg, Russia
Shapovalov V. T.
The Lengiproinzhproekt, Saint-Petersburg, Russia

When designing the main sewage collector, the designers faced a complicated tunnelling in unstable grounds at the northern part of the city of Saint-Petersburg from Kantemirovskaya Street to the sixth pumping station. The collector line at this site passes along the main branch intersecting the city, and through the washing off of the roof of the upper Proterosoic clays. The depth of washing off reaches 66 - 69 m somewhere.

Because of these intersections as well as crossings of the underground tunnels under the conditions of a general lowering of the roof of upper Proterosoic clays at the upper section of the collector, it was impossible to construct self-flowing collector. When constructing, its lower part was in the grounds which required the special methods of tunnelling and did not exclude deformations of the structures placed at this ground surface and did not provide a reliable construction when operating.

As a result of examination of various versions of the collector laying, it was decided to construct it as a pressure self-flowing siphon with two lines tunneled with the help of shield with outside diameter being equal to 4.03 m. These lines are placed at the distance of 20 m between axes along the collector, with increase of this distance up to 50-60 m at its lower part and pumping emptying station at the most deep part of the siphon.

When this version was approved, the designers had a rather reliable structure as per the conditions of the construction and completely unknown from the view point of its operation.

As opposed to the well-known designs of the siphon, this design has 15 connections, i.e. there is an increase in wastewater flow rate along the collector length as well as there is its time-variation (day, night, dry weather and rain) with due regard for the variations of the flow rates characteristic for a combined sewerage.

As per the calculations, with due regard for a production total recession and decrease of water consumption, the first commissioning complex will have a load equal to 5 cu m/sec under dry weather and up to 19 cu m/sec when raining. Wastewater flow velocity under dry weather will be at each line as follows:

- 0.3 - 0.5 m/sec at the upper part;

• 0.6 - 0.7 m/sec at the middle part; and

• 0.8 - 1.0 m/sec at the lower part.

Thus, the expected mode of operation during 340 days annually may result in silting of the lines of the siphon.

As the result of the researches, it was determined that at the self-purified rates, the wastewater may be transported in the siphon only by means of an air cushion created in the sub-vault space under excessive pressure in it. In that case, excessive pressure at each section of sub-vault space will be equal to the height of a water column in meters from a tray of the tunnel's collector up to the water surface (level of piezometric curve) depending on the wastewater flow rate. Air will be kept in sub-vault space separately for each section, by appropriate designs based on a waterlock effect.

Air will be supplied to the receiving-and-dropping pits of sub-vault space by means of ejection of air with falling liquid. In that case, the diameter of the riser is accepted on the basis of a maximum air delivery at the domestic water flow rate; and it will be minimized at the storm water flow rate. If piezometric line will rise above an admissible mark, the relief valve operates at the connection units that allows to release an excessive air and change the flow rate of a liquid at a sacrifice of it, exclude a rise of the piezometric head and, accordingly, backwater in the supplying collector. It is unattended process.

A control valve is of great importance in operation of the siphon, it releases air and maintains the depth of wastewater flow. A limiting depth of flow is the depth corresponding to a uniform movement mode.

Depending on the season, wastewater flow rates, number of the working lines, state of the equipment and instrumentation installed in the siphon, some operational modes are possible; they are as follows:

• Main (normal or optimum) operational mode with "air cushion" and partial filling of the tunnel collector with different pressure at each section;

• Forced operational mode with "air cushion" and partial filling of the tunnel collector - mode of washing and blowing through when equal pressures are built up at all four sections;

• Main (normal or optimum) operational mode with total filling of the siphon line when rated raining and wastewater flow rates being equal to 14.0 cu m/sec and more at one line (when releasing air from a sub-vault space of the tunnel collector to the atmosphere pursuant to the new accepted technology);

• Allowable mode of short-term partial utilization of " air cushion " at some of the sections in connection with a running repair of the equipment (replacement of an emergency valve, instrumentation etc.)

• Emergency operation - at full release of pressure and disuse of "air cushion" effect under dry weather conditions, that is transportation of wastewater by full filling with low speeds of movement 0.3 - 1.0 m/sec that may cause silting of the siphon.

The results of the calculation of the position of the piezometric line and rate of movement of a waste liquid in the pipe of the siphon have shown that it is possible to provide rates of movements excluding the silting of the collector at the liquid flow rates corresponding to the domestic water flow rate when air cushion is available.

PROSPECTS OF APPLICATION OF SETTLING STORAGE TANKS

Vysotsky L.I. , Ilyasov G.A., Zadohina N.A.
SGTU
Zadohin R.A.
SarvodokanalSGTU

In many cities the storm collectors are laid on the bottom of large ravines. Frequently superficial drainages are dropped in reservoirs without preliminary clearing, though the contents of pollution in them can in many times exceed maximum allowed concentration. The device of the centralized clearing structures requires to swap of enormous volume of drains from the lowered places, that looks like irrational operation. To use of small local installations with a long running cycle and low operational expenses which don't require the constant presence of the attendants is much more preferable. The cassette settling storage tank adequate all above-stated requirements was developed on faculty of hydraulics of Saratov state technical university(see a figure).

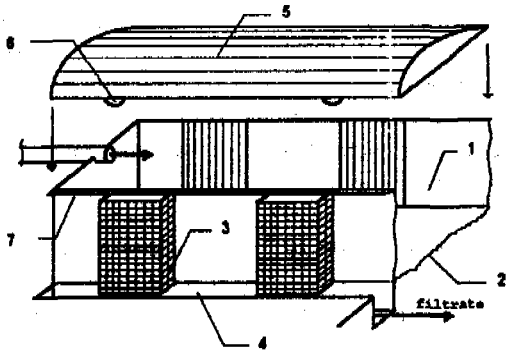


Fig. Circuit of the horizontal settling storage tank:
1 - case; 2 - bottom; 3- the filtering cartridge; 4 - tray; 5 - roller; 6 - directing.

The polluted superficial drains get in the case 1, where lamb's falling down the bottom 2 and filtration of a liquid through filtering cartridges 3, filled by sawdust, straw, sorbents, their combinations etc. simultaneously occurs. The filtrate is removed by the tray 4. The emerged film of petroleum is detained by a filtering load, the ions of heavy metals can be removed by the additions in a filtering material of the appropriate components. In process of accumulation of a deposit on the bottom of the settling storage tank the filtration goes through the top "pure" layers, that allows to support constant productivity of a structure during a work cycle. If the settling storage tank becomes fill, the mobile roof 5 can be moved on rollers 6 by directings 7 and the deposit can be unloaded (is not shown). It is recommended to arrange the standard drainage on the input pipeline in front of settling storage tank to provide the way of most polluted part (in a strong downpour).

The authors represent using of analogous construction - the filtering container - as a preferable one both on small platforms of transport's parking and washing and on bridge transitions. The difference is that the deposit is collected in the punched container inserted into the case, supplied by filtering cartridges. With filling the container by a deposit it is removed and the new container can be inserted. The application of the above constructions in practice of transport construction will allow to carry out the requirements of ecological supervision and to avoid the penal sanctions.

COST EFFECTIVE TECHNOLOGIES OF COMPLETE BIOLOGICAL WASTEWATER TREATMENT IN THE COLUMN AND GALLERY BIOREACTORS WITH PSEUDOLIQUIFIED LAYERS OF ACTIVATED SLUDGE AND FIXED FILM MICROORGANISMS

Yakovlev S., Sverdlikov A.
Src Nii Vodgeo, Moscow, Russia
Shcherbina G., Zemljak M., Sverdlikov A.
Nikti Gh, Kiev, Ukraine
Donald H.
Haycock, Waterloo, Canada

Recognizing the global and regional needs for improving wastewater treatment specifically with the respect to nitrogen and phosphorus removal from inland waters, NIKTI GH has been involved in the Programs of Industrial Collaboration and Professional Partnerships with Canada jointly with Canadian Company - Conestoga-Rovers and Associates (CRA).

The Institutes NIKTI GH and NII VODGEO have been investigated, developed and implemented new advanced and novel environmental technologies for complete biological treatment of wastewaters in module combine column and gallery bioreactors with pseudoliquified layers of activated sludge and fixed film microorganisms.

The most silent features of these processes are the incorporation of organic oxidation and clarification in a single bioreactor and the creation of pseudoliquified layers of activated sludge that simultaneously increase active biomass concentration and the ensuring biodegradation as well as provide filtration medium for the wastewater.

These technologies have been developed by incorporating the concepts of increased biomass, decreased specific loadings and oxidation rates in a single bioreactor. The increase in the concentration of activated sludge is achieved by the creation and utilization of low energy vortex of pseudoliquified layers of activated sludge.

The Institutes, in developing these technologies, has employed various types of engineering designs and configurations. 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 and recirculation as well as zones of suspended layers of activated sludge.

The aeration tanks of compact modular column types are design as a common column, or as a separate central aeration column, and are surrounded by multiple column reactor-clarifiers. The columns range from 1,8 to 12,0 meters in diameter and up to 20 m in height. The pseudoliquified layers of activated sludge are formed along the entire height of the tanks.

For maximum compactness, the units can be manufactured from steel, stainless steel, ferrocement, fibreglass-cement and fibreglass-plastics in modules ready for shipment and installation either assembled or assembled on site.

Column-type systems are presently used by small to medium size municipalities, mining camps, health resorts, and industrial facilities such as dairy, meat, poultry, and fish processing plants.

Ranging in size of up to 500,000 m3/day (110 mgd), the gallery-type systems are used by small, medium, and large municipalities as well as various industries.

The kinetics of biological nitrification and denitrification of municipal wastewater without substrate addition from plants operating at Hydraulic Retention Times (HRTs) of about 5 hours and Sludge Retention Times (SRTs) of 30 to 40 days as a function of effluent ammonia and nitrates-plus-nitrites concentrations were obtained.

The figures show that this process is capable of additional biological removal of nitrogen to the required effluent standards without the need to provide additional substrate. Both nitrification and denitrification data conformed to the Michaelis-Menten kinetic model, with maximum nitrification and denitrification rates of 0,5 g NH4-N/ g MLVSS-d (Mixed Liquid Volatile Suspended Solids per day) and 0,37 g NH3-N/ g MLVSS-d, with corresponding

half-saturation concentrations of 1,3 and 0,32 mg/L respectively.

In conclusion, these technologies are capable of providing biological and tertiary treatment of municipal and/or industrial wastewaters with a wide range of organic loading in single, two-stage, or multi-stage configurations, and produce a final effluent with BODu, total nitrogen, TOSS of approximately 5 mg/L, 1 mg/L, and 5 mg/L, respectively.

INSTALLATIONS AND STATIONS OF BIOLOGICAL TREATMENT OF SANITARY WASTEWATER "BRIZ"

Yakovlev S.V., Alfyorova L.A., Dyatlova T.V., Dyatlov V.A., Zemlyak M.M., Sokolova E.V., Churbanova I.N.
The firm "BIONIK", Moscow, Russia

The firm "BIONIK" has developed a normalized series of biological reactors "BRIZ", and on their basis, the typical design decisions of the biological treatment stations of sanitary wastewater, ensuring high quality of purified water for discharge in reservoirs,including the ones of fish-economical significance , were developed.

When developing the normals on bioreactors and their design, the main principles were the minimization of total costs on manufacturing, installation and operation of treatment stations and the observance of technologically essential parameters, ensuring the reproductivity of high quality treatment at 100-fold distinquished range of their productivity.

The block of biological reactors contains three anaerobic and one aerobic reactors which bodies are executed unified and represent a vertical column apparatus with ratio of height to diameter equal to (3...6):1 with conical bottom.The top of these three anaerobic reactors is used as regulating capacity,allowing to stabilize hydrodynamicregime on the aerobic stage of treatment.

Water movement in the bodies of the bioreactors is specially organized: it is in the direction from below upwards in the anaerobicones and in the direction from upwards below in the aerobic one with recirculation of 6-fold to average discharge and ejection of atmospheric air by means of jet aerator.

The design stipulates the fulfilment of installation and transportation of the reactors of complete factory readiness, or their equipment and heat insulation on the footing.

The reactors are filled in with inert loading, representing the kapron grain-oriented cord (of "Viya" type).The zone of clarification and the system of water recirculation and aeration are additionally organized and installed in the aerobic reactor.

The stabilized sediment from bottom cone of each bioreactor is periodically discharged into the well from which it is removed by a machine for sewage disposal.The purified water from the aerobic reactor is discharged by gravity through the unit of decontamination by Ultra-Violet radiation.

The concentration of pollution in purified water does not exceed (in mg/l):BODt - 3, suspended materials-3, surface-active materials-0.5,which are accepted for discharge into water reservoirs of fisheconomical significance.

The complete set of three anaerobic and one aerobic reactors is installed on the base with clearance equal to 0.5 m between them, then the platform of service with a ladder is established and binding by pipelines is made.

The process of consecutive biological treatment of wastewater under anaerobic and aerobic conditions has received its apparatus-technological registration on the basis of results of scientific and experimental researches,as well as practical experience of treatment installations and structures development, accumulated by the scientists leading in this area of SRC NII VODGEO , MSBU, NICTI of MS(Kiev), NABA , cooperaing with the firm "BIONIK".The design documentation of the firm on the development, published in the article is officially fixed in the Certificate N 6/14-97 (on the installation "BRIZ", productivity from 1 up to 100 m3/d), in the Specifications ("The Installation of wastewater treatment of a type" BRIZ".TU 4970-00117843576-97) and in the typical project of the station.

The establishment of mobile or stationary bathroom and lavatory prefabricated box unit (lavatory pan and wash - bowl), combined with the installation "BRIZ", which productivity is 0.5 m3/d from the above -mentioned standard series of bioreactors and which ensure high quality of treated water, satisfying the requirements of the reservoir of fish-economical significance are the most perspective decisions at separately located objects(for example, at the petrol stations,places for trading,markets,etc.) for sevring about 40 visitors per day with regard for water discharge, equal to 12l for a person.

THE NEW TECHNOLOGIES OF THE SEWAGE PURIFICATION AND SEDIMENTS UTILIZATION OF THE FOOD INDUSTRY ENTERPRISES

Yaromskij V.N.
Brestskij Politechnitscheskij Institute, Brest, Belarus

A great number of food industry enterprises are working now at the territory of Belarus among them are milk processing industry meet processing industry, potato processing industry and etc. A high concentration of organic senage pollution of these enterprises reaches about some grams per one liter of water. All these make the task of industrial senage

purification much more difficult.

A great importance for senage purification has the reduce of food stuffs losses in industry and of course the utilization of valuable waste products, which in most cases, come to the drainage system and even rivers. The reduce of fresh water use and utilization of valuable waste products is sure to lessen the volume and pollution of sewage and besides it will make the purification much easier.

Several up-to-date technologies of sewage purification and sediments utilization have been worked out in the laboratory of Brestskij Politechnitcheskij Institute in Belarus.

There technologies are based on intensive biochemical methods which work under pulse conditions. The use of these methods gives us a chance not only to purify the senage but also to utilize the formed sediments.

These new technologies are also based on modern construction some of which have been patented by Russian Federation. The new technologies of the sewage purification and utilization. on the food industry enterprises will let us raise the quality of water resources. use the sources secondary material and make the environment of the Republic better.

BIODEGRADATION OF OIL AND OIL-PRODUCTS BY RHODOCOCCUS SP. MFN IN INDUSTRIAL WASTE WATER

Yermolenko Z.M., Martovetskaya I.I., Chugunov V.A., Kholodenko V.P.
State Research Center for Applied Microbiology, Moscow region Obolensk, Russia

At present, environmental biotechnology focuses on purification of soil and water environments polluted with oil and oil-products. Of high priority are using cultures isolated from polluted areas, which acclimated to local conditions. Despite that many oil-oxidizing strains of different species have been isolated so far, none of them can be considered as unique because of variability of environmental conditions under which they may be applied. Therefore, obtaining new natural strains continues to be a key problem.

A new strain *Rhodococcus sp.* MFN was isolated from crude oil (oil pipeline «Druzhba», Moscow oil processing plant, Kapotnya). Similar to other representatives of this species, the strain is highly active both at low (10°C) and higher temperatures. The strain is capable of degrading crude oil and oil-products, such as mazut, diezel fuel and kerosene, at rates of $1.7 \cdot 10^{-5}$, $1.2 \cdot 10^{-5}$, $2.2 \cdot 10^{-5}$ and $2.5 \cdot 10^{-5}$ μg/c·h at 28°C, respectively. The strain retains its rather high degrading activity at lower temperature and it is found to be $0.41 \cdot 10^{-5}$, $0.37 \cdot 10^{-5}$, $0.58 \cdot 10^{-5}$ and $1.4 \cdot 10^{-5}$ μg/c·h at 10°C, respectively.

Moreover, the strain acts as an oxidizer toward oil hydrocarbons such as naphthalene, tetradecane, pentadecane, hexadecene, phenyldecane and prystane. Their biodegradation was 78, 54, 56, 64, 42 and 44%, respectively. The culture uses vapours of benzine and kerosene as a source of carbon and energy.

Its cells were found to be resistant to heavy metal ions being present in rather high concentrations: Mn (II), Ni – 10mg/l, Zn – 100mg/l, Mo – 100mg/l, Cu, Cr (IV), Cr (VII) – 20mg/l, Pb – 100mg/l, Fe – 100mg/l, Ag – 10mg/l.

Results suggest that the strain can be used for bioremediation of water polluted with oil and oil products within a wide range of temperatures and in the presence of heavy metal salts that are commonly observed in industrial sewage water.

Investigations were performed in the framework of Project #119-95 of International Science and Technology Center (ISTC).

WATER PURIFICATION ADSORBENTS BASED ON ALUMOSILICATES

Yevtukhov S., Shmeleva N., Berezyuk V.
Urals State Technical University, Yekaterinburg, Russia

The adsorption processes play a significant role in the existing technologies for portable and wastewater treatment. Taking this into account natural materials and cheep technological wastes are considered of a certain importance. Alumosilicates are the appropriate non-organic compounds.

The study investigated natural zeolite (clinoptilolite) (SiO_2 – 65,7%, Al_2O_3 – 11,53%) and microspheres, being a part of coal burned ash, as the natural adsorbent. The microspheres are sphere particles with the dimensions of 30 to 350 μm in diameter and thickness of the walls 2-10μm from complete nonporous material (SiO_2 – 50-60%, Al_2O_3 –25-35%).

The research demonstrates the adsorbents to be an excellent collector for the surface active compounds (SAC) and particularly for the cation active alkylthreemetilammonium chloride (ATM). Clinoptilolite is effective for the natural and wastewater treatment from copper (II) compounds by the ion exchange methods. Dependence of the solution pH, adsorbent mass, adsorbate concentration was investigated to access the effectiveness of the adsorption process and the kinetic parameters of the process were calculated. The ATM adsorption can be described by the polymolecular adsorption equation, and the copper adsorption – by parabola dependence. The dependence of the adsorption parameters

from the solution temperature was investigated and experimental activation energy has been achieved. This values estimates the gap of hydraulic surface at the adsorbent core. The ATM adsorption depends on ATM form in the solution (or colloid form grade) but copper ions distribution between the adsorbent and the solution can be described by the acting mass law and confirm the ion exchange mechanism of the process.

The optimal conditions demonstrated 98-99% extraction for the ATM and 95-97% - for copper (II), zeolite adsorption capacity for copper consisted of 9.0-10.0 mg per g.

DEVICE FOR WATER TREATMENT FROM PHENOLUM AND OIL PRODUCTS BY USING ACTIVATED LIGNINE CARBON.

Yunusov M.P., Perezdriasko I.V., Karimova. A.
Chemistry - Phannaceutic Reseafdl Institute, Tashkent, Rqlublic of Uzbekistan

As a result of intensiv polluted water disgorging into open reservoirs by enterprises and this water leakage into underground sources, the natural water sources property has changed essentially. It has led to 370/0 decrease in subsoil water volume, being the main source of drinking water supply and to practical disappearence of surface water in Uzbekistan for the last ten years. That's why the population of some cities having municipal water-pipe is supplied with water which polluted componalts, for example, organic components and salts, exceed the normal standards. All this indicates to necessity of water sources treatment. One of the main effective way is to use the adsorbing treatment method, when the activated carbon is preferably to be applied as a sorbent for the organic pollutions extraction. Usage of the carbon sorbents.bang obtained from varies waste material has economical and ecological expedience's the treatment process itself reqires low expenditure.

At presen*technology of the activated carbon obtaining from cotton lignine - an industrial hydrolytic waste material llaving various physical-chemical and sorbent parameters, has been developed by UzChPhRI staff. Drinking water soufce contaminated with 5-7 Cl of Phenolum, 3-4 Cl of oil products (0.P.Xmethane 40- 55"/(>,Napllten 34-45%, Aromatic 5-10%), ChOC 3-5 Cl and BCL 2-3Cl was used for the investlgatlon.Activated Carbon AUL-X type obtained in the UzChPhRI was chosen as an adsorbent.while the activatal Carbon ofAG - 3 type, an industrially produced sample, served as a control one. TI* results are given in the Table.

Tim Table shows that AUL-X has goodsorbing potency for phenolum and oil products if they both are contaillt'd in water. The water treatment resulted in BCL and ChCL content loweringto CL levels.

Actl**ated llgl-une carbon AUL-X was tested during two months in a pilot device aimed to treatment of water from phenolum and oil products; the adsorbent volume - 5 litres*inear velocity - 5 m/h., phenolum concelltlnllon - 0.5 mg/l, **0.P.** - 0.2 mg/l. The tests demonstrated 100% clearance of water from the mentioned substnllces, while AU*-X had preserved its sorbing and physical properties essetially.

Basing on the obtained data there was elaborated a design of the adsorbtion type module unit with 5 m* /h watel *lfflttlllellt capacity, period of the filter operation - not less than 18 months, the average volume of water to be l i*ated by one kg of Carbon - about 153 m* and one portion of AUL - X expenditure - not more than 425 l*. (duality of the water treated by the adsorbtion module device is in keeping with the drinking water standards.

ADSORPTION OF CAPROLACTAM FROM WATER SOLUTIONS BY ACTIVATED CARBON

Yustratov V.P., Krasnova T.A., Astrakova T.V.
Food Technology Institute, Kemerovo, Russia

The development of a resource-saving technology aimed at utilizing low concentrated sewage containing organic and mineral components (condensate) is an urgent problem; the introduction of this technology would allow to solve three tasks: to avoid environmental pollution by substances dangerous for life, to return valuable products of chemical synthesis into the technological process, to obtain required quality water for the formation of a closed water recycle.

At present great amount of condensate after biochemical purification in the best of cases is discharged into water reservoirs. However, there are some bioresistant compounds that worsen the performance of biochemical purifying plants, an example of such a compound being caprolactam.

To develop the technology of utilizing condensate sewage obtained from caprolactam production first it is necessary to solve the problem of separating organic components (the main one being caprolactam with concentration up to 500 mg/dm^3) from inorganic ones (represented mainly by ammonium sulfate with concentration up to 2000 mg/dm^3).

Investigations to find the possibility of caprolactam withdrawal from condensate by adsorption methods have been conducted. The peculiarities of caprolactam adsorption from water solutions by the adsorbents АГ-3 (PA "Zarya",

Dzerzhinsk), AP-B and АГ-ОВ-I (PA "Sorbent", Perm), and filtrasorb F-200 ("Chemviron Carbon", Belgium) as well as dependence of the adsorption process upon the porous structure of activated carbon have been investigated, maximum adsorption values (a_{max}) and characteristic energy values (E) for the sorbents have been calculated, optimum conditions for activated carbon treatment on the basis of thermal analysis have been chosen, adsorptional and thermal examinations of the adsorbent samples АГ-ОВ-I. and F-200 after caprolactam adsorption from water solutions as well as from those containing ammonium sulfate have been conducted, the possibility of thermal recovery of adsorbents after caprolactam adsorption has been studied.

The data obtained confirmed the possibility of effective caprolactam withdrawal from water solutions by carbon adsorbents. Activated carbon АТ-ОВ-I. has been recommended as a sorbent.

The results of the investigation are a cause for the development of the sorptional-membrane technology to utilize condensate sewage obtained from caprolactam production.

TANNERY WASTEWATER TREATMENT BY MEANS OF THE SYNTHETIC POLYMERS

Zainescu G.A., Bratulescu V.
Leather and Footwear Research Institute, Bucharest, Romania
Georgescu L., Barna E.
Physics Faculty, University of Bucharest, Bucharest, Romania

In the developed countries, the application of synthetic polyelectrolytes in leather industry showed a range of advandages: low consumption of inorganic coagulating agents,high settling rate and cleaning effectiveness in waste waters, thus reducing the treatment plant sizes and implicitly the cleanning costs.

Dispersed system(colloidal suspended particles) has an electrokinetic potential - zeta potential - where all particles are of the same sign charge.The same sign charged particles are repeling one another,opposing the coagaluation and flocculation.

Zeta potential is compressed by adding some adsorbent reacting agents oppositely charged to the stabilized cooloids untill the coagulation point is reached. Otherwise, the polyacrylamide is known to have such properties.

From the experiments a technology (patentable) for the preparation of a polyelectrolyte has resulted, based on modified polyacrylamide,anionically active,used particularty in tannery wasterwater clening.

DEEP PHOSPHORUS REMOVAL FROM WASTE WATER

Zaletova N.A.
Alternative Member of Academy of Municipal Economy, Water Supply & Treatment Research Institute

Phosphorus removal in our days becomes more rigorous because of real pollution conditions of water bodies and stringent effluent standards on phosphorus content.

As far as phosphates are an integral part of pollutants and traditional systems of biological treatment are not able to remove this phosphorus, it is necessary to remove phosphorus practically from all types of waste waters.

Chemical methods, applying in Western countries, are still not popular in Russia due to some technical, operational and economical reasons.

The grate interest presents modified methods of biological treatment, which allow to reach more efficient phosphorus removal.

By till now several theories were elaborated which in reality are based on laboratory experiments with artificial water and in some cases pure culture. In many aspects the elaborated theories are close to each other, but some aspects are different.

Laboratory experiments in NII KVOV were done on real waste water. The experiments has resulted depending of efficiency of phosphorus removal on aerobic (technology of aerobic treatment) and anaerobic conditions (time of release), temperature, present of organic acids and so on.

Microbiological evaluation of processes indicated availability of acid formation by number of microorganizmes, presented in waste water.

To evaluate the possibility of deep phosphorus removal by biological method in real conditions special experimental system was elaborated. The system has been practically tested on waste waters in Moscow, Tichvin, Desnogorsk and can be used for subproject works for various towns.

The technology of biological phosphorus removal can be used on newly constructed plants and plants under exploitation.

Application of the technology will allow to meet higher effluent standards for phosphorus.

USE OF SOME ELEMENTS OF THE TECHNOLOGY "TROFACTOR" FOR TREATING FACILITIES RECONSTRUCTION

Zinberg M.B., Dobrynina L.F., Nenasheva M.N.
Firm "Ecobios", Orenburg, Russia

The technology "Trofactor", based on immobilized microorganisms use, developed by the company "Ecobios" scientists has got wide application as for highly concentrated waste water treatment and for low contaminated effluents as well.

Nowadays in Russia a great number of biological treating facilities, constructed on type designs of 70-80 years, are operated. As a rule these are biological treatment stations on the basis of aerotanks of prolonged aeration with free floating active sludge and mixture of low contaminated industrial and municipal effluents is supplied in to the tanks.

In connection with a fact that the bulk of enterprises do not work at full capacity today and a number of personnel is sharply reduced, that is to say there is no required quantity of contaminations in effluents and as a result arises a problem of active sludge "starvation".

At the same time during the periods of repairs or emergencies, shock concentrations of contaminations got to the treating facilities; and that lead to active sludge with drawal from the facility. In such a situation all the attempts of the personnal to restore working duty at the treating facilities are in vain: free floating active sludge, brought from the other facilities could not exist in such conditions, it rots and serves as a source of secondary effluents ccontamination.

An example of such facilities is a station flr biological effluents treatment of the Sovkhoznaya station for underground gas storage (SSUGS) with capacity of 200 m^3/d in the Orenburg region, there nowadays is performed treating facilities reconstruction with the use of the elements of the technology "Trofactor" by tne firm "Ecobios": in the aerotanks corridors are installed frame modules with packing for active sludge microorganisms immobilization.

Reconstruction gave an opportunity to fasten active sludge in the facility and crated conditions for the formation of microorganisms succession and hydrobionts and that rose the degree of effluents treating efficiency greatly.

In the table are given averaged factors of the treating facilities operation before and after the reconstruction (according to service laboratory data).

Control factors dynamics of the treating facilities operations speaks for the fact that treatment from organic compounds has improved after the reconstruction, nitrification and denitrification processes have strengthened, have risen phosphates and suspended substances treating efficiency.

Besides under general improvement of treating quality, the treating facilities operation has simplified remarkably, during the whole period of observations, despite the low contamination concentrations and emergency discharges fastened sludge stayed in working condition with out any other additional operations.

Analogous results of elements of the technology "Trofactor" use have been obtained after the treating facilities reconstruction in Orsk (capacity of up to 12 thousand m^3/d), in the village M.Pavlovka (the Orenburg region) (capacity of 700 m^3/d), at the Orenburg gas production enterprise (capacity up to 900 m^3/d).

Table. Results of chemical-analytical control of the SSUGS treating facilities operation

Control factors, mg/l	Before recostruction (average for 1995)	After reconstruction (average for 1996)
BOD_5: inlet	27,2	25,1
outlet	19,8	6,2
Suspended substances: inlet	57,7	52,5
outlet	63,1	22,5
Nitrogen ammonium: inlet	3,01	4,3
outlet	2,89	1,41
Nitrogen nitrate: inlet	12,77	13,39
outlet	12,59	21,9
Nitrogen nitrite: inlet	0,05	0,028
outlet	0,11	0,095
Phosphates: inlet	1,06	1,49
outlet	1,22	0,72

TREATMENT OF AMINE WASTES AT A GAS PROCESSING PLANT BY "TROFACTOR" ANAEROBIC AND AEROBIC BIOLOGICAL PROCESS

Zinberg M.B., Nenasheva M.N., Dobrynina L.F.
Firm "Ecobios", Orenburg, Russia

There is a real danger for the environment by highly concentrated wastes produced by way of processing natural gas. Such wastes have recently been dealt with ley injection into the bed or by burning which is ecologically unsafe.

Technology for highly concentrated waste waters microbiological treatment, facilities for its realization and components of the unit, used for amine contaminated effluents treatment have been worked out by the firm "Ecobios" (1985-92) and copyrights are approved by 4 Patents in Russia and 13 abroad.

This technology was put into practice for the first time at Tengizchevroil gas processing plant (Kazakhstan).

The amine contaminated effluents treater is designed for local microbiological treatment of highly concentrated waste waters by means of highly active microorganisms-destructors, immobilized on inert packing.

Technological process is based on biochemical destruction of organic substances by anaerobic and aerobic microorganisms.

Diethanolamine, being one of the main contaminator of TSO amine effluents, serves as substrate for energy and construction exchange for anaerobic and aerobic microorganisms.

Under ferment effect of microorganisms takes place DEA destruction with yield of biomass and final products: CO_2, H_2O, H_2, NH_3, CH_4.

The amine contaminated effluents treater has been built in 1990 by the Hungarian company "Vedepsed". Putting into operation works have been done in 1991 by the specialists of firm "Ecobios".

According to the design, microbiological amine contaminated effluents treatment is provided on two parallel lines, consisting of anaerobic and aerobic bioreactors, capacity of each is 50 m^3/d.

At the moment of treater efficiency survey, only one of two constructed microbiological treating lines was in operation with capacity of 10-12 m^3/d.

Amine efflients are supplied periodically from KTL-1, KTL-2 of the gas processing plant to a balancing reservoir E-1, with capacity of 300 m^3 20-30m^3 per 1-6 days.

Then two centrifugal pumps Model CPKL 32-200 (one back up) supply effluents into upper section of the anaerobic bioreactor (BR-1).

To maintain microorganisms activity solution of biogenic elements is provided to the anaerobic bioreactor through a flush breaking tank by the pumps.

Superphosphate solution is prepared in a biogenic additives block.

The anaerobic bioreactor of battery type consists of 72 series connected sections, condititon of liquid movement was gravity flow.

From the upper section of the anaerobic bioreactor (BR-1) effluents by gravity are supplied to the bottom section № 1 of the aerobic bioreactor (BR-2), consisting of seven reinforced concrete sections, five of which are equipped with metal frames with carriers attached on it, for microorganisms immobilization, but sections № 1 and № 7.

Treated water after the aerobic bioreactors BR-1 and BR-2 (the second stage of treatment) is collected in the compartment-collector (7 section BR-2) and by gravity supplied to the pumping station for treated effluents, and then according to the design to the biological treating facilities.

Data analysis for 1996 demonstrated that the unit realizes the process for amine effluents treatment. Treatment effeciency is reaching 80%.

It is worth to note that in warm time of a year (April-October) treatment process is the most stable and effective (79,5-95,6%) despite periodic exceeding of DEA concentration at the in let 1,5-2,0 times.

In cold time of a year amine effluents treatment efficiency is reduced to 44,4-68,6%. Low effluents temperature is one of the reasons (8-10°C according to the treating facility specialists data).

Amine effluents treatment efficiency was 85%.

CCO reduction from 4660 mg/l to 712 mg/l indicated consumption of organic substances, such as DEA and also MDEA, in the microbiological treater.

As the production capacity of the gas plant goes up the joint Kazakh and American enterprise Tengizchevroil is interested in putting in operation the second stage of the amine treatment unit in cooperation with Ecobios experts.

DIVERSIFIED USE OF NEW BIOTECHNOLOGY IN ORGANIC SEDIMENT AND WATER TREATMENT

Zinberg M.B., Maslova O.G.
Firm "Ecobios", Orenburg, Russia

In the world and in the country there are problems at present time, connecting with after treatment of biologically treated waste waters, particularly by filtration method. There are belonging: search for cheap and effective filtering materials (preferably wastes of production, local raw materials), working out of the effective and technologically simple methods for filtering materials regeneration, that will give a possibility to reduce washing water consumption, and also stimulation of the main process-filtration.

What is concerned organic sediment harmless rendering (surplus silt of biological treating facilities) that problem has no optimal solution in commercial scale at present time.

Technology of after treatment of biologically treated waste water developed by scientists of the company "Ecobios" is a process of filtration on filled speedy filters with double layers loaded with lump or granulated sulphur recycling of wasted sulphur is performed owing to its unique characteristics microbiologically, practically without water wastes for traditional flushing. These sulphur characteristics are used for harmless rendering (mineralization) of surplus active silt of biological treating facilities and bottom silt of water pools in special bioreactors.

In such a way sulphur makes it possible to solve two problems at one object.

Technologies are copyrighted by three Copyright Certificates of Russia, have been tested in pilot-commercial conditions at treating facilities of the Orenburg and Astrakhan gas processing plants. Designs of commercisl plants for after treatment of biologically treated waste water with the capacity 12000 m^3/d each have been developed in 1984-85 for these objects.

Realization of the suggested project will give an opportunity to solve a number of ecological problems and also to get commercial profit.

Results of technology introduction are the following achievements:

- reasonable usage of explosion hazard production wates (non-conditioned lump sulphur) in the advanced technology;
- grewth of sulphur and equipment sales market owing to granulation;
- solution of burning problem of surplus active silt of biological treating facilities harmless rendering (mineralization);
- solution of problem of bottom water pools silt treatment and harmless rendering.

The suggested project has been presented and attracted interest at the International Investments Forums UNIDO (Vienna, 1995), "Boritec-96" (Milano, 1996), Russian-Swedish Sumposium (Stockholm, 1996), International Congress "Aquatec-96" (Moscow, 1996), "Environmental Technologies for a Healthier World" (Las Vegas, USA, 1997).

1,2 -DIACYLHYDRAZINE – NEW REAGENTS FOR WATER SOLUTIONS TREATMENT FOR HEAVY METALS BY IONIC FLOTATION

Zubateva G.I., Radushev A.V., Chekanova L.G.
Institute of Technical Chemistry Russian Academy of Science, Ural Department. Perm, Russia

Ionic flotation is a perspective method of aqueous solutions containing small metal quantities. Reagents, uniting the properties of complecsanes, hydrophobic educated sublates and foamers, are most interesting for this method. 1,2-Diacylhydrazine (DAG) of general formula R_1-CONHNHCO-R_2 meet these requirements, R_1 and R_2 being acylic radicals C_nH_{2n+1}.

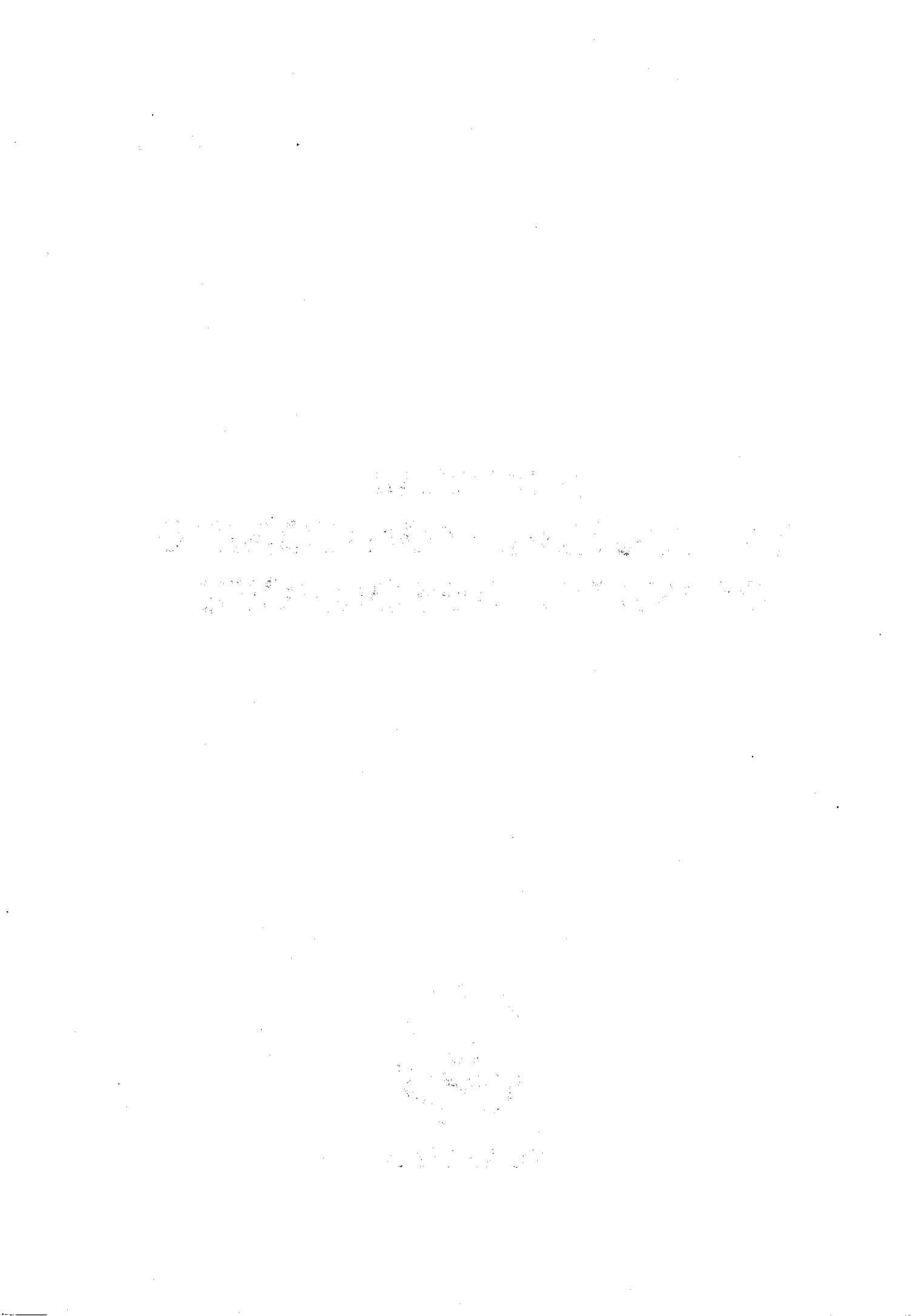
Principal regularities of flotation extraction of 10-100 mg/l quantities of metal ions (Cu^{2+}, Ni^{2+}, Co^{2+}, Fe^{3+} and others) from aqueous solutions using DAG with different length of R_1 and R_2 radicals the influence of the solution pH value, DAG quantities, process kinetic have been investigated. The experiments have been carried out on the laboratory flotation device using DAG alcohol solution.

It has been found out that the reagent under study is a perspective accumulator for the aqueous solution treatment from metal ions by flotation method.

Flotation is most effective in solutions with pH value, close to the conversion of the main part of metal ions into the hydroxide form, for example, Cu^{2+} – at pH of 8 to 10, Ni^{2+} – at pH of 10,5 to 11,5, Co^{2+} – at pH of 10 to 12. One may suppose that the metals extract from solutions due to the interaction between DAG and sols of metal hydroxide on the electrocoagulation mechanism with the formation of hydrophobic sublate particles extracted in foam. The optimal DAG dose is 0,5 M per 1 M Me^{n+} at the optimal solution pH value and flotation time which is 10 minutes for Cu^{2+} and Ni^{2+} and 5 minutes for Co^{2+}. In optimum conditions the level of metal extraction is 99-100%.

SECTION III
ECOLOGICAL MONITORING OF WATER RESOURCES

ECWATECH



MODERN INFORMATION STRATEGIES IN ASSESSMENT AND MANAGEMENT OF WATER RESOURCES

Adriaanse M.
Riza, Lelystad, Netherlands

During the 80's Western countries already discovered their "data rich but information poor syndrome". These days we even have to cope with an "information sickness syndrome" (Reuters, 1996). It will be a challenge for the next decennia to develop the concepts for "crucial information"!

Information is for decision making, for use. Information should be related to the core elements in water management: the functions and uses of the watercourse, the problems/threats, and the effects of corrective measures. Presentations via quality status reports, or environmental indicator reports should directly relate water uses, issues/pressures and policy measures.

There is a tendency to copy western style monitoring and information technology, which is not sustainable in the economic context of developing countries and countries in transition. One of the challenging questions for tailor-made monitoring and assessment is: how could effective information be realised where available resources are low?

Comparability of data is hampered by the lack of thorough quality control procedures related to all elements of the information production process (e.g. quality control procedures for sampling and analysis, protocols for data management and information exchange). Capacity building should not focus on the western practices, but on the tailor-made practices which fit the economic context of countries concerned .

To enhance the availability of the right information, information strategies should firstly focus on institutional aspects even more than on technical ones. These include defined responsibilities, agreements on cooperation and confidence (between institutions on local, regional and international scale), policy plans and specified information needs, legislation, access to information.

POTENTIOMETRIC PROCEDURE OF COD-DETERMINATION FOR SEWAGE TREATMENT PLANT MONITORING

Antsyshkina N.D., Diemina V.S., Dugin G.V., Pysarevsky A.M., Polozova I.P., Vlokh A.V., Shygaeva T.D.
NIIKhimii, St.Petersburg University, Russian Federal Nuclear Centre-VNIIEF, Sarovvodocanal, St.Petersburg, Russia

It was in the middle of the eighties that at NIIKhimii, St.Petersburg University, a potentiometric procedure for COD-determination was developed which preserved the main terms of the procedure approved by the Arbitration [1,2]. The oxidation process of the sample analyzed is continuously controlled with an element in which a glass pH-electrode with a solid electrolyte interphase is used as a reference one, whereas a EO-021 glass redox electrode serves as an indicator one. High concentration of sulfuric acid in the reaction mixture which does not change during the analysis allows to use a pH-electrode as a reference one. Electrical resistance of pH-electrodes at the analysis temperature (128°C) is less than 200 Kohm and does not complicate E.M.F.-measurements. Low catalytic activity of EO-021 indicator electrodes as compared with platinum ones allows to minimize side processes on the indicator membrane surface in the high-E_H range and at temperatures higher than 100°C.

Combination of ceric sulphates with potassium dichromate in the reaction mixture is of great importance. Thanks to this combination there provided reversibility for EO-021 electrodes and potentiometric method results comparable to those obtained within the arbitral procedure limits. Redox bufferability in the reaction mixture is set with $Ce^{4+,3+}$-system components, whereas the potassium dichromate concentration remains constant. Like in the arbitration procedure Ag_2SO_4 is used as a catalyst, but the concentration is an order of magnitude lower. E.M.F.-measurement is carried out with a I-115(I-130) ionometer, whereas results are calculated using a microcalculator with a programming unit of MK-52(B3-34)-type.

Following the potentiometric procedure the analysis time need not to be adjusted, because the result read-out begins on reaching the oxidation point of the sample in the reaction mixture. Kinetics data availability dealing with the reaction route in the majority of cases permits to shorten the analysis time appreciably, as compared to digestion for 2 hours stated according to the arbitration procedure.

2. The main parameters of the potentiometric set-up for COD-determination using the recommended reaction mixture has been found to range from 30 to 1300 mgO/l. The upper limit error of determination is not higher than 3%rel., whereas at the lower limit the value increases to 15%rel.

3. For about 10 years the potentiometric procedure has been employed at the experimental laboratory at Russian Federal Nuclear Centre-VNIIEF and at the chemical-bacteriological laboratory of "Sarovvodocanal", Nizhny Novgorod Region, accredited at RF Gosstandart for waste water analysis at the sewage treatment plants. It has been developed a result calculation program performed with a personal computer.

Results for COD-determination by the arbitration method compared to those by the potentiometric one showed good agreement at the first stage. Later the same comparison was repeated on the sewage treatment plants in St.Petersburg (island of Belyi).

For waters of the receiver and the initial settling tank maximum scatter of the results for the two methods used did not exceed 8%, COD-value being 180 ÷ 400mgO/l. It is worth

to note, that every determination by the potentiometric method took 50÷90 min for the inlet water and 15÷20 min for effluents (St.Petersburg), as regards Sarov these values were 10÷20 min and 5÷10 min respectively when compared to the analysis time of 2.5 h according to the arbitration procedure.

4. Since 1993 LEK-Standart Firm (St.Petersburg) produces an automatized COD-meter (Sh-05) which has a determination decision procedure set, whereas calibration results are kept in the memory of the device and results are given in mgO/l.

The meter of Sh-05 type has stood the test at the laboratories mentioned and has functioned successfully for 3 years.

So, the potentiometric procedure for COD-determination can be employed by using both hand handling of the results with the help of a microcalculator or a PC and an automated mode of operation depending on the analytical laboratory working conditions.

Subsequent development of the procedure will be concerned with reducing the lower limit value for COD-determination to 10 mgO/l and with the analysis of COD-BOD -correlation ratios for some objects including municipal sewage.

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A PROBLEM OF A DEMONSTRATIVE REVELATION OF THE OIL POLLUTION SOURCES OF NATURAL WATERS

Begak O.Yu.
Scientific and Production Association "Monitoring"
Konopelko L.A.
D.I.Mendeleyev Institute for Metrology

The demonstrative revelation of the oil pollution sources is the most actual nature-protection problems in the whole world. However, it is difficult to establish frequently the true initiator as an absence or a complication of the necessary methods. In the same time it is well known that an oil pollution is the most dangerous kind of nature pollution.

As the competent experts and specialists of United Nations suppose a spreading of the oil pollution substances has acquired the all-planetary character to the middle seventeenth-years of our century. The complexity of the revelation problem consists is not only in the fact that there is a large amount of the enough closely disposed potential pollution sources by oil-products (for example, by the ships are arranged in a harbor), but by the flowing (running) of the inevitable processes of an oil-hydrocarbon transformation (degradation), when they hit in the hydrosphere (evaporation, oxidation, dissolution, emulsification, photooxidative destruction, fractionation, biological utilization and etc.). That is all makes difficult the identification procedure of the sample from places of the pollution and proposed sources, since a composition of the oil hydrocarbons is changes as a result all the processes in the course of time. This circumstance demands to work out the methods, which are independent from an influence of time, seasonal, temperature and other factors of a stay the oil-products in a water.

It is issued the Instruction on identification of the pollution source of the water object in 1994, which envisages the execution identification procedure by way of a successive use of two methods: IR-spectroscopy (IRS) and gas-liquid chromatography (GLC). The latter is used in the different versions. The procedure includes a seizing of the representative oil samples from an overflow and all the intended sources, the getting of specific references seized samples and their comparison.

The identification chart consists from the successive steps, each of them eliminated the nonidentical samples out the analysis. First step of the identification includes IRS and low resolution GLC in accordance with the Instruction. Second step includes the different modifications of the GLC-method in dependence of the oil type. GLC with the capillary columns (high resolution GLC) is used for an analysis of a light oil, a low resolution GLC with a flame-photometric detector is used for the analysis of the heavy oils.

The Instruction is labor-consuming and time-consuming enough. Moreover the Instruction not takes into account an influence of a temporal factor on the transformation oil hydrocarbons in natural conditions sufficiently. Introduced by Federal Service on hydrometeorology and environmental monitoring «System of an identification of the overflows on a sea» has became an important step in course of a decision of the problem. The System that allows to identificate the possible sources of a sea pollution by the oil from the ships with probability 0,9 includes 3 methods and the procedure of an artificial curing (agening) the samples of interest. The System includes also the application of the methods based on the spectrofluorimetry, high pressure liquid chromatography and capillary GLC. The advantage of the system in comparison with the Instruction consists in the attempt to take into account the transformation of the oil-products in the course of time.

The presence of these documents as well a number of publications on that topic in the scientific journals not bring down the actuality of the working more simple and reliable methods of the revelation of the oil pollution sources. For this purpose can be used the high sensitivity methods of a metallic admixtures, the isotope identification methods on a concentration ratio of stable isotopes ^{12}C and ^{13}C, ^{32}S and ^{34}S, a high sensitivity radiometry.

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It is issued the Instruction on identification of the pollution source of the water object in 1994, which envisages the execution identification procedure by way of a successive use of two methods: IR-spectroscopy (IRS) and gas-liquid chromatography (GLC). The latter is used in the different versions. The procedure includes a seizing of the representative oil samples from an overflow and all the intended sources, the getting of specific references seized samples and their comparison.

The identification chart consists from the successive steps, each of them eliminated the nonidentical samples out the analysis. First step of the identification includes IRS and low resolution GLC in accordance with the Instruction. Second step includes the different modifications of the GLC-method in dependence of the oil type. GLC with the capillary columns (high resolution GLC) is used for an analysis of a light oil, a low resolution GLC with a flame-photometric detector is used for the analysis of the heavy oils.

The Instruction is labor-consuming and time-consuming enough. Moreover the Instruction not takes into account an influence of a temporal factor on the transformation oil hydrocarbons in natural conditions sufficiently. Introduced by Federal Service on hydrometeorology and environmental monitoring «System of an identification of the overflows on a sea» has became an important step in course of a decision of the problem. The System that allows to identificate the possible sources of a sea pollution by the oil from the ships with probability 0,9 includes 3 methods and the procedure of an artificial curing (agening) the samples of interest. The System includes also the application of the methods based on the spectrofluorimetry, high pressure liquid chromatography and capillary GLC. The advantage of the system in comparison with the Instruction consists in the attempt to take into account the transformation of the oil-products in the course of time.

The presence of these documents as well a number of publications on that topic in the scientific journals not bring down the actuality of the working more simple and reliable methods of the revelation of the oil pollution sources. For this purpose can be used the high sensitivity methods of a metallic admixtures, the isotope identification methods on a concentration ratio of stable isotopes ^{12}C and ^{13}C, ^{32}S and ^{34}S, a high sensitivity radiometry.

MONITORING OF DRINKING GROUND WATER RESERVOIRS AND WELL FIELD AREAS

Borevsky B.V., Yazvin L.S., Zakutin V.P.
Hydrogeoecological Research & Design Company HYDEC, Moscow, Russia
Kochetkov M.P.
Ministry of Natural Resources, Moscow, Russia
A.N. Klyukvin
Central Regional Geological Department, Moscow, Russia

1. Monitoring of drinking ground water reservoirs and well field areas represents the system of:

a) regular control of ground water, well fields as well as individual components of the natural environment under the impact of ground water exploitation;

b) assessment of spatio-temporal changes in ground water and its environmental components;

c) forecast of changes in ground water under influence of water withdrawal and other anthropogenic and natural factors.

2. Monitoring of ground water reservoirs and well field is also the subsystem of geological environment and monitoring of water bodies which are integrated parts of the unique state system of economic monitoring.

3. According to the concept of the monitoring of geological environment, the monitoring of ground water reservoir (well field area) is referred to object level, and the monitoring of zone under exploitation- partially to the object level, and in part - to local one. The compliance of object monitoring is obligation of juridical persons and citizens having a license for subsurface use for ground water extraction. State management authorities for subsurface reserves are charged of the organization of local monitoring.

Monitoring works on ground water reservoirs as monitoring of object level are funded by the subsurface user. In accordance with the law " On the subsurface" may be used for these purposes a share of allocations for reproduction of the mineral raw material which is transferred to the subsurface user in prescribed manner.

4. The content and inventory of works in ground water monitoring system may be essentially changed depending on the type of ground water reservoir, complexity of hydrogeological conditions, water withdrawal impact on the natural environment, well fields construction and its productivity, conditions of ground water exploitation, ratio of the value of water withdrawal to proved exploitable reserves, and their providing by predicted exploitable resources. In this connection, it is expedient to consider different kinds and classes of the monitoring which are differed by the extent of investigations and their content, including:

- inventory of objects under observation and number of survey points;
- inventory of observation characteristics;
- area under observation;
- observation methods;
- system of data processing and change forecasting in ground water reservoirs and other environmental components.

5. By content, inventory, and particularities of monitoring feasibility all ground water reservoirs and well field areas may be divided into two groups:

A) Monitoring of areas under exploitation by single or small groups of well fields (2 or 3 wells) where the content of monitoring includes only the control of yield, level, and water quality in operating wells.

B) Monitoring of ground water reservoirs and well fields areas under exploitation with large well fields by groups (as a rule, by centralized water supply systems). In this case, there are three classes of monitoring, and this classification is based on type of ground water reservoir, complexity of hydrogeological conditions, extent of environmental impact, and ratio of a value of water withdrawal to ground water safe yield.

In the first class of monitoring objects under observation are ground water of operating and adjacent aquifers and also unconfined water always; in the second, surface water are involved; in the third, - rocks of unsaturated zone, semipermeable layers, exogenous geological processes, other environmental components.

6. Recommendations related to organization of monitoring system and its implementation are elaborated for every group and class. The program of monitoring system and its compliance by stages is being developed on the basis of these recommendations for each specific ground water reservoir.

THE COMPLEX MONITORING OF THE SELENGA BASIN

Dambiev Ts.Ts., Dambiev Ts.L., Dambiev Tch.Ts.
East-Siberian State University of Technology, Ulan-Ude, Republic of Buryatia, Russia

In accordance with the accepted ecological arrangement in zones of Baikal lake basin and peculiarities of it's territory pollution (Mongolia and Russia) it's worth while to organize 3 monitoring groups:

- Background - for preserved unpolluted regions.
- Area pollution.
- Concentrated anthropogenious influence.

As a base forcreation of 3-level net of complex monitoring stationary stations it's economically sensible to accept the net of hydro- and meteorological stations that are located in Buryatia and Mongolia in the Selenga basin ensuring the increasing of the complex of observations up to the world standards substantiated level.

On the 1-st stage of creating of a 3 level net of complex monitoring stations it was necessary to work out the model of organization of monitoring in Gousinoozersk industrial junction then spreading a received experience on Selenginsk and Ulan-Ude industrial junctions.

The 2-nd stage presupposes the organization of a 3 level net of complex monitoring stations in the Selenga basin together with Mongolia.

The 3-rd stage includes the spreading of a 3 level net of complex monitoring stations on the whole aquatic lake Baikal basin in accordance with a national and global net of complex monitoring stations. It is a possible to reduce on amount of stationary stations in each group of complex monitoring by organizing an optimal amount of adjustable complex monitoring stations. That's why on the 1-st stage when working out the model of organization of complex monitoring an example of Gousinoozersk industrial junction it was necessary to elaborate an adjustable station of the system of controlling pollution of environment. The test of such a station gave an opportunity to work out a more detailed necessary elements of a 3-level net of complex monitoring.

All the researches showed a possibility of the organization of an up-to-date complex monitoring using a home-produced equipment in the condition of finance deficit.

ECOLOGICAL MONITORING, STANDARTIZATION AND SIMULATION OF MAN-MADE IMPACTS ON WATER ECOSETSTEM'S AND ITS STABILITY ESTIMATION AT THE MODERN STAGE OF HIDROECOLOGY DEVELOPMENT

Dmitriev V.V., Tretyakov V.Yu., Dmitriev N.V.
St.Petersburg State University, the faculty of geography and geoecology
Research institute of Geography,
International Academy of Ecology, Man and Nature Protection Sciences (IAEMNPS)

The united approach to natural ecosystem state and stability is considered. The ecosystems is considered both in natural conditions of development and in conditions of man-made influence. The method is based on multicriterial estimation of ecological systems by summary state and stability indexes in conditions of indefination.

The indexes building includes next stages:

- the geographical, climatological and ecological criterions of ecosystem state and stability discering selection;
- the building of numerical and qualimetrical scales for representative and optimum criterions;
- the building of state and stability classes alphabet for the chosen criterions; the chosen criterions indexes rate setting with account of choice possibility and rate setting function change;
- the getting of scale koefficients vector which reflects the influence of the individual criterions on the summary estimation with the aim of numerical and (or) non-numerical information;
- the calculation of summary state (and stability) indexes for the chosen state classes;
- the calculation of summary state (and stability) indexes for a concrete natural ecosystem and discering its state, stability and "stock of solidity".

The criterions, numerical and qualimetrical scales are considered for state and stability to man-made load diagnostics of: rivers, basins, soil cover, landscape as a whole.

The results of summary state and stability indexes are presented for water ecosystems of north-western Russia.

THE ESPECIALITIE OF MICROBIOLOGICAL MONITORING OF WATER TECHNOGENIC SYSTEMS

Dzerzhinskaya I.S.
Astrakhan Astrakhan State Technical University

In modern conception of natures protection based on imagination of biosphere structure and properties of biosphere, the main role is belonged to microorganisms. Exactly they fulfil the main condition of all the alive in the biosphere, which Is conduded in balanced distraction and producing of organic substances, and they are the main part of curculatlon of biogenned elements. Exactly here in the biogydrochemical "boiler" all the known polluted substances are destroyed, the savourable conditions for the process of selfcleaning are appearing and active destructors as separate concortisums, accosiations and shtammes and societies of microorganisms. Therefore the particular meaning is giving to microbiology monitoring.

The contents of any king of monitoring may be characterized by the tasks, including observing, control and prediction, which are the regular system In the space and in time. As the result the aim of the monitoring Is reached which is concluded by the information about the environment and its estimation it in the past, present and future.

Microbiological monitoring in the system of hydrometeoservise is marked as the monitoring of bacterioplankton and it includes the microscopic control of the common quantify of bacteria as saprophytes, oligotrophics, carbohydrooxydated, sulphatoreduced, the connection of time, double-ness of the number of bacterial, production of bacterial biomass, intensity of destruction of oil carbohydrates. By these results we can define the level of trophic and pollution of water. The character of organic substance, the activity of microflora to the attitude of organic, carbohydrates and phenols, the ability of hydrogen sulfate invasion and value of the state of ecosystems in the whole by the scale of ecological monitoring.The observations during many years after the ecological position of the hard polluted and technogenic water system show that the results, about which we have spoken, are not possible to value exactly and predict the further development.

For resolving these tasks it is necessary to define the quantity of specific microorganisms, which are properly only for this media and active biocenozis, the selection In the process of selfcleaning (pilling) of these water systems.

These specific (aborigines) microorganisms we can select ("using agar" by Romanenko, 1973 year) and biocenozis, using the method of microcosm in our modification (Dzerzhinskaya, 1973).

We can predict the development of selfpilling and its activity on the results of our facts about the sucseccian process, and we can also do the methods recultivation, used biomasses of selected microorganizms-destructors.

THE NEUTRON ACTIVATION ANALYSIS IN STUDY OF CARRY OF TECHNOGENOUS METALS BY RIVER SYSTEM OF NORTHERN CAUCASUS

Frontas'eva M.V., Chinaeva V.P.
The Joint Institute for Nuclear Research (JINR), Dubna, Russia
Barenboim G.M.
State Centre for Water Management & Monitoring(SCWMM) of Russian Federation Ministry for Natural Resources, Moscow, Russia
Saypulaev I.M.
Western Caspian Basin Administration (WCBA) of Russian Federation Ministry for Natural Resources, Makhachkala,Republic Dagestan, Russia

The significant influence on an ecological state of the Terek river basin has activity of the Tyrnyauzskiy Tungsten and Molybdenum Ore Dressing Industrial Complex in Republic Kabardino-Balkariya and the Sadonskiy Lead and Zinc Industrial Complex in Republic Northern Osetiya - Alaniya. This influence is displayed in intensive pollution of water of the Terek river system by heavy metals and some other chemical elements having high toxicity.

The purpose of the present research consist in study of distribution of heavy metals and a number of other elements in process of removal from a source of pollution in a river network.

The multielement neutron activatoin analysis (up to 42 elements) of samples of pulp, water and river suspension taken in 13 points, including background, was carried out on reactor IBR-2 by Laboratory of Neutron Physics of JINR in Dubna in channels of irradiation with density of thermal and resonant neutron flow of $5x10^{12}$ and $0,23x10^{12}$ neutron/sm^2·s., accordingly.

The contents of Na, Mg, K, Ca, Al, Cl, Sr, V, Cr, Mn, Fe, Co, Ni, Zn, As, Se, Br, Rb, Zr, Mo, Ag, Sn, Sb, I, Cs, Ba, La, Ce, Sm, Eu, Gd, Tb, Tm, Yb, Lu, Hf, Ta, W, Au, Th, U was determined. Some elements from named list are determined in water of the Terek river basin for the first time. On a number of elements the level of water pollution exceeds MPC in tens times. The regular behaviour of elements-satellites (zinc and arsenic) in area of the Sadonskiy Lead and Zinc Industrial Complex is revealed, that makes understandable the occurrence of arsenic in controllable water.

The water analysis of the Baksan river (in a zone of Narzan water sources) in a control point, which is taking place above on the river stream, than the Tyrnyauzskiy Tungsten and Molybdenum Ore Dressing Industrial Complex, has shown comparatively high concentration of uranium and thorium, that is coordinated with results of the analysis obtained by other methods in other laboratories. At the same time the contents of other elements in this test was within the limits of norm.

In connection with that the Terek river is polluted with oil-genous substances, their combination with heavy metals is especially dangerous, because some of the metals, which have been found out in tests, are inhibitors of ferments, which carry out chemical modification of insoluble in water hydrocarbons, penetrating in living organism.

As a whole, it is possible to note, that the Terek river (below the Kabardino-Balkariya location) and coastal water area of Western Caspian Sea should undergo strong ecological stress, which is connected to complex influence of the various antropogeneous chemical factors, in particular, with toxic concentrations of heavy metals, discarded into the Terek river and its tributaries by the industrial enterprises.

The neutron activation analysis has shown its utility during investigations of ecological conditions in the Terek river basin. The value of the results received with its help can be appreciablly increased if to apply in addition the methods of chemistry and physical chemistry to determination of that chemical forms, in which there are heavy metals (valency, type of compounds: salts, complexes with organic compounds etc.), and to take into account their distribution in river water (in the dissolved form, as components of suspensions and hydrobiota etc.).

POLY(M-TOLUIDINE)-MODIFIED ELECTRODE WITH RESPONSE TO TRACE CHLOROCARBONS IN AQUEOUS SOLUTIONS

Gorelov I.P., Volkova T.V., Nichiporovich L.N., Andreeva O.V., Ryasenskiy S.S, Nikolskiy V.M.
Department of Chemistry, Tver State University, Tver, Russia

Poly(*m*-toluidine) films grown electrochemically on Pt electrode produced a charge response to dichloromethane, chloroform, 1,2-dichloroethane and other small-molecule chlorocarbons dissolved in aqueous solution. A wide dynamic range of 4,5 orders of magnitude of dichloromethane concentration, from 30 ng/ml to 0,5 mg/ml, was detected without preconcentration or dilution. Applied potential, flow rate, and amount of polymer deposited were varied to obtain the maximum response for a given sample. It was found that cyclic voltammograms obtained with and without dichloromethane present may be used to predict the applied potential for optimum film response [1, 2]. Flow rates of 0,5 ml /min or less were necessary to allow equilibrium partitioning of dichloromethane into a 1 mC polymer film. Additionally, for larger amounts of deposited polymer, even slower flow rates were necessary, but larger charge responses were obtained. Other chlorinated compounds were studied, and qualitatively similar responses were obtained for chloroform, carbon tetrachloride and 1,2-dichloroethane. Small, nonchlorinated compounds investigated gave 5-50

times smaller responses than dichloromethane, indicating that some selectivity exists for the small, chlorinated compounds, particularly relative to more polar organic molecules.

The electrodes investigated were used for determinations of amounts of chlorocarbons in the assays of sewage.

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VOLTAMETRIC TECHNIQUES INFORMATION SYSTEM FOR THE CONTROL OF VARIOUS WATERS

Gorobets A.I., Petrova N.Ya., Davletchine D.I., Bycova L.N., Kadykova E.A., Salikhdzhanova R.M.-F.
Moscow State Institute of Radio Engineering, Electronics and Automation, State Textile Academy, Moscow, Russia

Voltammetric techniques information system for the analysis of various objects is created. The system also includs the various waters drinking, natural, including sea, artesian technological, rectiaid and waste. All system includs 843 techniques, from them more than 200 techniques partinent to waters analysis. The material is divided on two categories: analysis techniques from literary sources (monographies and articles) and from the documents, approvated by metrological services of regional branch and state ranks. The information system represents two forms of work:

- By means of the tables in which basic parameters of a technique are submitted: objects of the analysis and determination composition of a background for the voltammetrie determination; peak-current potential or half-wave; a recommended kind of a indicator electrode and the mode of the analysis, minimum determined concentration and literary reference. The approved techniques includs the list of substances, prevented to determination. Due to the tabulared form it is possible information file partially or completely quickly to look through; to choice a material on one, two or three ingredient, for example on object determination; on objects of the analysis and determination; on objects of the analysis and control and mode voltammetrie determination and etc..
- By means of the complete description of the techiques according to the literary reference. In this case the user can receive the information on sample preparetion, mode of polarograph operations, type of a recommended cell, and also the information about advantages and lacks of the technique.

The section of system devoted to the analysis of waters, contains following subsentions: water drinking, water natural, (is separately allocated), water sea, water waste and other waters. In subsection other waters there are techniques, in which the type of water is not underlined or the technique is recommended for several types of waters, and also water technological and rectified. Voltammetric determination objects in approvaled techniques are ions Cu, Pb, Cd, Zn, Co, Cr(VI), V, As, Mo and dissolved oxygen. The list of techniques of the analysis of waters according to a literary data is more extensive. It includes, for example determination of ions of Mn, Ni, Al, Bi, K, Na, cyanids, bromids, iodids, phenol, formaldehyde, surface - active substances, chlorineorganic pesticides, polyethylene glicol and etc..

The information system is automated specialized library, intended for independent use. At the same time this library can be used by construction of expert systems in of the software automated voltammetric analyzer. Thus from information system are choosed data which allow automatically to identify an analytical signal in an analyzed solution. And first of all, there are composition structure of the background, material of indicator and reference electrodes, ranges of polarization potentials of substances, which on this background display electrochemical activity, kind of polarization. Such expert system functions in structure of the software to polarographies ПУ-1М, ПУ-2 and ПЛС-1М.

VOLTAMMETRIC DEVICES FOR THE CONTROL OF WATERS

Gorobets A.I., Davletchin D.I.,Salikhdzanova R.M.-F.,Shmidt V.K.
Moscow State Institute of RadioElectronics and Automatics, Moscow State Textile Academy, Moscow, Russia

Voltammetric analyzers in general are intended for determination of microimpurity in various objects of firm, liquid and gas forms. It is enough widely the devices are used at the control of various waters on the contents of harmful microimpurity of a inorganic and organic origin at a level below extreme allowable consentration. Voltammetric analyzers for the laboratory control are manufactured in many countries of the world: USA, Denmark, Italy, Hungary, Czechoslovakia, Japan, Russia and other.In Russia voltammetric analyzers and the furnishing components to it are developed and deliver by more than 10 firms. A main method, sold in these analyzers is stripping dc-voltammetry with application of stationary firm display electrode. It is enough simple mode for realization, but determination ensuring enough large sensitivity of substances, capable to be accumulated on a surface of display electrode. List of these substances is limited. Therefore great interest is presented by devices, which besides this mode have modern high-sensitivity modes, for example Ac-voltammetry. This mode provides sensitivity on 2 order higher,than Dc-voltammetry.

In this connection the many firms begin to include this mode in spite of the fact that voltammetric device is thus considerably complicated.

The distinctive feature of modern voltammetric devices is using of automation for combining analyzer with PC or at the expense of application in devices designs of a microprocessor engineering.

Deviced of such type are:PU-1Нь - universal polarograph model 1 modernized (has almost 25 modes of operations; PU-2 -superuniversal polarograph (more than 50 modes of operations);

PLS-1Нь - polarograph laboratory specialized modernized (almost 15 modes of operations); Electrochemical computerised measuring complex, including besides dc- and ac-voltammetric modes, potensiostatic, galvanostatic and time-potentiostatic modes.

Universal polarographs are usually used for the research purposes, therefore have low sensitivity. Above the adduced devices despitesufficient universality are highly sensitive polarographs.

Therefore these polarographs are used for the analysis of various waters on the contents of harmful microimpurity at a level of extreme allowable concentration in sanitarian services and ecological centres.

THE ONBOARD SHIP AUTOMATICC NATURAL WATER PHYSICAL AND CHEMICAL PARAMETRES CONTINUOUS MEASUREMENT COMPLEX. METROLOGOCAL TESTS RESULTS

Goussev A., Begak O., Arzhannikov A., Shpolyansky A.
Joint-stock company "Granit-NEMP"

The continuously increasing anthropogenic water environment pollution demands restriction of the water's parameters control. That leads to the limiting of concentrations of new and new substances by the Health Department and the Department of Waters and Fishing. More than 1500 substances' concentrations are limited at the present time. It's natural, that the total monitoring of all these substances onboard the ship is impossible.

The presence of polluting substances in natural water leads to changing of its main hydrophysical and hydrochemical parameters such as hydrogen ion exponent (pH), dissolved oxygen concentration (O_2), oxidizing-reducing potential value (Eh), temperature (T), conductivity (σ). This is one of the reasons why four of these five above mentioned parameters (T, pH, O_2, σ) are included into the sea-water's parameters list recommended for monitoring by the MARPOL 73/78 international convention. In spite of the diversity of the USA's, Great Britain's and other developed European and American countries views on the water environment protection concepts, they all are based on the priority measurements of the mentioned integral parameters representing water environment quality.

In this connection, the metrological features of the devices, intended for T, pH, O_2, σ, Eh measurements in ecological monitoring systems, should meet the requirements of the international and national environment protection standards. Appropriate metrological tests must be carried out for the correct comparison of received results. The automatic natural water physical and chemical parameters measurement complex designed by the joint-stock company "Granit-NEMP" and intended for operation onboard the ecological monitoring vessels was subjected to such metrological tests. The tests were carried out by Mendeleev Russian Research Metrological Institute according to specially designed "Program and methods of the metrological certification of the automatic water environment physical and chemical parameters measurement complexes with the usage of the water environment parameter's analyzers" program , with appreciation of requirements, which met in the national standard 27384 and sanitary laws №№ 4630-88, 4631-88.

The results of three equipment complexes' metrological tests are listed in the following table.

Table

Measure parameter	№ system	T, °C	σ, mSm m^{-1}	pH, unit pH	Eh, mV	O_2, mg*l^{-1}
Measure range (according to specification)		-2...+35	5...200 50...2000	2...12	-700... +1200	0...15
Measure range	1	-2...+35	5...200 50...2000	2...12	-700... +1200	0...15
(according to	2	-2...+35	5...200 50...2000	2...12	-700... +1200	0...15
test results)	3	-2...+35	5...200 50...2000	2...12	-700... +1200	0...15
Accuracy (according to specification)		±0.1	±6% ±3%	±0.1	±10	±0.75
Accuracy	1	-0.04	1.8% 0.6%	0.02	2	-0.38
(according to	2	-0.03	3.9% 0.2%	-0.04	1	-0.45
test results)	3	-0.05	1.6% 0.6%	0.07	3	-0.60

As the listed data displays, the metrological features values satisfy all the requirements.

The analysis of the present similar complexes condition, intended for operation in natural conditions, demonstrates that the represented complex is just as good as the foreign analogues by the metrological features values and that it can be recommended for usage in the onboard ship ecological complexes.

STATE OF ECOLOGICAL MONITORING IN THE ZONES OF IRRIGATED AGRICULTURE

Grigoryan R.A.
Management of Water Economy and land reclamation of the Ministry of Agriculture
Oganesyan K.A.
Scientific Research Institute of Water Problems and Hidrotechnics, Yerevan, Armenia

In the conditions of water and land resources deficiency in the Republic the problem of irrigation negative influence on the state of ecological monitoring is of great actuality.

Very often lack of water resources in the irrigated regions leads to undesirable tendency of questionable quality water use and in future that may lead to negative influence on the content of soils as well as on the quality of culturated plants.

Making up of ecological monitoring of separate regions with developed irrigated agriculture is carried out in following sequence:

- assessment of modem state of the region
- interaction of the irrigation process with environment
- Forecast of possible changes of situation in the region
- working out of nature protecting measures with purpose of environment support in optimal state.

THE TECHNOLOGIES OF HIGH-SPEED ANALYSIS OF ORGANIC COMPOUNDS IN WATER SAMPLES WITH PORTABLE EKHO GAS CHROMATOGRAPHS WITH MULTICAPILLARY COLUMNS

Gruznov V.M.,Shishmarov F.N.,Baldin M.N., Naumenko I.I.
Design-Technological Institute of Instrument Engineering for Geophysics and Ecology,
Siberian Branch of RAS, Novosibirsk, Russia

Gas chromatography occupies a highly important place in monitoring organic water pollution. In the recent years a number of portable fast-acting Ekho gas chromatographs, based on highly efficient high-speed multicapillary columns (MCC) and high-sensitive detectors (ECD, ECD/AID, PID,FID), has been developed. Ekho gas chromatographs compare well in sensitivity with laboratory devices like "Цвет-500 ", "Кристалл"and portable devices like Photovac 10S Plus (Photovac International, U.S.), Sentex Scentograph, and even surpass them in speed of response owing to the use of MCC. "Ekho-ECD/AID", "Ekho-FID", "Ekho-PID"devices contain several replaceable injectors: syringe injector, loop injector, concentrator, separate thermostats for injector, column and detector, back column purge. Device portability allows to perform analysis at the site of sampling, ensures high efficiency and speed of response under field and laboratory conditions. Features of gas chromatography, realized in portable Ekho devices, are determined be MCC efficiency, equal to 2500-3000 theoretical plates, detector sensitivity and separation time.

- ECD sensitivity for lindane is $2x10^{-12}$ gr./s.
- FID sensitivity for toluene is $2x10^{-11}$ gr./s.
- AID sensitivity for toluene is 20 ppb.
- PID sensitivity for benzene is 10 ppb.

The time of gas-vapor separation is from 5 sec. to 2-3 min. depending on compound volitality. As compared with conventional capillary columns MCC make it possible to analyze a large volume of samples. A number of stationary phases used (SE-30, SE-53, Carbowax -20M,СКТФ-50Х, OV-61).enables to separate a wide range of organic compounds in water samples. High analytical path efficiency allows to analyze both trace compound concentrations in drinking, surface and subsurface waters and high pollutant concentrations in waste waters.

The techniques of gas chromatographic water analysis may be classified into two big groups according to the type of sample preparation: with direct water sample injection into gas chromatographic system and preliminary analyzed compound separation from water. The techniques of headspace analysis are also considered in the report. To perform these techniques no complex apparatus is required and thus they could ensure high-speed analysis under field conditions as the devices of Ekho type do.

For liquid extraction of chloroorganic compounds pentane(2) with a volume of 5 ml was added to a sample of drinking water with a volume of 100 ml. Extraction was performed by stirring the solution during 10 min. followed by solution precipitation up to the complete phase separation. For analysis an extract sample with a volume of 0,5μl was injected with microsyringe into evaporator of Ekho gas chromatograph. The experiments have shown that such extraction technique coupled with analysis with Ekho-ECD ensures high-speed analysis of chloroorganic compounds: chloroform, tetrachloroethylene, tetrachlorinated hydrocarbon in drinking water samples at the maximum allowable concentration (MAC). Studies have shown that the use of pyridine as a solvent and Ekho ECD/AID to analyze halogenated compounds formed in pyridine by the well-known Fudgivara reaction offers high sensitivity of analysis.

High-speed gas extraction techniques were studied in static and dynamic.In the former case glass vessels with a volume of 10-40 ml with airtight chemically inert plugs were

used. To determine the concentration of C_i inpurities in water samples the equation was used:

$C_i = Cg (K + Vg/Vl)$, where Cg is concentration in equilibrium vapor, Vg/Vl are volumes of gas and liquid phases correspondingly, K is coefficient of impurities separation between liquid and gas phases. To reduce K standard NACL solution was added to water sample. It is shown that the above mentioned chloroorganic hydrocarbons could be analyzed in water samples with direct headspace injection into evaporator of Ekho-ECD/AID at 0,1MAC with analysis time less than a minute. In drinking water benzene is analysed at 1 MAC, toluene is analyzed at 0,05 MAC. With Ekho-FID and Ekho-PID detection limit for benzene reduces to 0,1 MAC.

In dynamic gas-extraction technique when water sample is continuously purged with inert gas, based on trapping chloroorganic hydrocarbons on the sorbent like Tenax and pulsed desorption in the evaporator of Ekho device, sensitivity is ten times the sensitivity of statical technique, which is enough for monitoring natural water pollution.

To evaluate the situation with water pollution by chloroorganic hydrocarbon samples of Baikal water, bottled Baikal water, drinking water from Irkutsk, Novosibirsk and Moscow were analyzed. The chloroform content is the highest in the water of Novosibirsk, is at MAC in the water of Moscow and less than MAC by a factor of 100 in the Baikal water.

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A SYSTEM OF HYDROECOLOGICAL MONITORING ON GOLD DEPOSITS OF PRIOKHOTIE

Ivanov A.V.
Institute of Water and Ecological Problems, Far East Branch, Russian Academy of Sciences

Hydroecological monitoring is aimed at revealing background characteristics of natural and artificial water bodies for forecasting possible consequences of gold extraction by cyanide bleaching. The system of monitoring involves hydrological, hydrochemical, hydrobiological, hydrogeological, glaciological, and glaciochemical aspects.

1. Hydrological monitoring is carried out by a) daily measurements of water level and temperature of the main watercourse in the given locality; b) weekly measurements of water discharge and suspended matter; c) calculation of daily water discharge (in particular, for determining the volume of runoff) and bed load. A similar procedure is performed on river tributaries.

2. Hydrochemical monitoring is intended for determining background concentrations of major ions, biogenic and organic matter, some microelements, cyanides and rodanides in atmosphere precipitation, in river, lake, marsh and underground water and in the water of settling basins. Water sampling is done where water level in the main river is extremely high or average. Special attention is paid to monitoring on a river below a possible water runoff into it from the future tails storage.

3. Hydrogeological monitoring involves observation of discharge, temperature and chemical composition of the known underground water springs, of perched water discharge in a specially made mine working, of filtration and infiltration processes.

4. Glaciological and glaciochemical monitoring is aimed at definition of characteristics of snow cover, ice regime of surface basins and watercourses, and of icing formation. Besides, parameters of broken-up subsurface ice (ice veins, sheets, nuclei, heaving knobs) are investigated.

5. Hydrobiological monitoring reveals parameters of ecological and production processes in rivers, natural and artificial basins. It is conducted by determining the dynamics of water-dissolved oxygen, photosynthesis, diurnal and 5-day oxygen consumption, of a, b and c chlorophyll, phytoplankton and periphyton concentration. The obtained data are used to calculate their biomass and productivity of water bodies.

The system is based on correlation of separate aspects by localities and dates of sampling, investigation and change of parameters.

Monitoring allows 1) computation of possible runoff water discharge into rivers depending on their level and chemical composition; 2) forecast of consequences of people's activity for each particular deposit; 3) evaluation of ecological safety of man's life activity.

ECOLOGICAL MONITORING IN OIL-AND-GAS AREAS

Ivanov Y.K.
Institute of geology and geochemistry, Urals Branch Russian Academy of Science, Ekaterinburg, Russia
Shishmarev V. M.
Committee on guards of a nature of a Ymalo-Nenetsky Area, Salekhard, Russia

Changes a regime and chemical composition changes of groundwaters in a production areas are large because of hydrocarbon and salt waters inflow to them. There are deep horizons drilling by prospecting holes and production holes.

Petroleum and toxic brain water pollution to fresh water have a wells more than 70000 pieces in Bashkiria, about 80000 in Tatarstan, 50000 in Khanty-Mansy area. The similar

situation have territory of Udmurtiya, Republic of Komi, Orenburg area and northern parts of Western Siberia.

In West-Siberian region the conditions is complicated by wide application in technological process of specific components such as dihetilenglicol (for drying of gas) and methanol (for dissolution of blockages in production wells). The large amount of burning associated gas torches could be led to soil accumulation the dioxine one of most toxic organic connections.

Hence a main object of researches must be the fresh underground waters of the surface zone that is responsible for plants-animals ecology and including human activity.

For this reason they are underlying to needs in ecological examination, in order to carry out degree of influence from both surface and underground man-made hazards.

It is not completely clear the migration characteristics of the basic components - pollutant that accompanying the oil-and-gas extraction. The information on chemical changes occurring with the pollutant components during their filtration through aquifers is absent. It is necessary to note that there is possibility to transformation a number of components from the inert to toxical combination. Hence for making the reliable long-term prognosis related to development of an ecological situation in oil-and-gas extraction areas it is necessary an additional investigation .

The main question underlying to study in Western Siberia are:

- hydrogeology, hydrochemistry and geothermy study of a deep geological section (in natural and man-made conditions);
- investigation of hydrodynamical, hydrochemical and thermal influence of deep underground waters to surface hydrosphere;
- investigation of geothermic waters influence to permafrost;
- study of engineering-geological processes related to hydrocarbon extraction (landslide, fall etc.);
- investigation of a aquifer water permeability changes it response to the surface waters infusion (for hydrostatic pressure support);
- study of hydrogeological and hydrochemical aspects concerning to groundwater protection and man-made intensity processes;
- carry out a forecast of negative processes trend and development of methods to their neutralization (monitoring).

The decision of these problems will be accompanied by the creation of complex information system which should be take in into account the current requirements of consumers and in some time to overtake they.

The structure of such monitoring could be presented by three large blocks:

1. First stage, during which it will be decide the technique of researches. This stage include work concept and a conceptual model creation of system. Then collect and processing the available information. These operation performed with using "retrospection monitoring" - when the materials interpretation proceed from their reliability and sufficiency. At the same stage perform the cartographic models of territory. Select mathematical device and software for functioning constantly working models of system.

2. At the second stage is formed information base as an electronic database . Database is contained the items of information on geoecological conditions related to investigated system.

On the basis of this database forms the information system as complex of models. Such models include mathematical models and expert estimations that describing a real condition of environment.

3. The third stage of work represents creation of real monitoring system in areas of oil extracting, forecast of man-made changes, and also recommendations for management of man-made processes and rational use of natural system.

THE CONTROL OF CONTAIN THE FISSION RADIONUCLIDES IN WATER BY RADIATION-CAVITATION METHOD

Ivanov S.I.
Kharkov State University, Kharkov, Ukraine

The observation of veriety the special display of spantaneous or indused fission forms and creates the modern methods of the nuclear control of substances with fussion materials.

Nuclear-splinters from the fission have a short run in water, though they carry a main portion of ionization energy the nuclear fission. It do not allow to detect this splinters, especially in small concentration the fission radionuclides as in standards of radiation security.

We suppose, that radiation-cavitation method is one from suitable methods for decision the task of ecological control the fission radionuclides in water. It is founded on cavitation threshold change, that in definite conditions is measure of fission substance concentration.

The sensibility of this method is more than gamma-spectrometry, it is easy and permits to pursue the continuous automatic control of radiation pollution in water.

First results of radiation-cavitation method was obtained in Chernobyl zone [1]. In report will adduce the research data and the structure scheme of experimental speciment of radiation cavitometer.

Reference

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A SYSTEM OF THE INTERCOUSTRAINED STANDARDS FOR AN OVER-ALL INVESTIGATION OF THE HYDRO-CHEMICAL DEVICES IN THE STATIC AND DYNAMIC MODES OF OPERATION

Kochar'an S.A., Suvorov V.I., Tudorovskaya O.V.
D.I.Mendeleyev Institute for Metrology, Russia

1. In last years the devices are supplying with the several interconstrained channels for a measurement of the physical and chemical water descriptions have become to use broadly for the over-all investigations of the ocean and a ecological monitoring of internal natural waters. Usually the devices include temperature (T), specific electroconductivity (χ), hydrostatic pressure (P), velocity and direction water flow (V), hydrogen index (pH), redox potential (Eh), dissolved oxygen (O_2), ion composition (pX) and sound velocity (V_a) probes. The combined devices determine traditionally a salinity, a density and the sound velocity and also a quantitative composition dissolved substances. The peculiarity of the application of the devices, and first of all, an accommodation on the underwater or above-water (outboard placing, forced pumping by a water of interest, autonomous or towed design) determines their actual metrological references (a measuring range and an inaccuracy) in much. The dynamic operation conditions can be determined by spatial and time inertia of the sensible elements in the real conditions and also by the additional inaccuracy for an influence of the velocity and direction of a running flow.

2. The system of interconstrained standarts has developed in Lomonosov branch of VNIIM

for the over-all tests of the water-quality devices. A base of the system is the hydrodynamic pool with dimensions 3 m · 3 m · 3 m. To exclude the induction currents in a water the pool was shielded by a metallic net and all the inlets were made from polyviniIchloride. The pool was equipped by a heating and intermixing system, that provided for the laminar and turbulent stream modes of operation on the different depth with a mean velocity up to 8 m/s and superheating up to 1,5 °C and also the vertical stratification mode of operation with temperature overfall up to

10 °C. The pool can be filled in both fresh and salt water and also by organic solvents. The oil film with well known thickness can be created on the water surface. Apart from the stream measurements the determination of the dynamic references of probes was running on specialized units, such as the variable temperature standard, unit "Dynamic measure", generator of gas mixture microflows.

3. The executed investigations by VNIIM have pictured out a number of the probe designees for the hydrochemical values. Their dynamic descriptions allowed to recommend the application for mobile objects in the real modes of operation. Among such the probes relating the transducers of the specific electroconductivity and water temperature have been developed by joint-stock company "Granit" and pH and Eh-probes (glass electrodes with hard metallic contact) have been developed by electrochemical glass laboratory of Saint-Petersburg State University; dissolved oxygen probes (Clarc type, the original construction for the deep-water probe); improved design AgCl-electrode.

ABOUT CREATION OF THE AUTOMATED SYSTEM OF WATER CADASTRE DATA INTERGOVERNMENTAL EXCHANGE

Kolobaev A.N.
Central Research Institute for Complex Development of Water Resources, Minsk, Belarus

The hydrosphere pollution of any state is determined by anthropogenic impact not only within the borders of that state, but also on the adjacent territories. Transboundary pollution transport, multiple water use along transboundary rivers stipulate the necessity of data interstate exchange on water environment conditions according to the agreed system.

Comprehensive analysis of water resource data, their use and water quality of transboundary rivers is vital for preparation of interstate catchment agreement and special projects during the solution of water division problems, implementation of complex water conservation measures, grounding of claims for the violation of agreed rules of water use and water source contamination on the upstream catchment area.

It is reasonable to use the following principles during organization of data interstate exchange on water resources, their use and water quality:

- the primary exchange of generalized, but not initial, information;
- the parity of transferred and received information;
- elimination of the possibility of the received information transfer to other states or international organization without the consent of the data owner;
- use of the same type format and data organization on magnetic mediums, and also codes (or jackets) of separate properties;
- ensuring of reading (without copying) the information database and receiving the same access to the information base of another state.

As the future system of interstate exchange is aimed mainly on interstate water use regulation, the main river sites, to which the water ecological information should be "tied", are the state borders and nearby hydrological and hydrochemical stations, and also reservoirs dams and main constructions of big hydropower stations, which regulate water

use the sites of big quantity of polluted waste water discharge. In accordance with above mentioned the same "tiding" (for neighboring states) of hydrological and hydrochemical stations, and also of water intakes and waste water discharges to the river catchments. We offer to use the distance from the river mouth to the according site (station as a "tyding key".

Creation of the above-mentioned system within the limits of CIS (Commonwealth of Independent States) is provided by the resolution of the Intergovernmental Environmental Soviet session (24.10.1996), in accordance with which the first stage of this work has been carried out by the present time. "The project of the structure of water cadastre indices liable to exchange and formats of their presentation on magnetic bearerse" is worked out and submitted for concordance to the interested collaborating countries. According to the project, the intergovernmental water cadastre database schould include information on the four major sections:

1) surface water

2) ground water

3) water use

4) standard information funds (reference books and classifiers of river basins, water users, sources of pollution, etc.)

After the concordance and ratification of this document, working out of programme provision and working documentation of the Automated system of water cadastre data intergovernmental exchange is planned. The system approbation is mapped out in Dnieper, Don and Irtish basins (together with preparation of an intergovernmental edition of water cadastre on these basins).

For effective functioning of the automated system,creation of an intergovernmental information-methodical centre on water cadastre is advisable, which in perspective can be reorganized into an intergovernmental centre on water use management and water protection in transboundary basins.

THE MONITORING OF THE MOSKVA RIVER ECOLOGICAL CONDITION

Kouzmina N. P., Romanova G. I.

MOSVODOKANALNIIPROJECT Moscow Institute for Water & Wastewater Research & Design, Moscow, Russia

The Moskva River upstream part serves as a source of water supply of the Capital; the part of the River within the City boundaries and downstream receives the effluent water from the Wastewater Treatment Plants of the City of Moscow, the wastewater from individual industrial enterprises which are not connected to the Wastewater Treatment System of Moscow as well as the pollutants which enter the Moskva River with surface run-off and storm water. The monitoring of the Moskva River is one of the most important tasks for the evaluation and control of Moscow Region ecological condition.

The water objects, being the most dynamic and variable component of nature which determine the condition of all the elements of the natural environment, are characterized by a large number of indices since the water factor is the main transportation means for pollutants transfer.

The ecological monitoring of surface water, especially the surface water used for the water supply purposes, envisage the establishing of a complex system of monitoring for a sufficiently large number of pollutants compounds. Both the world experience and the Russian practice reveal the necessity of differential approach to the problem of determination of the list of the indices controlled and the periodicity of analyses carrying out within a rationally arranged monitoring system. This circumstance is firstly the result of the high price of precision instrumentation for the determination of toxic substances low concentrations.

Having a large amount of data accumulated during many years concerning the hydrological parameters of the water bodies and the quality of natural and drinking water, MOSVODOKANALNIIPROJECT Institute predicts the water quality and the condition of the water objects both for long-term and shirt-term time periods.

Taking into account the accumulation of the new data concerning the toxicity of individual compounds at the Water Supply Sources Laboratory of the Institute, MOSVODOKANALNIIPROJECT since 1969 has been systematically performing the monitoring of the metals contained in water. During the period of 1978 - 1995 the upstream part of the Moskva River is characterized by the following metals concentration increase: iron - twice; chromium - thrice; cadmium - 5 times; copper - twice; lithium - 4 times; nickel - 2.5 times. The concentration of arsenic has also increased. The average annual concentrations of zinc and strontium have remained at the same levels, but their absolute values are considerably lower than the MPCs.

The existing network for the monitoring of organic phosphorus pesticides (their determination was mastered by the Water Supply Sources Laboratory in 1990) has made it possible to determine that in some 15 - 20 % of the cases their concentration exceeds the European Standard norms in individual areas during the periods of floods and agricultural fields fertilization.

In order to improve the monitoring system the Institute has also carried out the work concerning the certification of the industrial enterprises located within the sanitary protection zones, taking into account the level of technological processes, the raw materials and other materials used, the lists of the products being manufactured, the capacity of the treatment facilities, the treatment methods efficiency, the certification of the wastewater concerning meeting the MPCs requirements, etc.

The part of the Moskva River between the Village of Kolomenskoye and the Village of Otdykh is characterized by the fact that the formation of the water qualitative composition depends basically on the effluent water discharged by the Wastewater Treatment Plants of the City of Moscow. This part of the River is controlled every month by MOSVODOKANAL Moscow State Enterprise.

The water samples from the Moskva River within the City boundaries were taken by the Water Supply Sources Laboratory of MOSVODOKANALNIIPROJECT Institute in July 1997. A water sample from the Moskva River part located upstream the City near the water intake of Roublevskaya Water Treatment Plant was taken for comparison purposes as a background one.

Based on the results obtained it may be concluded that during the Moskva River flowing within the City boundaries the water concentrations of iron, manganese, cadmium, lead, zinc, copper and nickel are being increased. Apart from that a considerable increase in iron, lead and zinc concentrations in the River water downstream the discharge points of the effluent water from the Wastewater Treatment Plants of the City of Moscow may be also stated.

OPTIMIZATION OF GROUNDWATER MONITORING NETWORKS

Kovalevsky V.S.
Water Problems Institute, RAS, Moscow, Russia
Semyonov S.M.
Geoecology Iinstitute, RAS, Moscow, Russia

The increasing role of groundwater in population water supply and simultaneously growing anthropogenic impact on the groundwater, cause not only quantitative and qualitative changes of groundwater, but also numerous environment disturbances, resulting from hydrogeological condition changes. Revealing and prediction of changes in the groundwater and related to it environment is an important problem, expensive in realization and requiring to prove the necessity of making a small, but enough for solving a problem monitoring network, and optimal programs for its observation.

When planning an optimal network for groundwater monitoring, it is reasonable to follow a certain sequence. In the first stage, it is reasonable to make territorial zoning for groundwater formation conditions, considering the main factors and conditions of regime formation (periods of intensive recharge, groundwater intensive drainage, lithological composition of water bearing rocks, depth of groundwater table occurence). It makes it possible to place the network in diffrent natulal regimes conditions, characterizing background regime properties, id est, to make a network of background regime.

In the second stage, it is necessary to make an ecological-hydrogeological zoning for territory, taking into account both, the degree and character of groundwater regime disturbance, and potential susceptibility of the territory to origination and activization of negative natural processes, caused by ground water (karst, landslides, subsidences, surface runoff losses, disturbances to ecosystems and soils, land salinization, swamping and underflooding, and etc.). This zoning will allow to place the observation network in places, where such processes can result in the most negative consequences.

The next stage of optimization is studying space and time groundwater synchronism and asynchronism, basing on crosscorrelation analysis diffrent remote wells. Revealing the radius of statistically valuable correlation contacts will allow, in some cases, to reduce duplication wells, bored on the bases of two previous procedures and, in other cases, to plan an additional network for comparatively similar hydrogeological conditions, where it would be possible to have a lesser number of wells, basing zoning.

The next stage of optimization, being also a case for assessing the level of network adequacy and excessiveness, can be one of geostatic analyses for observation data, called kriging. This analysis is aimed at observation network density minimization within synchronous regime zones on the side, and, on the other side, kriging is aimed at proving a necessary adequacy of network density for making regional mathematical models, mapping regime and its prediction. Thus, the procedure of kriging makes it possible to prove both, a duplication network reduction and its supplementing for those territories, where data extrapolation from neighbouring wells does not provide required preciseness of predicted assessments.

A final stage of groundwater monitoring optimization consists in making minimal observations frequency, the criterion being, the inter polation accurasy for given measurement under their different discretization levels, assessed by a relation of measurement errors to their dispersion. The difference between relative accuracy of measurement and relative expenses for their production can serve a function of purpose for such optimisation. By curve extremum of this difference, it is possible to determine an optimal measurement discreteness, corresponding to their requires accuracy. The latter is caused by both, practical requirements (the problem being solved) and conditions of the most directions for researches of Hydroregime service, realizing groundwater monitoring in our country.

Thus, groundwater monitoring optimization is a complex multilevel problem, reguiring the knowledge of both, regularities for groundwater regime formation, and modern methods for analysis of groundwater regime.

The work has been done under financial assistance of RFFI (grant 96-05 65272). groundwater formation, in per cents of amplitudes for seasonal and perennial groundwater level fluctuations.

TO THE PROBLEM OF CREATION OF ABIOTIC CRITERIA OF SAFE POLLUTANTS CONTENTS IN SURFACE WATER OBJECTS

Lepikhin A.P., Miroshnichenko S.A., Sadokhina E.L.
Institute of Ecology and Microorganisms Genetic of Ural Branch of Russian Academy of Sciences

Under the influence of the intensive anthropogenic loads the considerable changing othydrochemical features of surface water objects takes place. At the same time the evaluation of water pollution preventing actions is determined by objectivity of applying criteria of safe pollutants contents. Before the last time these criteria development was directed on the conservation of separate consumer characteristics of water objects. Given circumstance has brought about using the system sanitary- hygienic and fishing LAC (limit allowed concentration). Main defects of these LAC systems are:

- not versatility of principle of threshold, being the basis of LAC systems. Herewith in independence from irritant different biological objects often demonstrate polymodality;
- difficulty and in many events impossibility of evaluation "combinatorial" effects, because for the large amount of considerable substances the number of their different combinations mushrooms with increase simultaneously registered pollutants.
- absence of account soil, geochemical particularities of watershed area of river basin, which are reflected on the natural background concentrations of substances;
- absence of efficient criteria of resemblance between model test-systems, used for evaluations LAC and observing water objects.

Obviously that for exogenous pollutants, generated in the production process, values LAC and LC50%, which were obtained from the results of toxicological studies, are sufficiently often the only features for the determination of their ecological danger. At the same time for usual for natural hydrochemical mode of water objects endogenous pollutants a criterion of safe contents must be built on the base of analysis of their natural contents in concrete water object.

In independence from the methodological approach to the determination of standard LAC, taking into the account stochastic nature of fluctuation as hydrological so and hydrochemical factors of natural water objects, it is necessary also to assign a reliability factors (P) of observance in the control water objects parts of normative concentration of specifying pollutants.

Criterion of safe pollutants contents on the base of the analysis of their natural contents must estimate a degree of "vicinity" othydrochemical mode of water object in the natural condition and its mode under the influence of technogenous loads, and herewith take into account a stochastic nature of fluctuation of hydrological and hydrochemical features.

GROUNDWATER MONITORING AT AN ESTIMATION OF INFLUENCE OF TECHNOGENIC POLLUTION ON GROUNDWATER SUPPLY OF TOMSK

Lgotin V.A., Makushin Y.V.
TC Tomskgeomonitoring, Tomsk, Russia

The Ob-Tomsk triangle which is taking place in the south of Tomsk area, is original range, where large volume of researches behind hydrodynamical and hydrogeochemical modes of groundwater is carry out . It is connected that one of largest in Russia Tomsk groundwater supply being a unique source of economic-drinking water supply of the regional centre is located here. The proximity to supply of Tomsk with its numerous industrial enterprises, Tomsk petrochemical and Siberian chemical combines (SCC) testifies to enough intense ecological conditions in area of Tomsk, that requires organization of system of a monitoring behind groundwater and environment.

In a basis monitoring of groundwater (GWM) the following principles are fixed:

Unification of system of supervision for level mode and quality of groundwater on coordinated with the users of depths of a network of observant wells;

Use of the automated information systems (AIS) for a storage, analysis and processing of the information on GWM;

Visualization of primary, computationally manipulated and prognostic data with use of full-function geoinformation systems (GIS), complemented by the specialized software;

Development of the administrative decisions for prevention or minimization of damage to geological environment at technogenic pollution of groundwater.

The monitoring system is based on reception of the authentic data about a condition of geological environment and its change in time under influence of antropogenic activity on a network of observant wells and is conducted under the special program developed in TC Tomskgeomonitoring and coordinated with all users of depths, having the state license for production of groundwater or on manufacture of injection of industrial wastes in aquifer horizons.

GWM is carried out on structures of observant wells which are taking place through Ob-Tomsk triangle, Tomsk groundwater wellfield, the Seversk groundwater abstractions and the polygons of injection of liquid radioactive waste. The supervisions over levels of groundwater and their quality are conducted on all aquifer horizons under the uniform rules. Within the polygons of injection the control of distribution liquid radioactive waste is conducted by a geological service SCC under the special program. The general methodical management of monitoring of groundwater carries out TC Tomskgeomonitoring.

All retrospective and received in process of monitoring the information is stored in specially developed AIS "GEOMON", including nameplate data on all reconnoitered on territory of Tomsk area deposits of groundwater, working supplies, single operational and observant wells with their geographical location and complete set of the attributive information on a geological and hydrogeological section of each well, observation infrastructure itself, abstraction, mode of levels, quality and use of groundwater. AIS includes a subsystem of formation and control of performance of conditions of the license agreements on the right of production of groundwater in a part them monitoring and allows to create and conduct under a databank of the licenses, to automate formation of the license agreements and graphic appendices to them on the basis of GIS-technologies.

The accepted structure of a database allows to supervise integrity of the information, to form of a various sort the target documents, to carry out sample and grouping of the data for statistical and mathematical processing and forms the basis for construction models of geofiltration and geomigration.

The cartographical representation of the data monitoring is based on full-function GIS Mapinfo, equipped by the interface of direct access to AIS "GEOMON".

The system of variably scaled mathematical models is intended for the decision of a complex of prognostic tasks of a geofiltration and geomigration in imitating statement. The results of prognostic and imitating modelling serves as the basis for development of the administrative decisions directed on prevention or minimization of damage from adverse influence on underground hydrosphere, optimization both processes injection and abstraction, and network of observant wells and monitoring as a whole.

OPTIMIZATION PROBLEMS OF A RIGIONAL AUTOMATED SYSTEM OF ECOLOGICAL MONITORING IN WATER MEDIUM (ON THE PATTERN OF SAMARA OBLAST OF R.F.)

Machinya A.P.
CPC "AQUAECOS"
Kuper V.Y., Rubtsov M.G.
SPC "PALS"

When establishing any regional automated system of ecological monitoring in water medium (RASEM-WM),development enngineers are confronted the necessity of minimizing the production cost , meeting certain requirements of quality and quantity of information, the drive of getting and using it, which provide the effective work of the system.The general task of the optimization includes a number of particular tasks, the most important of which are: the optimization of the territorial disposition system RASEM and the technical means RASEM requirements.

When solving the problem of system disposition,there must be considered the location question of the regional information analytical center (RIAC); also the quantity and location question of analytical zone centers (ZIAC); the amount and functions of stationary points of automated control (SPAC); control points by dint of mobile means (CPMM) and others.Besides the mentioned tasks must be solved in mutual connection between the systems of monitoring of shallow, subterranean and sewage water. The most reasonable approach to the geographical conjunction of RASEM-WM and its subsystems is based on the principal of the water subsystems origin:

- for the subsystem of shallow water is the water basin principle;
- for the subsystem of subterranean water is the territorial basin principle;
- for the subsystem of sewage water is the industrial development principle.

The determination of ZIAC and SPAC amount and territorial location must be proceeded by ecological zoning regarding the two main groups of factors which:

- define the necessity of installing RASEM-WM at water using activity, to which refer local zones with high industrial load, water areas or their local zones with unsatisfactory water quality, territories and water areas, where accidencial and emergency situations can appear and others;
- define methodological decisions of the spacial structure and functional capacity of RASEM-WM.

Moreover it is necessary to take into cosideration the factors of organizing and technical character (presence and development of different service lines, dislocation places and laboratory analitical base equipment, expences of fundamental building and others.) In reality the complex of dislocation problems is worked out on the pattern of Samara oblast infrastructure. When opimizing the requirements of technical facilities RASEM-WM, the general type requirements of technical equipment of RIAC, ZIAC, SPAC and CPMM, the organization of getting and passing data, their keeping, executing records on computer base and its softwear. Besides during RASEM-WM of Samara oblast optimization the specialized (specific) for the oblast (regional) and general (exterritorial) demands to the set (spectrum) of water-quality index, controlled in automated regime were also taken into consideraration. Proceeding from the technical and economic expediency it is irrational to direct our attention toward the automated water quality control in the regime "Diagnosis Now" using the maximum list of indexes.The analysis used in traditional monitoring index practice allows to speak about the usage of the minimum list, mainly the four standard index sets, which characterize:

- the capacity of the using activity to self-cleaning;
- the degree of water mineralisation;
- the degree of water pollution by some specific compounds of industrial nature;

• the general level of industrial pollution load because of sewage water discharge.

The development engineer's task of the automated motoring system is to choose out of numerous idexes the minimum set, which :

• has sufficient representation;

• allows to reveal anomalous situations quickly with a certain degree of reliability.

When forming the index set for motoring in the regime "Diagnosis Now" it is also necessary to take into consideration technical characteristics of existing devices and automated control systems of water quality. Using our own experience in solving the enumerated problems concerning water using activities in Samara oblast, we decided to choose indexes, which to this or that degree are functionally integrated, such as conductivity, pH, eh, concentration of dissolved oxygen, turbidity, biological oxygen demand (BOD), concentration of nitrogen triad (ammonia nitrogen, nitrite nitrogen, nitrate nitrogen), chlorides, chlorophil-A (for a summer season). In conditions of natural observation for a concrete control using activity on the basis of establishing correlated connections between the set of integral and regime indexes (a wider list) a smaller group of indexes was distinguished: conductivity, pH, chlorides, ammonia nitrogen, nitrate nitrogen.

There also exist differences in the recommended controlled index sets between the subsystems of shallow, subterranean and sewage water. During the control of sewage water it is necessary to take into consideration the specification of a concrete industrial using activity and the composition of its sewage water according to the dominating and desirably specific for this technology ingredients. We believe that the recommended index set for subterranean water must include indexes such as temperature, conductivity, pH, eh, general hardness of water, chlorides, ammonia nitrogen (for badly protected), nitrates.

Another indispensable peculiarity while using automated control water quality system is the application of automated water samplers in the control pionts. When registrating an anomalous or accidential situation the automated water sampling will be provided in the moment of accidence in order to take the next sample using the whole (directly diagnostic) spectrum of regime investigations in conditions of stationary laboratory or adequately equipted mobile laboratory when arriving at the base station. It will help to personificate the "culprit", which caused the anomalous situation and to work out perpousful, nature guarding measures and managing decisions.

ANALYTICAL CRITERIA IN CONTROL OF COMPOUNDS IN WATER

Malycheva A., Dorogova M., Korepanova O.
A.N.Sysin Research Institute of Human Ecology and Environmental Health, RAMS, Moscow, Russia

Deciphering of real spectra of compounds of water reservoirs taking into account individual sources of pollution according to component composition, level and chemical class is important for the improvement of the state analytical water control system functioning in accordance with hygienic requirements to drinking and surface water quality. As result of analysis of research findings of spectra of pollutants in drinking water of 75 towns and surface water of 25 river, 7 lakes, 7 storage lakes it was possible to find out the existing qualities of organic compounds, which are contained in drinking water - 142, in water of storage lakes - 238. These organic compounds belong to 25 classes of chemical compounds. This fact indicates the limitations of federal environmental monitoring, which includes a standart set of up to 20-60 controlled indices. Analysis of the indentified compounds in water bodies showed that more than a half (up to 69%) of organic compounds did not have MACs, which requires further studies in the sphere of setting hygienic standart for compounds. Compounds which get into reservoirs with waste waters from industrial interprises and at the same time contained in surfase water are always represented by spectra of variable composition from several dozens to hundreds of compounds depending on source of pollution.Thus, in Moscow drinking water 37 compounds were detected, in Zelenograd drinking water - 39, in Novokuznetsk drinking water - 65, in the Moscow river - 70, in the Seversky Donets river (below the point of discharge from "Krasitel") - 78, in the Ladoga lake (with waste waters of the pulp and paper plant) - 56. The range of compounds depends on the disinfection method: during water chlorination the main polluting compounds are clorine-containing ones (chloroform, tetrachloromethane, tetrachloroethane, bromodichloromethane); during water ozonization - oxygen-containing hydrocarbons (formaldehyde, benzaldehyde); during iodination - iodine-containing hydrocarbons (dichloroiodomethane, diiodochloromethane, dibromodiiodomethane). It is important to note that the problem of control is complicated by the processes of compound transformations which lead to the formation of new compounds, among which there might appeare more toxic and dangerous compounds than the initial ones.

Selection of the main indices for control on basis of the revealed component composition of pollutants according to the degree of their hygienic significance should be done with regard for a complex of analytic criteria:

• frequency of detection;

• levels of concentrations;

• belonging to the class of compounds;

• specificity for waste waters of the local polluting source during the control of the quality of water in the reservoir;

• character of the disinfection method in the process of drinking water control;

• ability of compounds for transformation;

• possibility of formation of more toxic compounds as result of transformation.

ELECTROMAGNETIC SCANNING INSTRUMENT EMS-1

Manstein A.K.
Institute of Geophysics, Novosibirsk, Russia
Gruznov V.M.
Desing-Technological Institute of Instrument Engineering for Geophysics and Ecology SB RAS, Novosibirsk, Russia

Purpose

EMS-1 unit is used for specific electrical resistivity measurement in the soil at the depth up to 20 meters.

Sounding is carried out using artificial alternating electromagnetic fields. The unit carries out induction frequency sounding by three magnetic dipoles. By changing frequency of the current, powering the generator dipole, the unit controls depth of field penetration. Selective change of the secondary field by two receiving dipoles provides data on geoelectrical cross-section in vertical direction.

The unit is used for search and exploration of fresh and salted water, structure control, search for and localization of industrial waste, sources and volumes of water leakage in water and heat supply systems, search for metal pipelines laying, mineralized waste water monitoring. It may be used also for constriction sites selection (search for empty spaces, water cut zones, fractures, etc.).

Expected results

Provision of engineering-geophysical, construction, environment protection, transportation and communications companies with portable, rather cheap and mobile unit for subsurface space research.

Scientific-technical level:

1. In comparison to the best Russian analogs

There are no close analogs in Russia. Experimental instruments are available for non-stationary sounding which have higher cost and restrictions for operating in areas with high electromagnetic disturbances (such as city zones).

2. In comparison to the best foreign analogs

There are no direct analogs. Most close are georadars, manufactured by many American, Canadian and Israeli companies. However their usage is restricted by near surface structure research in rocks and other low conducting substances, and also in artificial facilities made of concrete and other isolating materials.

Unit operation does not have any influence on environment.

Technical characteristics:

- range of sounding frequencies, kHz 2.5 - 285
- number of frequencies 16
- power supply from one battery 10-14 V, 20 A·hours
- operational temperatures range from -5 to +50 °C
- hardware control, sounding data storage and interpretation is carried out by portable personal computer
- dimensions, mm measuring unit 230 x 250 x 450 sonde 150x350x2500
- weight, kg measuring unit 10 sonde 10

VOLTAMMETER DEFINITION OF HEAVY METALS WITH THE UNIFORM SYSTEM OF SELECTION ATTEST AND INDICATION OF STRUCTURE

Mokrousov G.M., Knazeva E.P.
Tomsk state university, Tomsk, Russia

During maintenance of water objects there is a pollution of water, ground and coastal adjournment, vegetation by heavy metals. Last here are, as a rule, in the connected state and in an insignificant amount, therefore even their definition with the help of highly sensitive methods of the analysis needs preliminary preparation attest. It increases duration of the analyses, does not allow to carry out selection of test and definition in it of heavy metals directly on a place of finding of the object. We develop variant voltammeter of a method of a research and analysis of various objects, mainly their surfaces, on a content of heavy metals in element and oxide form. It in main eliminates the above-stated difficulties.

The basis and novelty of the given method is made by application of the uniform system for selection attest and definition in it of metals. As such active system we use a film or drop of mercury (gallium, conductor polymer), activated by electronegative elements (alkaline, alkaline earth). Last provide restoring definition metals from them oxide and connected forms. Selection and accumulation of metals from analyzed objects, as a rule from their surface, without destruction of a basis of the object and them consequent voltammeter definition provides mercury (gallium, polymer). Thus, above described chemically active system (electrode) combines in itself sampler both concentrating properties and properties of the indicator of substance. It reduces expenses of reactants and time by one definition.

In the report the results of the analyses of water, ground and coastal adjournment, vegetation are resulted. For example, the analysis of test of ground adjournment is carried out (weight, dried up to the constant with 100-150°C and ash with 500°C) with application sampler and indicator amalgam (sodium) electrode. Then removed current-potential curves oxidation obtained amalgams on a background 0,1M of a solution KCL (W = 30 mV/s, L = 2 $*10^{-8}$ A/mm). With the analysis of test is detected cadmium, which concentration was estimated on a method of weighing, C = $4*10^{-7}$mole/cm^3. In passing in test the presence of copper is fixed. The results of the analysis are confirmed by an independent method.

The approbation of a method is carried out on a wide circle objects of an environment. The method has allow to carry out express (time of contact with a sample 1-2 mines) definition of the microcontents of metals forming amalgams, at a level 10^{-6} - 10^{-11} g on various on square sites of a surface with relative standard deviation 30 - 40 %.

SORBENTS, INDICATOR POWDERS AND INDICATOR TUBES FOR DETERMINATION OF METAL IONS, ANIONS AND ORGANIC COMPOUNDS IN WATERS

Morosanova E.I., Kuz'min N.M., Zolotov Yu.A.
Analytical Chemistry Division, Department of Chemistry, Lomonosov Moscow State University.Moscow, Russia

Very often, toxic analytes can not be directly determined in waters by the most simple, available and inexpensive instrumental methods. In these cases sorption preconcentration of analytes can be used. Two approaches to immobilize of complex-forming and redox analytical reagents for preparation of many new sorbents and indicator powders have been suggested:

- on-line coating of reversed-phase silica gels and ion-exchangers by reagents;
- obtaining of porous sol-gel silica powders doped with reagents;
- the possibility of microwave irradiation for drying of wet gels have been investigated.

The retention of metal ions, anions, and organic compounds on the sorbents and indicator powders has been developed and studied in static and dynamic. Quantitative sorption conditions have been selected.

The procedures for determination of trace metals (Cd, Pb, Cu(II), Mn(II), Co(II), Zn, Fe(II,III)), anions (nitrate, nitrite), free chlorine, aniline, hydrazine, and phenols have been elaborated. Various kinds of analytical schemes and ways of detection (flame atomic absorption, spectrophotometric, solid phase spectrophotometric, diffusion scattering) have been proposed. The procedures developed by us showed good performance characteristics and high selectivity.

In many cases tedious laboratory analysis methods should be replaced by cheap, rapid, and reliable methods for on-site determinations. Express test tools for water analysis have been suggested based on the use of small indicator tubes (4 mm-1 mm,i.d.) filled with sorbents or indicator powders. The analytical signal (the length of colored zone which is proportional to the concentration of an analyte) is detected directly after the sample passage through the indicator tube.

The following ways of sample injection were used here:

- the solution upwards through the indicator tube by capillary forces;
- a home made pumping device was used in order to pass the sample slowly through the indicator tube.

Various analytical schemes are available which can be used in analyzing solutions with indicator tubes: the sample was passed through a tube containing immobilized reagent; the reagent was added to the sample and the resulting colored solution was passed through a tube that did not contain immibilized reagent. The first way is useful if colored compounds are formed as a result of the rapid interaction of one reagent. The another way is useful when colored compound results from the interaction with two reagents or if the interaction is slow.

The length of colored zone depends on reagent concentration in the indicator powder or colored solution, tube diameter and flow rate. To increase the sensitivity of the method, it is necessary to decrease the amount of reagent or colored product per unit mass of the support whenever possible. Narrowing the tubes leads to an increase in sensitivity. The rate at which the sample is passed through an indicator tube affects of the determination significantly. At the higher than 0.25 mL/min, an appreciable blurring of the colored zone is observed.

The analytical procedures for metal ions (Fe(II,III), Co(II), Cu(II), anions (nitrate, nitrite sulfite, and other S-containing), free chlorine, hydrazine, aniline and phenols were developed. The performance characteristics of the suggested test methods (anlytical range, detection limits, and RSD) are comparable with those of quantitative instrumental methods.

The application sorbents, indicator powders and indicator tubes for chemical water analysis has been discussed.

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AUTOMATION OF CHEMICAL ANALYSIS OF WATER: CONTINUOUS FLOW ANALYSIS

Morosanova E.I., Kuz'min N.M., Zolotov Yu.A.
Analytical Chemistry Division, Department of Chemistry, Lomonosov Moscow State University, Moscow, Russia

Continuous-flow analysis (CFA) is an automatized high-performance method. It is known as one of promising tools for the automatization of the routine analysis. The needs of water analysis require both determination of metals and organic compounds, including trace analysis and simultaneous determination of several or many components. For these purposes following approaches have been suggested:

- dual detection;
- on-line metal ions preconcentration and separation; microwave sample processing.

Photometric determination of metals and organic compounds was performed with a continuous flow analyser RFA-300 (Alpkem, USA). The analyser includes: sampler; peristaltic pump; manifold, including flexible tubes; sorption column if it is need; coils; spectrophotometer with two flow

cells; and recorder. To provide flow analysis a necessary flow system (manifold) need to be constracted.

Simultaneous determination of two components by dual detection. Dual detection by one dual-cell flow detector allows the construction of the simple flow system for the simultaneous deter mination of aluminium and manganese(11); aluminium and iron(111); calcium and magnesium in natural and potable waters. The different stabilities and/or the rate of formation of the colored complexes of determined metals served as basis of these systems. Up to 32 samples per hour can be analysed.

On-line separation and preconcentration for metal determination. In the case of determination of low concentration of metals capillary column with hydrophobic inner surface was included to the manifold. The configuration of the flow system was designed so as to achieve three goals: to realize on-line coating of capillary column; to carry out high sensitive and selective determination of trace metals and to obtain two plugs from the same injected sample via sorption separation in order to allow a two component analysis.

Immobilization of different complex-forming reagent on various capillary columns was investigated. Coating a capillary column is possible in pH range where the reagent exists predominantly in the molecular form. All the reagent studied were readily retained on the surfaces with phenyl groups. On-line coated capillary columns were suitable for use in the sorption/elution cycles during 3 - 42h.

The retention of Ca, Mg, Cd, Co(11), Cu(11), Fe(111), Mn(11), Ni, Pb, Zn, Sn(11), Bi(111) on the on-line coated capillary columns was studied. Sorption of metals depended on:

- reagent immobilised; pH value;
- flow rate.

Depending on the conditions and immobilised reagent on-line coated capillary columns can be used for group or selective preconcentration of metal ions.

The flow system proposed were used for both determination of trace metals with sorption preconcentration and two-component determination with sorption separation. The optimum conditions found for the sorption, desorption, and photometric determination of me:als allowed the on-line preconcentration of Cu(11), Co(11), Fe(111), and Pb on the on-line coated capillary columns. Determination of trace metals is selective, performance: 17 - 19 samples/h. High performance (50-60 samples/h) was observed for two component determination. Microwave sample processing for determination of metals and organic compounds. The development of high-per formance automated methods of water analysis requires innovation in sample preparation. The use of microwave irradiation shows much promise in flow analysis. Sample preparation of natural and waste waters in the flow for subsequent flow-photometric determination of metals and organic compounds have been developed.

Manifold for spectrophotometric determination of metals in natural waters involving microwave sample preparation with on-line preconcentration by capillary column has been elaborated for the determination of Mn(11), Co(11), Fe(111), and Pb. The manifold proposed was used for analysis of the swamp water from the source of Moskva river.

The procedures of metal ions and organic compounds determination worked out can be recommended for the use in the analysis of drinking, waste and natural waters.

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OPTIMIZED MONITORING OF SURFACE WATER USED FOR PUBLIC WATER SUPPLY

Naidenko V.V., Kaschenko O.V., Parkhayev Yu.G.
N.Novgorod State University of Architecture and Civil Engineering, N.Novgorod, Russia

The optimization problem has been solved within the framework of implementation of the Targen Federal Program "Rehabilitation of Ecological Situation in the Area of the Volga River and Its Tributaries, Rehabilitation and Preventing Degradation of Natural Complexes of the Voga Basin" ("Revival of the Volga"). Reliability of the systems providing drinking water for the population can significantly be raised through efficient water quality monitoring of surface water used for public water supply. The results of the monitoring should be used as a basis for flexible control of water intakes and waterworks.

In forming a basin-wide system of ecological monitoring including routine and regime observation, using contact and remote control methods, level-type organization of monitoring is considered the most rational. In regional monitoring systems the optimum relation of informational capacity and cost can be esured through coordination of control measures by ecological monitoring services; adjusting parametrical control to reasonable changes in user requirements concerning the information generated;optimization of the network of automated control stations. The methodology developed for grounding the location of emergency monitoring stations envisage combining the analysis of hydrological and hydrochemical parameters of streams, and statistical data on potential sources of accidental wastewater discharge, experimental research and modelling of pollution spreading by actual and design data. The main advantage of this methodology consists in the fact that it helps to reduce considerably the amount of hydrological and hydrochemical investigations needed for grounding the location of emergency control stations.

The pattern for location of the stations on the N.Novgorod Region stretches of the Volga and Oka is designed to ensure timely warning of waterworks in N.Novgorod, Kstovo and other towns about the emergency condition of public water supplies. In forecasts of emergency

situations one- and two-dimentional mathematical models of pollution spreading can be used depending on the boundary conditions, parametrization following the results of preliminary hydrological and hydrochemical studies.

The technology of water treatment adopted at the waterworks is unable to provide removal of organic pollution , heavy metals, pesticides, oil products, phenols, detergents. The only available means of protecting municipal water supplies against pollution, with the existing system of water treatment works, can be temporary blocking of water intake from the river. The system of water supply monitoring allows to stop water intake in time and determine adequately the duration of the emergency situation . Increasing safety and efficiency in operation of waterworks facing heavy man-induced pollutional load on public water supplies can be achieved by application of modern water treatment technologies - primary ozonization and use of effficient powdered and granular sorbents.

Creating automated systems of basin-wide water quality monitoring of public water supplies including regional systems of monitoring emergency situations accompanied by simultaneous introduction of efficient water treatment technologies is the main condition for providing quality public water supply.

THE MAIN DIRECTIONS OF COMPLEX MONITORING

Nesterenko Yu.M., Skvaletskiy E. N., Kuksanov V.F.
Orenburg Department of the Most Expedient Nature Usage and Geological Environment Protection of the College of Mines, Ural Department of the Russian Academy of Science

The environment monitoring in Russian Federation is built on the departmental principle dispite of the regional monitoring centres. This causes a disconnection, a non-coordination and excessive expenses. The following several departments do the monitoring of the surface and underground waters: the nature protecting departments, the geological departments, the hydrometeo services, the water economy controls, the sanitary epidemic supervisions and the others. The conclusions are made and the departmental - like recommendations are given according to the departmental observations, rather often without complex solving of the nature usage problems. Therewith the essential and sometimes the defining factors fall out from the field of vision. Such an order is conditioned by the financing character, at which the credits for monitoring are in the hands of organizations and enterprises which soil the environment and make worse the ecological situation .It's high time to pass from the departmental principle of environment monitoring to the territorial one, having determined it's aim- the improving of the vital activity of ecological situation nowadays and in the future, and also the improving of nature in the whole. Therewith one should pick out technogen's assimilated territories and cities monitoring, where a natural vegetal community have been destroyed and a water balance, an atmosphere, soils have been radically changed. The prime aim of these territories is the conditions providing for healthy and safe life of people under the conditions of industry and city economy functioning. As a rule the complex monitoring inside the cities and technogen's zones should include the atmosphere quality and precipitation control, the underground and surface waters observations and their quality, including the water intakes condition, the seismic monitoring, the soil control in the basis of engineer erections, the ground and agricultural situation control ,the vegetation observations (including the one which causes illnesses) and the microbiological monitoring. The complex monitoring in the cities should be done by the special service, which has scientific informational analytical, inspection and prognosis centres and it isn't a departmental one. It shouldn't be done by the departments, which are responsible for separate natural factors. The efficient and technological control should be concentrated in the departments to manage the technogen's influence of enterprises on people and city environment efficiently to prevent the emergency situations or to remove their consequences. The main aim of complex monitoring beyond the bounds of technogen's zones is the providing of safe keeping of the main qualities and connections of nature or of those, which have been purposefully changed by the economic activity of a man. According to the data of this monitoring one should provide nature functioning, its ability for self purification and development, what should preserve the living conditions for a man in this zone. It would be reasonable to divide the monitoring of these zones into the complex monitoring of agricultural areas of economic significance and the monitoring of natural vegetal community. The complex monitoring of agricultural areas of economic significance must give the initial data to provide their functioning and the soil fertility growth. On these lands one should do the monitoring of soil fertility and also the observations of humidity, of soil composition and the quantity of salt in it, of subsoil waters and of the other factors. The natural vegetal community complex monitoring should be done, taking into consideration the type of vegetal community: steppe, forest, reservoir, marsh, drain and so on. The special place must be taken by the water resources complex monitoring, because water resources is a leading factor in the development of living and lifeless matter. The mutually connected underground and surface water monitoring with the elaboration of short and long-term prognosis programs enter it. While doing the complex monitoring to reduce the scope of work it would be reasonable to reveal the dominating factors, which define the condition of territories in the whole and to check then systematically. The other indexes should be checked periodically. In the lakes and ponds such a factor can be the vegetation, which is the I in the edible chain of living organisms, which reside in it. For natural steppe such factors can be the presence and power of turf, for ploughing areas they are humus and moisture.

OPTICO-SPECTRAL- BASED SURVEILLANCE OF WASTE WATER POLLUTED WITH OIL POLYAROMATIC HYDROCARBONS. RAPID BIOTESTING OF THEIR INTEGRAL TOXICITY

Novikov I.A., Gurov B.N., Fomchenkov V.M., Kholodenko R.V., Kholodenko V.P.
State Research Center for Applied Microbiology, Moscow region Obolensk, Russia

At present, oil and its products are widely used in industry to generate energy. This inevitably leads to that when being explored, processed, transported and applied, these pollutants contaminate waste waters. Of particular concern are water extracts of polyaromatic hydrocarbons (PAH) of oil pollutants. Thus, a major problem in this field is the development of methods to control the environmental situation.

The work focuses on some optico-spectral methods for surveillance of waste water polluted with water soluble PAH fractions as well as on rapid testing of their integral toxicity.

The content of water extracts of oil PAHs in water samples was measured by UV-spectroscopy and fluorimetry. Oil, kerosene, diezel fuel and benzol were applied as experimental pollutants. The methods allowed the analysis of PAH water extracts that were obtained from oil products of different consistencies (film, emulsion). In respect of pollution degrees, the following succession was observed: *benzol > kerosene ≥ diezel fuel > oil.*

For the assessment of integral toxicity of PAH-polluted water samples, a fluorocolorimetric express-method was offered. The method allows one to measure water toxicity by changes of reducing activity of a test-culture versus a two-color redox dye. PAH water extracts obtained from emulsions are found to be the most toxic that is likely due to the increased PAH concentration.

Results suggest that optico-spectral methods can be successfully used for surveillance of PAH-polluted waste water and for express-biotesting of integral toxicity of water environments followed by their detoxification.

Investigations were performed in the framework of Project #119-95 of International Science and Technology Center (ISTC).

AUTOMATIC WATER QUALITY MONITORING STATIONS

Obert J.- C.
Company SERES

French Company Seres' purpose is to manufacture and commercialize automatic Water Quality Monitoring Stations.

These stations are suitable to monitor :

- River water,
- Urban sewage water,
- Industrial sewage water,
- Drinking water.

Seres is manufacturer of Water Quality Monitoring Systems for more than 30 years and has installed equipment all over the world, mostly in Moscow, where more than 100 Seres analysers are installed by "Mosvodokanal".

Water Quality Monitoring Stations are composed with the following parts :

I. Monitoring analysers

Water Quality Monitoring Analysers are designed to measure several parameters in water, automatically and continuously. Used measuring principle avoids repetitive and costly manual intervention and allows to control 24 hours a day water quality.

Some of the main parameters measured by Seres are :

- Chemical Oxygen Demand (COD) (oxydation by internal microwave)
- Total Organic Carbon (COT)
- Hydrocarbons
- Phenols - Ammonium - Iron - Aluminium - Chlorine - Phosphates
- Turbidity
- Coliforms (Automatic and continuous control of bacterium number (coliforms)
- and more than 100 other parameters.

II. Automatic sampling and filtration system

Station reliability and availability will highly depend on sampling and filtration design. As a matter of fact, water characteristics (level, flow, suspended particule, colour,...) are changing sometimes very quickly and could perturbate analysers and results. According to its past experience, Seres designs and delivers Automatic Sampling and Filtration Systems adapted to all situations.

Examples :

- Submerged (or not) pump
- Blow back system with pressurized air
- Decantation system
- Filtration system (hydrocyclon, ultrasounds, etc...)
- Autosampler
- etc...

III. Computerized Data Acquisition And Communication System

All data from analysers can be collected to a computerized Data Acquisition System. Then, thanks to a high sophisticated software developed by Seres and running under WINDOWS, computerized system offers a lot of possibilities for data treatment (average, historic, curves,...).

Stations can be under permanent attendance and transmission to a central control room using the most reliable system (radio, satellite, telephone line). In case available rooms are missing (e.g on river boarder), all above-mentioned elements can be housed in an air conditioned container or in a mobile laboratory (van).

Automatic Water Quality Monitoring Stations, which have got the "Gost Standard" Approval, are the result of several years development program in Seres R & D Department followed by extensive field trials. They are offered for export only after having proved their worth during long duration uses in our own country, as we sell not only our equipment, but also our methods, our applications, our service and our "know-how".

ON MAXIMAL ERROR OF VISUAL WATER TESTING VIA REAGENT INDICATOR TOOLS

Ostrovskaya V.M.
Kurnakov Institute of General and Inorganic Chemistry of the Russian, Academy of Sciences, Moscow, Russia

Visual methods of analysis employing chromogenic reagents on solid substrates and colour comparators are considered to be semiquantative with standard deviations from 10 to 50 % [1-6], and generally the standard deviations for visual test-method is not given at all.

To reduce the error of analysis several approaches can be used: (i) the comparators are provided with various mechanical devices [1,2,7,8], (ii) an appropriate backgro-und colour of the scale is selected [9], (iii) a marker dye is put on the test strip [10], or the visual method is calibrated with the instrumental method [11,12] or another visual method [13-15] to estimate their equivalence [13] or reliability [14,15].

While conducting metrological attestations of rapid semiquantitative methods of analysis of inorganic ions in water using a set of reagent indicator tools, produced by Company LTD "ECOTEST", [16] we used the standard colour scales TC 29.01-91-87 of 20 comparators ECOTEST to monitor the colour intensity change of the indicator reaction zone with the ions' concentration; the standard colour scale was chosen in such a way as to make each reference sample as close as possible in its colour to the measured one for a number of increasing concentrations.

In the equal-contrast colour measuring system [17,18] the analytical parameters,

depending exponentially on the coloured substance content, are the following: colour brightness difference DL, colour saturation difference DS, and colour shade difference DE. The colour measuring method is based on the formula of overall colour difference or shade difference $DL = L_0-L$ $DS = [(A-A_0)^2+(B-B_0)^2]^{1/2}$

$$DE = [(L_0-L)^2+(A-A_0)^2+(B-B_0)^2]^{1/2}$$ where L, A, B, L_0, A_0, B_0

are colour coordinates of the measured and reference samples, respectively.

The shade difference DE changes from 0 to 100 conventional units (C. U.), one colour distinction threshold corresponding to 1 C. U. The measured cocentrations of the analyte best recognized by the eye are chosen in accordance with a definite step in DE. Visual graduated test scales based on DE - concentration (C) dependences allow one to quantitatively describe not only colour intensity, but also colour changes in a test method. For methods where the human eye sees light reflected from the surface of the sorbent, it is advisable to build test scales with DE > 10.

The dependence of DE on C is logarithmic, therefore with DE=const one gets the geometric progression in the concentration change of the measured component in the sample. As a lower detection limit ($C_{d.l.}$) one may take the concentration dependence corresponding to test-samples with a colour difference DE=10 C. U. at C=0 for one of them. A minimal detectable step is about 10-15 % of the whole colour change, Therefore the colour scale is made to consist of 6 - 10 steps depending on brightness, contrast and saturation of the initial and final colour samples. The colour measuring method makes it possible to produce an equal-contrast colour-metric scale well adapted to the human eye. The adopted colour distinction threshold DE defines the error of measurement in the range C=0 to its maximum value using the graduated test scale.

If the unknown concentration C_x of a component falls in between n and n+1 members of the series, and in one case $C_x = (C_n + C_{n+1})/2$, where n is the standard sample serial number, one can estimate a maximal relative error

$$s_r = \pm 100\%.(C_{n+1}-C_n)/2 : Cx = \pm 100\%.(C_{n+1}-C_n)/(C_{n+1}+C_n),$$

which will constitute $sr = 100\%C_n/3C_n = \sim \pm 33$ % for $C_{n+1}=2C_n$ in the geometric progression series, and for the case where $C_{n+1}=3C_n$ $s_r = \pm 100\%.2C_n/4C_n = \pm 50$ % (without taking into acccount other error factors). When $C_n = C_1 = 0$ (at the beginning of the concentration scale) and $C_{n+1} = C_2$, maximal relative error is $s_r = \pm 100\%(C_2 - 0)/(C_2 + 0) = \pm 100$ %

Tests were carried out to check the conformity of comparator colour scales to colour changes of test strips when detecting ions Ca, Cd, Co, Cu, Fe, Hg, Mg, Pb, Zn, of the sum of heavy metal ions, Cl_2, Cl^-, NO_2^-, NO_3^-, PO_4^{2-}, SO_4^{2-}, pH 2-13, using the colour scales of the comparators ECOTEST (procedure described in [16]) by Lipina T. Yu. (STC ECOSERVICE), Krasnova N. B. and Bulatizki K. K. (State sientific-research institute of chemical reagents and special purity chemicals, ATC, Moscow) in January-April 1997. Acceptance test acts were signed by Kolchin A.V., director of STC ECOSERVICE. Precision of measurement using the present methods was estimated via reproducibility of natural colour scales by reagent indicator tools.

The relative errors of the order of + 30 % for $C > C_{d.l.}$ and ~ ±100 % for $C = C_{d.l.}$ are common for visual methods of analysis.

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PROBLEM-ORIENTED APPROACH AND THE USE OF INDICATORS IN GROUNDWATER MANAGEMENT

Ottens J.J.
RIZA, Lelystad, Netherlands

The selection and use of indicators is an important step in the development of an integrated water management policy. Integrated water management has to deal with different functions and uses of the waterbody under concern and this may lead to conflicting interests. To be able to manage this complex of interests, the right information is vital. Indicators become increasingly important in providing this "right" information, since their function is communication, simplification and quantification of information on a (groundwater) system.

Under the UN/ECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Helsinki, 1992), guidelines on the monitoring and assessment of transboundary groundwater are being developed. These guidelines will be based on the monitoring cycle, which specifies successive steps in elaborating a monitoring network. The first step, that links monitoring with water management, is the specification of information needs. The use and selection of indicators can be seen as part of this step. Therefore, the background studies, that are executed as part of drafting these groundwater guidelines, include a study on a problem-oriented approach and the use of indicators. Based on the preliminary results of this study and of an inventory of transboundary groundwater and related monitoring and assessment activities, a framework, which facilitates the development and use of indicators and which can be use to attain the goals of groundwater monitoring and assessment programmes, will be presented.

Rather than recommending the use of specific indicators (because they are a.o. time and place dependent), the aim of this presentation is to propose a method for selection and use of indicators in the monitoring and assessment of transboundary groundwater. Stepwise it is indicated which aspects have to be dealt with for a successful process of development and implementation of tailor-made indicators. These steps can be described as:

- identification of function/use and issues (function like drinking water supply and issue like salinisation)
- if issues are conflicting with a certain function, management objectives can be formulated.
- translation of formulated management objectives into information needs
- as part of the tailoring indicators to the specified information need, the following aspects have to be taken into account:
- the stage of the management (see management life-cycle: problem identification, policy development, policy implementation and control)
- identification of stage in the PSIR concept (Pressure, State, Impact, Response -causality chain of relation between the socio-economic system and the environmental (groundwater) system). This concept acknowledges the different goals for which indicatros will be used
- the hydrological and geochemical functioning of the groundwater system
- the information users (policy makers and/or operational managers)
- the available(technical and financial) means

From the inventory an overview of the different functions/uses, issues, and management objectives, that are recognised amoung countries that have ratified the Helsinki convention, has been obtained. From this overview examples of the tailoring of indicators for particular issues will be demonstrated. And although in groundwater management there is no such thing as universal indicators, due to differences in the aspects mentioned above, let alone in a transboundary context, indicators can present harmonised environmental information at a global scale, when the development or choice of indicators is based on the same approach.

QUALITY MONITORING OF GROUND WATER. USED FOR INDUSTRIAL AND DRINKING WATER SUPPLY OF THE SVERDLOVSK REGION POPULATION

Palkin S.V. Rybnikova L.S.
URALGEOLCOM, Yekaterinburg, Russia
Belyayev G.N.
URALHYDROEXPEDITION, Yekaterinburg, Rusia

The quality of ground water extracted by intakes in the Sverdlovsk Region for industrial and drinking water supply is formed under the influence of natural and human factors. The main natural factors are physical and geographical, hydrogeological, physical and chemical ones; various industrial and economic activities of the man, including the very water extraction, refer to human factors.

Natural factors present in the zone of active water exchange, in which the majority of intakes for industrial purposes are carried out, lead to the formation of infiltrogenic sweet hydrocarbonate water, less frequently sulphate water with a relatively wide range of mineralization (0.1 to 0.6 g/dm3), depending on mainly the speed of processes taking place in the hydrosphere of water exchange. Under specific hydrodynamic and hydrogeochemical conditions, such water can contain higher amount (sometimes higher than maximum permitted quantities) of iron, manganese, silica, as well as calcium and magnesium, which lead to a higher than usual hardness of ground water. Locations and areas where ground water has higher natural content of arsenic, radon, boron and bromine are also known.

Variety of natural hydrochemical conditions requires to organise and to carry out a target mapping of the Sverdlovsk Region which will be the basis of regional monitoring. On the basis of mapping, areas for prospecting new intakes will be selected as well as analysis of operating intakes and ground water quality changes will be carried out.

Monitoring at the central intakes of the Sverdlovsk Region has been carried out by the geological service for many years. The results show that for the majority of water reservoirs, ground water quality remains stable and corresponds to hydrogeological forecasts and recommendations on standard methods of water preparation developed at the stage of intake prospecting and designing.

Alongside with this, there are cases when ground water quality undergo certain changes. It happens, in the first place, because of the progressive unfavourable effect of natural factors which form the chemical composition of ground water, and in the second place, because of violating land-use regulations and conditions of hydrosphere protection from antropogenic impact in the territory of an intake.

The following factors of man-induced impact on the ground water quality of intakes supplying water for industrial and drinking purposes were observed:

- activization of sulphuric acid leaching of rocks during the de-watering of both a productive collecting area and layers overlapping it and containing dispersed sulphide mineralization (S.-Mazulinsky, Poldnevsky, Samotsvetinsky intakes);
- ground water pollution by leakages from service lines and storage facilities of industrial objects and public utilities (Bogdanovichsky, Mazulinsky intakes);
- setting up agricultural estates with intensive land-use in the area where ground water is formed (Yelizavetinsky intake);
- inflow of naturally non-conditioned water within the productive horizon (Solodilovsky intake);
- violation by the maintenence service of nature-use conditions set up during the state testing and confirmation of ground water supplies (Lipovsky intake).

Results received by monitoring of such objects, should be used to substantiate managerial decisions of different kind (changes of intake and land-use regulations, change of catchment scheme, etc.) and re-assessment of used ground water supplies.

NEW ENERGETIC FACTORS OF A CHEMICAL CONNECTION OF THE MATTERS

Parfenova N.I.
All-Russian Research Institute for Hydraulic Engineering and Land Reclamation

May anticipate, that developed by author the energetic factors have a total natural significance and indirectly the strength of connection for all natural chemical matters, and also for the quantitative values of energetic connection factors (or chemical transformation) for salts, that prevail in ground waters of each landscape-geographic zone. These values increase from North to South synchronously with an increasing of a solar radiation, that shows their physical connection. Energetic factors of an election density and chemical connection reflect the laws of changeability of atoms composition, of charge and mass distribution radius ion along.

Energetic out goes for chemical connections synthesis are equal theoretically to ones for their analysis (by Fersman). These outgoes are calculated through the energetic factor of a chemical transformation (or chemical connection strength). Lowest values energetic factors are typical for organic matters (from 0,25 to 0,70), for inorganic matters they are more (from 1,0 to 2,8). The vegetative societies of forest, forest-steppe and steppe zones show some increasing energetic factors synchronous to increasing of solar radiation.

On summaries base author schematically have divided 4 stages of transformation - synthesis, humification and

mineralization of organic matters. Calculated for each stage the energetic factors and dividing barriers (by difference between previous and next barrier) have shown: as more difference, as harder transformation. Energetic outgoes, as show the difference between stages of transformation (between barriers , are nearly equal.

Original mineralization of organic matters on second stage is more intensive and deep, as result of most inflow solar energy. So, in desert and half-desert zones quantity of humus is low, but a soil fertility is high because many of nutritive elements for a vegetation. But in forest-steppe, steppe and aril-steppe zones creation and support of a favourable hydrothermic regime has a big significance for a microbiologic productivity.

WATERCOURSE ECOLOGICAL ASSESSMENT BY FUNCTIONAL TIES OF MACROINVERTEBRATES

Pavljuk T.E.
RosNIIVKh, Yekaterinburg, Russia

Among the problems, resulted from scientific-technical developments, one of the prominent one turned out to be that of clean water, as surface water appeared to be the most sensitive link of the environment.

The majority of existing assessment methods (bioindication) for water ecosystem are not very demonstrative when giving results.

In the present paper we tried to illustrate advantages and shortcomings as well as to solve problems of bioindication methods within the framework of ecosystem approach. While using the latter, energy streams and the substance cycle of biotic and abiotic ecosystem components happen to be in the center of attention (Green, 1990). The main interest focuses more on functional ties (e. g. trophic links) of living organisms among themselves and within the environment, rather than community species, defining rare ones or changes in their number. The ecosystem approach emphasizes the community integrity despite its environment and places, occupied by organisms. Having this in mind we deal with bottom communities as being functionally identical despite their geographical surroundings. The break of community regulating mechanisms the bottom one in particular, due to environment pollution may result in biological disbalance and the system rebuilding on a new level under new conditions.

The system of biological monitoring was developed by means of structural -cenotic community features of macroinvertebrates and ecosystem approach as the basis (Odum, 1975). The biological principle of species unification in trophic levels, trophic determination of the bottom community were used as the basic featured. The analysis of bottom community functioning mechanism made it possible to develop an assessment method - Index Trophic Completeness (ITC) - structural integrity of the water ecosystem under anthropogenic conditions using macroinvertebrates as one of the central water ecosystem links.

Two principles were adopted a priori:

1. ecologically untouched water ecosystem has the maximum affordable number of trophic inner links between all the biotic and biological components;
2. water ecosystems may differ as to their species composition, but are always integrated as for the quantity and quality of trophic links between and inside its cenosis components. Using variety of scientific papers we distinguished main criteria underlying macroinvertebrates trophic classifications. Detailed analysis resulted in five criteria by means of which it's possible to describe such an abstract notion as trophic niche in the macroinvertebrates community. the following statistic and general biological analysis gave us an opportunity to define 12 trophic links of invertebrates, which are to be always present under ecologically stable conditions at the maximum functional and biological variety of river ecosystems.

Any anthropogenic changes in a water system sooner or later lead to trophic links break in hydrobiocenosis and disappearance of intensification of negative interference.

While using ITC it's possible to solve the following problems:

1. To male maps of water ecosystems despite their geographical surroundings. It'll permit to evaluate the effectiveness of carrying out long-term programs on water bodies rehabilitation as well as assess the impact of local pollutant discharges of different types. This is convenient when dealing with two different as to species composition water bodies, but identical as to the number of trophic links. These maps might serge as the data base by means of which one could detalize various aspects of fishing and fishery. Evaluate a body capacity for self-treatment, get statistics on changed scale in the environment;

2. To identify the extent of ecosystem break after an incident. The number of links helps to define if an ecosystem as a functioning whole has or has not changed after it. Even if some species are likely to vanish, an ecosystem may function as it used to before with the same number of trophic links, the latter being very important from the point of view of the ecosystem approach;

3. To make a forecast for river systems rehabilitation. Having defined vacant trophic niches, one may predict what species have to show up in an ecosystem during the process of rehabilitation measures. Similarly it's possible to predict the possibility of this or that species appearance, having the information on the trophic niche of species in a particular water body (vacant, taken, if taken, then by what, taken to what extent);

4. To possibly define prevailing pollution type (metals, organic pollution), based on the non-present links data.

5. At present ITC is being adopted to the Urals region and the Netherlands watercourses which could make it possible to use this method for any geographical regions.

THE "VOLZHSKY FLOATING UNIVERSITY" PROJECT AND ITS OPPORTUNITIES IN DECISION THE VOLGA BASIN'S ECOLOGICAL PROBLEMS

Plyakin A.
Volzhsky state committee protection of environment, Volzhsky, Volgograd region, Russia
Roschina T.
Volgograd regional center on hydrometeorology and monitoring of the environment, Russia

The report deals with development of same aspects of the problem of ecological monitoring of water bodies in the Volga Basin.

The people of Russia are intimately aware of the intense ecological transition now underway on the Volga Basin. It is a transition that has or will touch every aspect of culture or society. It is critical for us to understand dimensions of this transition, with an understanding of how each of our decisions and actions affect the whole.

Ecological monitoring is the important element of assessment of water body conditions and appreciation of the anthropological influence on hydrological regime and forecasting of changes in the ecological condition of river and reservoirs in this large region of Russia. Ecological monitoring is the main tool for effective decision support.

The difficulties of financial and material security activity of the State committee on hydrometeorology and monitoring of the environment is the reason of search the additional ways of monitoring organization. For example, there are educational ecological programs on monitoring of water ecosystems for schoolboys («Green», «River Watch», «Aquadata») in Europe and USA. There is growing awareness of the role played by higher education in any sustainable development programs. In accordance with the decision of the General Conference of UNESCO at its 26th session in 1991 was launched the Coastal Marine (COMAR), Promotion of Marine Sciences (PROMAR) and Training and Education in Marine Sciences (TREDMAR) UNESCO's Programs as a form of inter-university cooperation in East and West Europe.

Elaboration of the «Volzhsky Floating University» project has made in Volzhsky Institute of Humanities of Volgograd State University. This project was elaborated in accordance with the *UNITWIN* / UNESCO CHAIRS PROGRAMME and with the support of Institute of the Biology of Inland Waters Academy of Science Russia (Borok), Volgograd regional center on hydrometeorology and monitoring of the environment (Volgograd) and the Volga and North Caspian Basin Ecological Parliament (Volgograd). Project will seek to achieve more effective training of students through participation in annual «training-through-research» cruises, post-cruise scientific and training seminars, publication of initial expedition results and presentation at scientific meetings. During the period 1998-1999 will carry out 4 research cruises in the «Volgograd reservoir» for execution the program on ecological monitoring. R/V *Storm* (Volgograd) will be the main research platform for the chemical-biological investigations of water bodies. The Volzhsky Institute of Humanities is the capital base for creating and using ecological Data Bases, Expert Systems and Geographical Information Systems for Environmental Screening and Decision Support. The «Volzhsky Floating University» project will contribute to the understanding of environmental changes in the water bodies of Volga Basin through execution the programs of ecological monitoring, strengthening international and interregional inter- university cooperation, using a new computer-based approaches to Environmental Impact Assessment. Our address: Volzhsky Institute of Humanities, 11, 40-years of Victory St., Volzhsky, Volgograd region, Russia 404132

STRATEGICAL PROGRAMME MEASURES INTENDED FOR REORGANISATION OF WATER BODIES MONITORING SYSTEM

Pozdina Ye.A.
RosNIIVKh, Yekaterinburg, Russia
Mogilenskikh A.K.
UB CPPI, Yekaterinburg, Russia

In contemporary conditions of the large-scale and many-sided anthropogenic impacts on the environment there is the deterioration of the surface water quality everywhere. From the one hand it depends on the increase of the pollutants discharged and from the other hand it depends on the disturbance of the natural functioning of the water ecosystems, change of the abiotic and biotic processes of the water quality formation.

In order to manage water resources and realise the water protection activity in the river basins it is necessary to have the organic objective information concerning the whole geoecological system of the river basin and sources of the anthropogenic impact as well.

The most important aim of the monitoring programmes is the permanent assessment of the water body ecological characteristics in order to know whether the target indicators of the ecosystem are reached. Besides the monitoring programme implementation contributes to the formulation of the correcting actions if the target indicators are not reached.

In order that the programme satisfies the requirements it is necessary to organise a number of programme measures that can be divided into several groups:

1. The organisation of the combined observations in regard to physical, chemical and biological parameters together with the simultaneous fixation of hydrological parameters.

The physical-chemical monitoring enables to control the narrow range of ingredients. Data of such the monitoring are discrete and only the limited number of parameters and substances can be subjected to the automated monitoring.

The peculiarity of the biological monitoring is its capability to fix the complex state of the water environment.

2. The co-ordination of the place and time of the abiotic and biotic information collection, the analysis of interrelations

in the framework of the ecosystem, the application of the mathematical modelling.

3. Elaboration of the necessary standard-methodical and metrological base of the river basins monitoring and sources of the anthropogenic impact.

The stepwise technical reequipping of the monitoring systems by the modern analytical facilities and the optimum utilisation of aerospace and land observation devices resources as well.

4. The organisation of the monitoring of the water bodies pollution diffuse sources. It is necessary to organise the control system of the emission of pollutants of the anthropogenic nature from the diffuse sources. Characteristics of pollutants entered the water bodies from the diffuse sources are defined mainly on the base of calculated methods. The results of natural investigations of the flow from the agricultural areas and built-up territories are the input data for calculated methodics.

5. The optimisation of the monitoring of drinking water supply sources. The monitoring of drinking water and drinking water supply sources quality provides for the substantiation of the choice of the necessary number of priority indicators which are the obligatory indicators for all controlling departments under the operational control taking into account conditions of the formation of the water sources quality and technological schemes of drinking water treatment.

6. The development of the observation network at the surface water bodies aimed at the database organisation and management and substantiation of basin agreements. The observance of the territory interests in the field of the water resources utilisation and protection and water bodies restoration should be ensured at the expense of the well-grounded distribution of water resources in accordance with the basin agreements between the constituents of the Russian Federation.

In order that the basin agreements have the technical-economical substantiation and to control their fulfilment it is necessary to organise the additional points of the observations for quantitative and qualitative parameters of water resources.

7. The organisation and use of the reference databases (the systems of data accumulation and analysis) for the purpose of the integration of available data and information collecting by the various monitoring subsystems. The working out of maps characterising the ecological aspects of water management. The formulation of the complex reports on the ecosystems conditions.

8. The working out of regulations regarding the interaction between the persons, which are responsible for the ecosystem monitoring, and decision-makers at all levels (the municipal level, catchment level and interterritorial level).

The realisation of the measures aimed at the organisation, development and functioning of the system of the water bodies complex monitoring will ensure: 1) the fulfilment of State engagements concerning the presentation for the Oblast public organisations and population the reliable information on the water bodies conditions, 2) the implementation of the water management policy, the common policy for the Sverdlovsk Oblast, in the field of the water utilisation and protection, regulation of interregional distribution and utilisation of water resources, 3) elaboration and realisation of the economical mechanism of water management.

PECULIARITIES AND RESULTS OF 30-YEAR MONITORING OF THE NATURAL ENVIRONMENT STATE OF LAKE BAIKAL

Prokhovnik L.B.
Irkutsk Department of Hydrometeorology and Environmental Monitoring, Irkutsk, Russia
Chebanenko B.B.
Siberian Energy Institute, Russian Academy of Sciences, Irkutsk, Russia

Lake Baikal is a unique natural object included in the list of the world heritage of UNESCO. The lake contains 23 thousand cubic kilometers of weakly mineralized water which comprises 80% of surface fresh water reserves of Russia and about 20% of the world reserves. Since the late 50s the intensive industrial exploitation of the lake has begun and the anthropogenic load on it increases from year to year.

A system of the state observation, study and control of the state of natural environment elements on the lake has been actively developing since 1963-1965 with construction of the pulp and paper mill (BPPM) on the Baikal coast. The present-day scheme of this system has been published in the Baikal Atlas (Izdatelstvo RAN, M, 1993, 147 p.)

Monitoring of Lake Baikal comprises observation, analysis and estimation of:

- hydrochemical and hydrobiological regimes of water thickness and clastic deposits of the lake as well as a part of 336 rivers determining 90-94% of water flow into Baikal;
- supply into the lake water of harmful (toxic, carcinogenic, mutagenic and teratogenic) substances of an anthropogenic origin with flows and emissions into the atmosphere;
- content of these substances in the atmosphere of coasts and over the lake mirror, in water thickness and bottom deposits, in precipitation (rain and snow) and atmospheric falls.

The main peculiarity of monitoring on Lake Baikal consists in the dual system of environmental quality estimates: on the one hand, orientation to the state environmental quality standards, on the other hand, uniqueness of the natural (background) content of many substances that is characteristic of Baikal, on which the equilibrium functioning of the whole ecosystem of the lake and especially its endemics is based.

Necessity to control the content of those impurities in environment elements, which are supposedly not contained in the emission of harmful substances from enterprises but are present in raw material, in applied chemicals or formed during destruction of chemical compounds in water and bottom deposits (heavy metals, mercury, PAH) represents another peculiarity of monitoring. Observations of the content of mineral, organic and suspended substances in the lake water during .30 years show their pronounced growth. For example, the increase of suspended substances accounted for 100% (from 0.06 to 0.12 mg/l), the increment gradient of

mineral substances grew from 0.015 to 0.100 mg/l. Chemism of the atmospheric precipitation also changed substantially, i.e. the content of suspended and mineral substances in rain and snow of the Southern hollow of the lake increased by 46-50'/o and in the area of BPPM - 10-36 times.

On the background of great changes in the hydrochemical regime of the lake a group of the anthropogenic pollution areas is separated, among which the BPPM area is considered as most dangerous with respect to quality and most extensive with respect to sizes. Here (he spots of bottom deposit pollutions are formed, which migrate to the lake depth with a grade of the bottom relief of 30-40 ".

Violations of the hydrochemical regime and water pollution by harmful substances could not but have an effect on the lake ecosystem:

- in the late 70s - the early 80s the essential deviations in dynamics of phytoplankton structure and appearance of alga species that are not typical of the deep-water part of the lake were noted;
- by the end of the 80s the indigenous Baikal species of phytoplankton microalgae in the deep-water part were practically substituted by (he Siberia-wide species with predomination of algae that are inherent in polluted water;
- in the early 90s the rate of mutations of the endemic mollusks sharply increased (more than 15 times) both in the area of BPPM influence and beyond its limits within a radius of50-60 km.

These and some other symptoms are indicative of the considerable violations in functioning of the Baikal ecosystem and destruction of the biological mechanisms of water self-purification.

In the area of impact of the BPPM flows the bottom communities of fauna and *flora radically changed, the populations of more than 100 endemic species disappeared, etc.

Results of the systems (in time and space) comprehensive monitoring on Lake Baikal give impressive grounds to assert that:

- negative processes caused by the intensive activity on the lake are developing at an increasing rate;
- anthropogenic load exceeds potentialities of the natural environment of the Baikal region to self-purification and regeneration.

The results of monitoring, its richest database can and must be the basis not only for elaboration of the scientifically well-grounded feasible norms of impact on environment elements and forecasts of consequences but for planning of the sustainable ecological and economic development of the region.

MODERN ECOLOGICAL PROBLEMS WITHIN THE BASIN OF THE TERECK RIVER

Saipulaev I.M., Guruev M.A.
West-Caspian BWU

The Tereck is a chief river of Northern Caucasus and plays an important role in economy of Kabardino-Balkaria Republic, Northern Osetia-Alania Republic, Ingushetia Republic, Chechen Republic and Daghectan Republic. More than 2,7 million people live in its basin area and its water resources are actively used for the purposes of electro power engineering, industrial water supply, irrigation (with 490 thousand hectare of sewage area) and for preservation and breeding sturgeon in there.

During the last 4 years waters in the Tereck river have undergone significant structural changes on qualitative parameters. On the one hand, catastrophic fall of the industrial manufacture, located on the river makes water pollution less. For example, in 1996 chloride dumping decreased (from 173,8 to 12,51 thousand tons), iron dumping decreased (from 749,9 to 106,7 tons), molybdenum (from 14,51 to 2,42 tons), arsenic dumping into the waters of the river decreased (from 3,43 to 0,9 tons). Such changes are caused by the reduction of dumps from Tyrnyayzsky tungsten-molybdenum and Sadonsky load-zinc industrial complexes, that are the main providers of heavy metals into the waters of the Tereck river. Hydrochemical control over the waters of the river revealed significant lowering of heavy metals concentration in the river that is due to reduction of waste dumping.

On the other hand, the oil-refining complex situated in Chechen Republic, damaged by the war in 1994, is of great danger for ecology in the lower of the Tereck river. According to the observation more than 16 thousand tons of oil-products have been thrown into the Tereck since 1994. Today the concentration of oil products in the river waters is more than 3,6 thousand tons.

The problem is that drainage systems of more than 100 million m^3 per year capacity became inserviceable. Sewage get into the waters of Sunzha (the Tereck's tributory).

Because of the certain reasons there is no opportunity to test on chemical compounds of waste water (sewage) dumped in the territory of Chechen Republic. To estimate a share of antropogeneous loading on the Tereck river the multicomponent monitoring was set up on both hydrochemical ranges.

It is known that while transforming oil and its derived a lot of toxicant are released including heavy m etals. Their involving in biological circulation causes ecological breaches.

According to the observations, measures taken have decreased water pollution at the mouth of the river and Caspian coastal line. Valley dumps of oil products into the waters are fixed by the systems set up.

West-Caspian BWU signed an agreement with Chechen Republic Ichkeria on increasing the efficiency of the accepted administrative decisions of the problem. While working out the bilateral agreement between Chechen Republic and Daghestan Republic, West-Caspian BWU offered number of measures to restore the drainage systems, recultivation of the polluted soil, to repair the damaged oil pipe-lines, slits and other oil industry objects.

Besides, researches on the following pants are considered to be made simultaneously:

- examination on the compounds of the subsoil waters in the sewage area of the Tereck river delta for the present

time and on the basis to draw up a scheme of polluted areas;

- ichtyological researches on specific compounds of the waters in the lower reaches of the Tereck river;
- biochemical, physiological, hystological and toxicological researches on sturgeon.

ANTHROPOGENIC MONITORING OF WATER QUALITY IN LARGE VOLGA RIVER RESERVOIRS

Seleznev V.A., Selezneva A.V.
Institute of Ecology of the Volga River Basin of the Russian Academy of Sciences, Togliatti, Russia

Monitoring of the water quality in large man-made impoundments of the Mid and Lower Volga is being effected nowadays without due regard to the structure and dynamics of their water masses. In this connection, there is no chance to objectively estimate the present-day state and trends in the change of waters from the Nizhnekamskoye, Kuibyshevskoye, Saratovskoye and Volgogradskoye reservoirs.

These water bodies are distinguished by a spatial heterogeneity and temporal variability in their water quality resulting from the presence of several genetically differing water masses in any given reservoir. Large-scale variations in the water quality can be inherent in a reservoir on the whole and are determined by the respective riverine inflows. For example, the Kuibyshevskoye and Nizhnekamskoye reservoirs are greatly influenced by the inflowing Kama and Belaya rivers, respectively. Lack of large riverine inflows into the Saratovskoye and Volgogradskoye reservoirs accounts for the occurrence of large-scale variations in their water quality only during the spring flood-time. Meso- and small-scale variations are typical to all reservoirs and are observed at the sites of inflows of medium and small-size streams, as well as at the waste water outfalls from the towns of Naberezhniye Chelny, Kazan, Ylianovsk, Togliatti, Samara, Syzran, Balakovo, Saratov.

Mixed water masses to be formed at the inflows of streams into a reservoir essentially differ from the Volga proper in terms of the ion composition and the extent of contamination of riverine water under the impact of diffusion and point-type sources. Zones of pollution or water masses of anthropogenic origin are usually formed at the reservoirs at the sites of outfall of industrial, municipal and rainwater sewage discharged by large towns. The quality of water in the nucleus of anthropogenic water masses is 5 to 10 times (and in case of emergency situations in the systems of town water disposal - even 10 to 100 times) worse as compared to the background indices for the reservoirs.

An information-measuring system "HYTON" for the "in situ" control arranged on board an expedition boat enabled to reliably differentiate versatile water masses. Uninterrupted information flow from its eight gauges was directed through an interface to the board computer to be processed and analyzed. Temperature and electrical conductivity of water taken as the basic criteria for the water heterogeneity facilitate the detection of even small-size water masses of anthropogenic origin at the sites of waste water outflows (Fig.1). Samples of different water masses were then identified based on a comprehensive chemical analysis.

Application of adequate observational methods and tools enables to optimize the system of anthropogenic monitoring at large water-storage reservoirs in terms of rationalization of the observational net and heightening the validity of the results obtained.

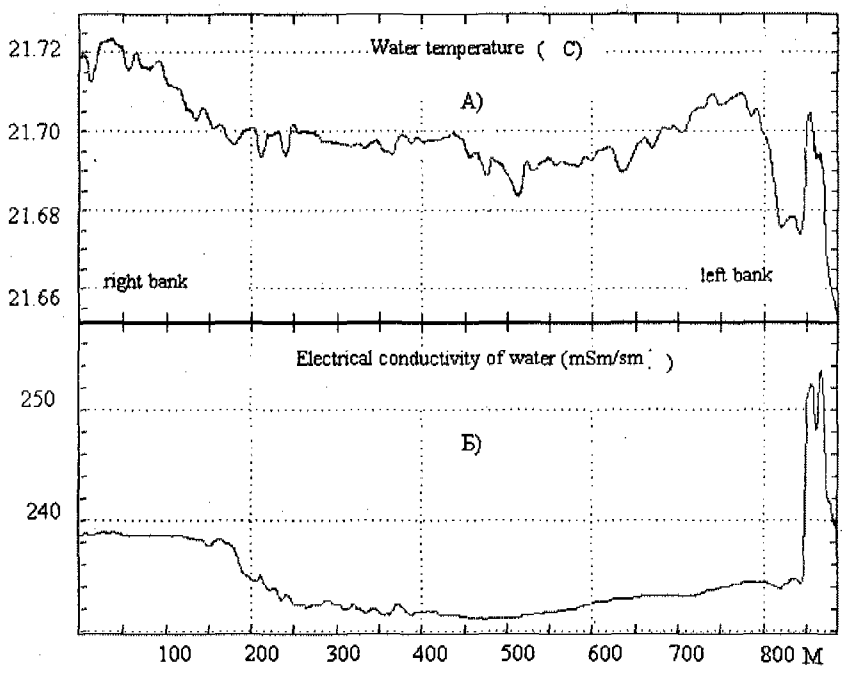

Fig.1. Variations in temperature (A) and electrical conductivity (B) of water as measured across the Saratovskoye reservoir downstream of the outfall of sewage from Togliatti.

ESTIMATION OF A BACKGROUND CONDITION OF A MODE OF GROUNDWATER, AS A BASIS OF ECOLOGICAL MONITORING

Semenov S.M.
IEG RAS
Kovalevsky V.S.
IWP RAS
Kovalevsky J.V., Batrak G.I.
IEG RAS

The conceptual necessity of knowledge of groundwater background conditions is defined:

By the obligatory requirements arising in all cases with estimation of technogenic changes of a mode of groundwater, when the background represents itself as an initial level, deviation which from define character and scale existing and forecast of antropogeneous infringements in underground waters;

By tasks of a service of background monitoring, aimed on revealing local, regional and global техногенных of changes in underground waters at the earliest stages, when these changes it is most difficult to define;

By the requirements of design, scheduled and prospecting organizations connected to definition limiting - admit of loadings and sanitary norms;

By necessity of information maintenance of a service of the control on revealing ecological offences and establishment of the ecological prooves.

The methodology of the approaches and receptions according to a background is based on opposition of laws and mechanisms of natural and technogenic formation of changes of a mode of groundwater.

The natural changes of parameters of a mode of groundwater are distinguished by one important feature consisting that these changes for rather long intervals of time occur around average long-term importance.

Technogenic change, on the contrary, as a rule, submit to the law unidirectional, trend fluctuations.

The background technogenic of chemical substances not meeting in a nature, is not determined and is accepted for zero.

The background meanings will be objective reflection of an ecological condition of groundwater, if they are determined on the data of generalization of long-term monitoring supervision.

The background is not defined on individual and isolated measurements.

It is obvious, that the background meanings can be representative and to represent itself as the standard for comparison only then, when they generalize all variety spatial - temporary of laws of process.

Parameters of a background mode of underground waters are:

Middleyear meaning norm for an examined period as the steadiest representative of a background;

A deviation σ_{C_a} (for mineralization) factor of a variation Cv (for levels and mineralization). And long-term amplitude A_{h_ϕ} And A_{C_ϕ} - as a parameter of probable deviations of the members of a number concerning norm;

The confidential interval for average meaning of background concentration or middleyear of a level, output for which limits will testify about unbackground.

The definition of the top borders spatial - temporary of variability of a background is most urgent for revealing influence of economic activity on a mode of groundwater.

Is developed and the system of methods of estimations of a background condition of a mode of groundwater is recommended.

Among offered methods most effective are:

- Statistical;
- The analysis of genetic structure of a number of monitoring supervision;
- Definition of background factor;
- Interpretation of a double integrated and reference curve;
- Polyfactor analysis;
- The analysis of algorithm of seasonal and long-term variability of a hydrochemical mode.

The account of a background with accounts technogenic of loadings and estimation of an ecological condition aquifers is the basic procedure with definition limiting - admit technogenic of loadings. Last should be those to not cause changes in underground waters exceeding ПДК (with pollution) or critical levels (with floding or drainage). Therefore settlement with designing levels and the concentration owe it necessary be represented as, reflecting their structure:

C = Ca + Cf (for mineralization)
h = Ha + hd (for levels),

Where C p - that part of allowable change of concentration, which is caused prospective by technogenic influence;

Ha - that for levels.

For the first time, mapping of a background condition it is recommended to carry out with the help of special factor describing spatial - temporary variability of a mode of groundwater.

THE ENSURING THE ACCURACY OF THE RESULTS OF QUANTITATIVE ANALYSIS OF WATERS FOR THE CONTENT OF MICROCOMPONENTS: THE EXPERIENCE OF PRACTICAL REALISATION

Shaevich R.B.
National Scientific and Research Institute for Phisical Technical and Radiotechnical Measurements - VNIIFTRY, Moscow, Russia
Kreingold S.U.
Moscow Institute of Fine Chemical Technology, Moscow, Russia
Klyachko Yu. A.
Moscow State Extra-mural Institute of Food Industry, Moscow, Russia

It is known that consumer, ecological and technological characteristics of the water depend to a considerable extent on quantity and nature of the microcomponents that it contains. Unfortunately, the accuracy of their quantitative determination results is not sufficient: a differences in the results of analysis of the same sample of substances for determination of such contents components according to the information of laboratories may reach several hundreds of percent (relative) and more (see, for example [1]).

It is known also, that dominating contribution to these differences comes from the errors common for the series of determinations, i.e. systematic errors of final the result analysis [2].

The efficiency of such known way of the systematic errors elimination as the method of additions, the blank experiment and interlaboratory experiment is not sufficiently high: the fact remains the existence of very large differences in the results of analysis obtained in different laboratories. As to the most efficient means of accuracy control - use of the Standard Reference Materials (SRM) the differences indicated above do not permit or sufficiently complicate their creation.

Because of these circumstances the search for nontraditional ways for solution of the problem of accuracy of results of determination of minor and very minor contents was undertaken. Solution obtained [3 - 6] allow to determine actual impurities contents in samples of substances without SRM which are similar to the samples from determining impurities contents point of view. This solutions are based on determination and use of dependence $\Delta = f(c)$, where Δ is an estimate of result analysis systematic error, c - is an estimate of content of component as a result of analysis. The determination of this dependence is implemented by results of SRM analysis with r e l a t i v e l y h i g h attested contents, i.e. such contents that creation of suitable SRM is not complicated by difficulties specific for low contents.

In this report, results of experimental verification of way which contains the extrapolation of dependence $\Delta = f(c)$ on range where the supposed quantity of impurities is existing and with following making correction to analysis result are stated [3,4]. Coded samples of drinking water that contains ions of iron, copper and manganese, were used as analysis object. Determination of such ions was implemented by kinetic method [7]. The series of the solution - imitators of SRM, that contains ions of iron, copper and manganese, were prepared. Such solutions and investigated sample were analysed for content ions indicated above means of by graduating solutions prepared on the basic of high purity water. It must be pointed out that nonadequation between graduating solutions and samples, when method [3,4] is used, do not influence on final estimate of content because takes into account by correction value. The values of ions concentrations obtained by above - mentioned procedure sufficiently coincided with data of long standing investigations of water from known source.

The solution expounded can be applied to any analytical method without creation of new equipment.

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RADIOHYDROGEOLOGICAL MONITORING OF THE KYIV URBAN AGGLOMERATION

Shestopalov V.M., Rudenko Yu.F., Makarenko A.N.
Scientific-Engineering Centre for Radioecological Studies, NAS of Ukraine

Kyiv Urban Agglomeration area (KUA) involves Kyiv City, the satellite towns of Vyshgorod, Irpen, Boyarka, Brovary, Borispol and adjoining territories within the radius of 60-70km. With regard to geological structure, the aquifers and aquifer complexes of the Quaternary, Eocene, Cenomanian-Callovian and Middle Jurassic rocks can be distinguished within the KUA area.

The Cenomanian-Callovian and Middle Jurassic (Bajocian) aquifer complexes have the best prospects for intensive water supply and are widely exploited. The water

quality of these aquifers is determined, mainly, by the state of the upper superficial aquifer through which groundwater recharge occurs.

The analysis of prolonged multiannual observations on the hydrodynamic and hydrochemical regime within the studied area has indicated the increase in water exchange intensity and depth, caused by technogenous influence.

The technogenous hydrochemical regime was formed within the central part of the depression cone of exploited aquifers. It is characterized by the following features:

enhanced areal variability of macrocomponent chemical content of exploited

groundwater;

enhanced temporal variability of the chemical content of the exploited groundwater as compared to its analogue in unexploited conditions.

However, on the whole, it could be stated that the areal and temporal variations are of restricted character and they have not led to considerable changes of groundwater quality.

An important point is that there occurs the temporal and areal stability of the oxidability values. This indicates the absence of substantial groundwater contamination.

The influence of the Chernobyl NPP accident on the underground hydrosphere was manifested in initial contamination of both the upper superficial aquifer (in Quaternary deposits) and more deep ones not only within the Chernobyl exclusion zone but also at large distances from the Chernobyl NPP. The measurable concentrations of ^{137}Cs and ^{90}Sr were observed practically in each of water samples.

The depth of groundwater sampling equals 2-18 m for the Quaternary, 45-65 m - for the Eocene, 80-150 m - for the Cenomanian-Callovian, and 200-300 m for the Bajocian aquifers. The occasional detections of ^{134}Cs in groundwater samples during the early post-accidental years indicate the Chernobyl origin of these radionuclides. In this connection it should be emphasized that the control sampling of groundwater occurring in the similar hydrogeological conditions but beyond the contaminated territories (less than 20 kBq/m^2), did not reveal the essential quantities of radionuclides mentioned above.

It is very important to know pathways of their income. It was found that vertical downward radionuclides migration pathways play the major role in contamination of multiaquifer groundwater system. The lateral migration pathways are of secondary importance because of relatively small lateral groundwater flow velocity components.

Along with natural pathways of radionuclides migration, the technogenous pathways have been revealed which caused by technical imperfectness of wells and their casing. The input of technogenous migration in total radioactive contamination of groundwater aquifers is not large, but may lead to substantial distortion of the results of radionuclides concentration measurements obtained from episodic groundwater sampling.

The intensity of radioactive groundwater contamination depends on the variety of factors such as fallout concentration and forms, landscape and geochemical conditions, sorption storage capacity, homogeneity of geological medium, intensity of filtrational interrelations between the elements of water-exchange geosystem, etc. The correlation dependencies are found between the intensity of groundwater recharge, depth of depression cone, thickness of low-permeable layer of Kiev marls, sorption properties of soils, surface contamination by radionuclides, and groundwater concentrations of 137Cs and 90Sr in natural and, what is very important, in disturbed conditions.

The majority of organizations which periodically implement determinations of radionuclides concentration in groundwater usually orient themselves only to reaching or not reaching the maximum allowable concentration (MAC). For this reason, in most cases there are no observations providing the possibility to assess the dynamics of this parameter for groundwater, as time trends, seasonal and other variations. As a result, there is still no sufficient factual base for reliable forecasts of groundwater quality, and if necessary, for in-advance elaboration of rnanagerial decisions.

In spite of revealed initial contamination of groundwater by radionuclides of Chernobyl origin, the confined aquifers remain the most reliable source of water supply of regions which suffered from radioactive contamination. So, for providing reliable forecasting and, if necessary, groundwater management, is necessary to organize well correlated system of monitoring that include:

1) Periodical sampling from exploited and regime water intakes, using elaborated methodology, including assessment of the wells technical state;

2) Setting up the regime test sites which involve multilayer system of aquifers, aquitards and unsaturated zone at different landscape-geochemical, hydrogeological and technogenous conditions;

3) Creation and refining of permanent-action hydrogeological models of large water intakes, other objects of water supply industry, and regime test sites providing the forecasts and, if necessary, the elaboration of managerial decisions for optimization of ecological state of water resources and adjoining elements of environment;

4) Creation of a system of independent control for the cases of anomalous concentrations of radionuclides occurrence, with involvement of external organizations which provide obtaining of reliable results.

ECOLOGICAL SUPERVISION OF WATER RESOURCES STATE IN AREAS OF GOLD DEPOSITS DEVELOPMENT IN PRIOKHOTYE

Shevtsov M.N., Machinov A.N., Pancratov B.P., Lopatyuk V.A., Dydmc V.A.

The development of deposits of minerals in northern areas of the Khabarovsk territory located in of the permafrost, zone greatly influences the superficial waters, polluting them with weighed substances, petroleum, heavy metals. Reliable protection of superficial waters aguinst poisonous cianic compounds is one of the main conditions for the application

of cianic treatment technologies for radical deposits of gold. So, it is necessary to work out the scheme of IP supervision at all phases of deposit preparation and usage. The are 4 stages of water objects supervision in deposits development. At the first stage (the designing of hte mining enterprises) complex estimation of modem condition of water objects, is made the tendencies of their natural mode chages come to light on the basis of organization of a network supervision, which basic elements of which will be used subsequently.

The second stage covers the period of construction of the basic structures and preparatory works for deposit development. At this stage the clarigication and specification of information on natural waters state will be carried out, the features of antropogeneous intervention into water objects state are fixed, that allows to improve supervision system.

At the third stage the complete and constant supervision over water objects undergoing the most intensive influence of deposit development and also for itself drains and reservoirs, which are kept in a natural condition in vicinities of a deposit is carried out. Thus, not only perculiarities of allocation and dynamics of water objects, but also perculiatities of technological methods used in deposits development are taken into account.

The fourth stage is characterized by the reduced supervision program over water objects state after deposit development. The supervision proceeds over the most slowly restored elements of natural environment - turbidity of water, river bed processes, formation of a longitudinal structure of the rivers on sites quarrys and heaps etc. It is necessary also to carry out hydrochemical and hydrobiological research.

The experience of network supervision organization over radical and dispersed deposits Priokhotye has shown, that the most effective tracking of water resources state is possible only in a complex with supervision over other components of natural complexes in view of their local specific features - extreme condition of existence of ecological systems, high degree of their '0 vulnerability, weak restoration ability and significant dynamics of numerous natural processes.

MONITORING OF DRAINAGE LANDS IN HUMID AREA OF RUSSIA

Shtyckov V.I., Klimko A.I.,
Scientific center "Northern research Institute of hydraulic engineering and land reclamation" (SevNIIGiM)

The purpose of drainage lands monitoring is to obtain timely and reliable information about the condition of drainage lands and drainage systems, subsoil and drainage water quality as well as the estimation of efficiency of water and soil protection measures.

Monitoring of drainage lands is part and parcel of the state Monitoring of lands in the Russian Federation. Handbook for Monitoring of drainage lands has been worked out in the Scientific center "SevNIIGiM" containing the elements of monitoring: soil-water-plant system pollution criteria, chemical elements doses, report forms and methods for determination of pollutants in drainage water and soil. The following characteristics of drainage water quality estimation were used: colorness, limpidity, smell, turbidity, suspended matter, dry residual , ph (acidity), hardness, CO_2, O_2, Ca^{2+}, Mg^{2+}, Na^+, K^+, CO_3^{2-}, HCO_3^-, SO_4^{2-}, Cl^-, mineralization, NH_4^+, NO_2^-, NO_3^-, N_{total}, $N_{mineralizable}$, P_{total}, Fe_{total}, Fe^{2+}, Zn, Mn, Cu, Mg, Ni, oxygenation, organic carbon, agricultural chemical, BPK (biological oxygen demand), PDK (maximum allowable concentration), pesticides, phenols (flying), heavy metals. Applied programs on drainage water chemistry have been worked out for observation data accumulation, processing and analysis. The set of applied programs consists of unit files of the program SNIOMI (accumulation and processing amelioration information system). It has been developed in Scientific center "SevNIIGiM".

To determine metals in drainage water the methods of atomic-absorptive spectroscopy and flame photometry are used. To determine phosphorus, nitrates, nitrites content a photometric method is used. It is recommended to determine mercury by non-flame atomic-absorptive spectroscopy. The estimation of water body phenol pollution is carried out by the method of extraction photometry.

Monitoring of drainage land gives an opportunity to estimate ecological and land reclamation condition of soil and water, agricultural plants and engineer systems, field water quality and its influence on water pollution in the water intake systems.

The observation data during 8 years at 2 experimental plots "Zaitsevo " and "Leninskiye Iskry" in Leningrad region showed that at the plot "Zaitsevo" 12 indexes of drainage water had allowable pollution (pollutants concentration is less than PDK) and only P_2O_5 and Fe content was high pollution; at the plot "Leninskiye Iskry" 8 water indexes of 15 were "clean" and 7 showed moderate harmful pollution .

The amount of chemical elements drained off is rather small: at the plot "Leninskiye Iskry" the amount of NO_3, NH_4,Ca, Mg, Cl made average 65 $^{kg}/_{ha}$ in spring; 24 $^{kg}/_{ha}$ - in summer and 45 $^{kg}/_{ha}$ - in autumn; at the plot "Zaitsevo" 38,0, 32,0 and 48 $^{kg}/_{ha}$ respectively . Most of all Ca, Cl and Mg are drained off.

The amount of chemical elements drained off from soil at arable lands where cultivated crops are grown is NO_3 - 17 times, NH_4 - 31 times, Ca and Cl - 2 times greater as compared with those from pastures (perennial herbs). The fact is explained by extreme doses of mineral fertilizers used for cultivated crops.

EXPERIENCE IN THE USE OF MONITORING RESULTS FOR SUBSTANTIATION OF THE INCREASE IN THE PRODUCTION RATE OF WELL FIELDS UNDER PERMAFROST HYDROGEOLOGICAL CONDITIONS

Sidorkin V.V.
Hydrogeoecological Research and Design Co. (HYDEC), Moscow, Russia

Fracture ground water reservoirs occur predominantly within aquiferous strata in the discontinuous permafrost zone. The bedrock is disintegrated irregularly, which is responsible for the variation of seepage parameters. The investigations, carried out by HYDEC in the northern Amurskaya oblast and in southern Yakutia (Stanovoi hydrogeological massif), show wide distribution of blocks of slightly fractured basement rocks frozen to depth ranging from 50 to 100-150 m. Against the background of regional fracturing, characterized by low water transmissivity, there are local zones of intense fracturing and crushing of the bedrock genetically associated with disjunctions and having high water transmissivity. The permeable zones drain the slightly fractured blocks and, thus, ensure the ground water flow from areas of recharge to those of discharge. In the areas of tectonic fractures and crush, the permafrost thickness generally does not exceed 5-15 m, and the sites of ground water discharge (subaquouse, as a rule) contribute to generation of local continuous taliks with an area of a few hundreds of square meters, which are identified by icings in the winter.

It is evident that under the conditions being discussed ground water may be withdrawn most efficiency by wells located within the water conducting continuous taliks. Moreover, if river flow exists, it may be drawn to the wells.

It follows from the above that the conditions of generation of ground water for development are rather complicated in the hydrogeological strata of the permafrost zone. These conditions hamper greatly the reliable assessment of the commercial potentialities of the ground water reservoirs. The experience gained by HYDEC in the investigations of the Shakhtaumskoe and Gilyuiskoe ground water reservoirs in the northern Amurskaya oblast and the Verkhne-Neryungrinsky and Amnunnaktinsky ground water reservoirs in southern Yakutia, shows that it is impossible to determine the main components of the balance of commercial water withdrawal using well group pumping tests even for 3 to 4 months in the winter low flow period. The pumping test during a part of the winter low flow period does not provide the full drainage of the upper section of continuous taliks. Here, a seasonally frozen ground layer is formed, and it hampers the infiltration of the spring flood water into the drained aquifer. The depth of the cone of depression is much less than in the case of commercial water withdrawal, which makes impossible to draw to the test wells of all the components of the safe yield generated in fractures and the more important amount of the regulated portion of ground water resources located in slightly fractured blocks. The above factors are responsible for the considerable underestimation of the safe yield values. This fact is corroborated by the experience in the development of some ground water reservoirs where wells do not abstract fully the ground water resources generated within hydraulically isolated fractured blocks.

We organized monitoring with allowance for the specific natural conditions in the Shakhtaumskoe, Verkne-Neryungrinskoe, and Amnunnaktinskoe ground water reservoirs. The monitoring program, in addition to standard observations (variations of water withdrawal and ground water levels), included special observations: studying the regime of icing formation and flow of rivers, the water of which is a part of the water abstracted by the wells; observation of variations in the isotopic and chemical composition of the withdrawn water and the river water for determining the balance of water abstraction (river water and ground water of different "stages" of the profile differ in chemical and isotopic composition).

The assessment of the safe yield was optimized using the results of these investigations from 1-2 to 12 years long, which made it possible to determine the main components of the commercial water withdrawal and to estimate the contribution of each of them, to optimize the assessment of the safe yield. As a result, we substantiated a two-three increment in the water withdrawal in these ground water reservoirs (the validity of the substantiation was supported by the experience in the development of the Shakhtaumskoe ground water reservoir in recent years), which is highly useful at the existing shortage of drinking water because the reconstruction of the well fields requires much less expenses than the development of new sites under conditions of a severe climate and a rugged terrain.

EXPRESS ANALYSIS OF DRINKING WATER POLLUTION

Skvortsov L.S., Rachmanin U.A., Zolotov U.A., Varshavsky V.Y., Kozykina M.A., Martchenko D.U
Ecotech - Moskva Ltd., Association "Water - Medicine - Ecology" Moscow State University by M.Lomonosov, Moscow, Russia

The necessity of express methods development is caused by task of water quality definition directly at the consumer and is confirmed by the European Community Council Instruction. The decision of this task is connected to a number of difficulties of organisational and technical character. First of all there is no normative base in Russia for the test (express) methods and nomenclature of the appropriate terminology is not legalised. There are some difficulties to define the pollution in drinking water because of relatively low meanings initial concentration, from one side, and of necessity to develop some special methods which should take into account some specifity of the express analysis, from the other.

The special seminars take place on the analytical chemistry faculty Moscow State University where a preliminary terminology for the express analysis was formulated. Thus

estimation of presence or contents of components in the researched solution is named as *testing*, using for this purpose devices and account materials are determined, accordingly, as the *test-devices* and *test-forms*, their set is named the *test-means*, and at last test-means and the appropriate instructions are together named as *test-methods*.

Necessity of testing application directly at the consumer has resulted in creation of the express laboratory ideology. The accreditation of such laboratory has some difficulties because of absence of the normative documents. At the same time availability of methods and also presence of the test-means and the test-form manufacturers make us sure the express laboratory is very perspective. Already now this laboratory has a possibility to make measure 25 the basic parameters of water pollution. Among them: colour, turbidity, smell, smack, microbe amount, Coli-indexes, mineralisation, organic substances contents, electrical conductivity, dissolved oxygen contents etc. The analysis duration not more then 2 hours.

This laboratory should be acquired by the appropriate services in .each area. It has all the necessary properties: mobility, speed, cheapness. On the basis of the analyses the expert easily and reliably can recommend the demanded water clearing technology with the help of filters including.

Except for the requirements to sensitivity and accuracy the test-means, the following basic conditions were taken into account for creation of test-method equipped laboratory:

- Test preparation should have to have the minimal number of operations;
- The reactions between a determined impurity and added reagent should be carried out directly in measuring utensils;
- The reaction should proceed quickly and without of heat transfer;
- All reagents should be ready for using and dose packed;
- All accounts should be incorporated in the test-device program, give out the final information in measurements units;
- The test-device should be simple in service, mobile and to have the built - in power supply.

The listed conditions allow to carry out the testing outside of laboratory, that is in the places of test selection directly. The accepted test-method are satisfied to all listed conditions. Their further improvement will be carried out in the following directions:

Creation the base universal test-device with special inserts, to decrease the cost and increase amount of parameter definitions;

Development the absolute new test-device that will ensure significant increase the test sensitivity and will allow to defme with the greater accuracy the water pollution contents;

Development the new test-forms and techniques for testing components, that are not determined now (some heavy metals, organic and first of all chloror-ganics and polycyclic elements).

THE BIOINDICATION OF POLLUTION OF THE POND'S WATERS OF SARATOV

Soloviova E., Malinina J.
The Institute of the Water Problems of the Russian Academy of Sciences, Moscow
Saratov State University, Saratov

The ponds are the inalienable characteristic of the landscape of Saratov.Some of them have a long history of their existence and they are situated inthe historical centre of the city; another, which are near the industrial andagricultural centres, accept the faults of the sewages, the downpour seweragesystem and the superficial drains. Many ponds are situated in subburb districtsand are used for bathing, watering and as watering places. In summer 1996 the investigation of 8 ponds, situated in different districtsof Saratov and liable to the anthropogenic influence of different degrees ofintensity, were made. The hydrobiological works, that were made, were consisting of the selectionof the samples of zooplancton, zoobentos and zooperifiton.

It is revealed that the population of the water thickness and the bottom ofthe reservoirs under research was various and the season changes were notsynchronic and they often depend on the level of the anthropogenic influence.In this situation the ecological stress is not only pollution but the cleansingof the reservoirs as well. The submersion and water macrophytes in the reservoirs under research arerepresented by Typha latifolia and Ceratophillum demersum. Except them we canoften meet Phragmites communis Trin, Butomus umbellatus L., Elodea canadensis,Scirpus lacustris L. and Lemna. In a whole, the water macrophytes of the cityponds are significantly poorer than the flora of the river. In the zooperifiton of Typha latifolia 19 groups of animals were found andamong the perifiton of Ceratophillum demersum 22 groups of organisms of differenttaxonomical rank and stages of the living cycle were met. In all samplesChironomidae, Oligochaeta, Cladocera, Copepoda, Rotatoria were found (frequencyof finding - 100 per cent). On the coastal plants Gastropoda molluscs, leechesand Nematoda were usual to be met and on the submersion plants Hydra andHeteroptera were found. Chironomidae's larvas are considered to be thedominating group according to the number and to the biomass. The index of the similarity of the species (Serensen's index) allows todetermine that the associations of the hydrobionts of different ponds aresimilar according to their species' composition, but there are some significantdeviations between the ponds which are used for different types of householdactivity.

The results that were received were compared to the hydrochemical indexesof the quality of the ponds' water (the data are from Saratov Committee ofEcology). According to the results of the investigations the ponds can bedivided into several types:1. The ponds situated in the subburb zone rather far from industrialenterprisers. They are used mainly for the recreation purposes. The ponds in thevillages Dok-

torovka (1) and B.Polivanovka, on the river Razboishina (2) and onthe river Berezina (3) not far from the village Kokurino refer to such ponds.

In the waters of these ponds the insignificant exceeding of extremelytollerated concentrates of sulphats and chlorides, connected perhaps with theconditions of forming of the underground waters, and of some metals (Zn, Cu, Co,Fe, Ni, Cd, Cr) is revealed. The bottom's deposits are often a hard source ofthe second water pollution. In the samples of only these ponds Bryosoa, characterized as having great-demandings to the water quality, were found; Trichoptera's, Simuliidae's,Testacea's larvas, which hardly to be met practically in the reservoirs insidethe city, were often to be met here. In a whole, taking into consideration theindicator significance of the separated species (the index of the cleanness)and their number, the quality of the water in these ponds can be appraised assatisfactory.2. The ponds which are situated inside the city but on the nature protectingterritory. They are ponds situated in the Gorkii park for leisure (4) and onthe territory of the sanatorium "Oktyabrskoe Ushelie". These reservoirs are usedby the city-dwellers for bathing and fishing.

The water in these reservoirs are characterized as very coloured with highcontent of organic substances and biogens. The pond in the Gorkii park is exposedto the regular cleansing from water macrophytes because of its abundant-development and that is why the associations of the water organisms are exposedto the stressful influence for some time. Into the both reservoirs the fisheswhich eat the plants were let in. The counted indexes of Shenion, Simpson and the coefficient of equivalenceallow to characterize the development of zooplancton and bentos in thesereservoirs as natural.

The zooperifion in these ponds is characerized as having a great number ofRotatoria living on the plants and Ephemeroptera's larvas. The zooperifiton ofthe 4th pond is represented by a minimal number of the groups of invertebratesbut among them Trichoptera's larvas were met and among Chironomidae the larvasof the subfamily of Orthocladiinae were prevalent. In the 5th pond the maximalnumber of the groups of animals were revealed but their biomass was minimal (incomparison with the rest ponds).3. This group of the ponds is exposed to the significant anthropogenic press.They are situated very close to the industrial enterprises. The ponds (6) and(7) are forming the cascade on the river Nazarovka near the thermal power-station (TPS - 2); besides, the pond 6 is situated near the animated main road.On the banks of the pond Bahchev (8) several factories of building materials andthe poultryfactory are situated. In the waters of the ponds 6 and 7 there is a deviation from the extremelytollerated concentrates of sulphats, the general cruelty of water, petroleumproducts, the acidity and of some metals (Fe, Zn, Cu, Ni, Cd, Cr, Co, Pb).Besides, in the pond Bahchev the water was very coloured and has a great amountof biogens and organics. In this reservoir the full lack of bentos is observed.In the association of the perifiton in the ponds of this group the role of Nematoda, Oligochaeta and Ostracoda was greatly increased and the number of Gastropoda molluscs was considerably decreased.

COMPILING OF SPECIAL TOPOGRAPHICAL MAPS FOR THE MONITORING OF SURFACE WATERS

Stepanov I.N., Loshakova N.A.
Russian Academy of Science, Moscow, Russia
Myskov J.M.
Ministry of Natural Resources of the Russian Federation, Moscow, Russia

1. Existing topographical maps with the horizontals are used as obligatory planned documents by ecological investigations, designing, building, exploitation and preservation of waterworks. However, topographical maps of this kind began not to be suited to the requirements imposed by new economics of Russia.

2. The group of researchers of RAS and Ministry of Natural Resources of the Russian Federation has worked out methods of compiling of new topographical maps. On these maps the horizontals are supplemented by the isolines of null plan curvature. The lines of curvature distinguish divergent and convergent basins of the surface and underground flow of natural waters on the topographical map. With the use of these maps existing ways of migration of water-salt flow can be traced as well as reliable forecasts of trajectories of polluted substances can be compiled.

3. The group proceeds to the compiling of trial different-scale topographical maps of new type for the territory of the Moscow region. Topographical maps of new type will be demonstrated, methods of estimation and forecasting of ecological situations in different conditions of anthropogenic pollution will be shown.

INFORMATION NEEDS AS THE BASIS FOR MONITORING

Timmerman J.G.
Institute for Inland Water Management and Waste Water Treatment (RIZA), Lelystad, The Netherlands

Routine monitoring provides the basic information for water management. In many cases however, there is a gap between the information a monitoring network provides and the information water management needs. Next to this, increasing knowledge of the complexity of processes in water systems has lead to a growing demand for information. Nevertheless, budgets for monitoring networks are limited. This brings about the need to provide the right information at little cost.

Under the UN/ECE Convention on the Protection and use of Transboundary Watercourses and International Lakes, Guidelines on Water Quality Monitoring and Assessment of

Transboundary Rivers have been developed. One of the basic principles of the guidelines is the monitoring cycle, specifying the steps in elaborating a monitoring network. The first and most important step in this cycle is specification of information needs.

Defining information needs involves asking many questions until the right questions come up. These questions should be specified further within the framework of the overall water management objectives and should consider the requirements that result from preceding and following steps in the information cycle. Most questions will be related to the specific functions or uses of the water under consideration. However, different functions and uses may have conflicting requirements to fulfil. What is needed is a method to cope with all different and sometimes conflicting aspects, leading to specified information needs for the monitoring network.

Different studies have been carried out to develop a method. From these studies it was concluded that the method should incorporate the next three elements:

- Communication: Information producers should take more interest in the problems information users are involved in, while information users should try to better specify what exact information is useful to them. This can only be achieved by bringing both groups together.
- Institution: What organisations are involved in producing and using information and what are their responsibilities in the process. This information is essential to be able to understand what information can be produced.
- Structure: The process of specification of information needs is complex and therefore needs a structure defining what activities to perform at what stage. Visualising techniques, like diagrams, are essential elements in such a structure.

These elements have been worked out in a method for specification of information needs. This year a project has started to specify the information needs for management of the national waters, using this method. Findings from this project will be used to improve the method.

INFORMATION NEEDS AS THE BASIS FOR MONITORING

Timmerman J.G.
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Routine monitoring provides the basic information for water management. In many cases however, there is a gap between the information a monitoring network provides and the information water management needs. Next to this, increasing knowledge of the complexity of processes in water systems has lead to a growing demand for information. Nevertheless, budgets for monitoring networks are limited. This brings about the need to provide the right information at little cost.

Under the UN/ECE Convention on the Protection and use of Transboundary Watercourses and International Lakes, Guidelines on Water Quality Monitoring and Assessment of Transboundary Rivers have been developed. One of the basic principles of the guidelines is the monitoring cycle, specifying the steps in elaborating a monitoring network. The first and most important step in this cycle is specification of information needs.

Defining information needs involves asking many questions until the right questions come up. These questions should be specified further within the framework of the overall water management objectives and should consider the requirements that result from preceding and following steps in the information cycle. Most questions will be related to the specific functions or uses of the water under consideration. However, different functions and uses may have conflicting requirements to fulfil. What is needed is a method to cope with all different and sometimes conflicting aspects, leading to specified information needs for the monitoring network.

Different studies have been carried out to develop a method. From these studies it was concluded that the method should incorporate the next three elements:

- Communication: Information producers should take more interest in the problems information users are involved in, while information users should try to better specify what exact information is useful to them. This can only be achieved by bringing both groups together.
- Institution: What organisations are involved in producing and using information and what are their responsibilities in the process. This information is essential to be able to understand what information can be produced.
- Structure: The process of specification of information needs is complex and therefore needs a structure defining what activities to perform at what stage. Visualising techniques, like diagrams, are essential elements in such a structure.

These elements have been worked out in a method for specification of information needs. This year a project has started to specify the information needs for management of the national waters, using this method. Findings from this project will be used to improve the method.

THE THEORY OF IDENTIFICATION IN THE SYSTEM OF ECOLOGICAL MONITIRING OF THE AMUDARYA DELTA

Trofimova G.Yu.
Water Problems Institute Russian Academy of Sciences, Moscow, Russia

The decrease of the Aral Sea level has been observed since 60-ies of our centure. During this period the Aral Sea level fell down from 53.4 m (1960 year) to 36 m (1996 year). The main reason is that water managing activity for irrigation in the Aral Sea basin lead to the decreasing runoff of Amudarya and Syrdarya rivers. As a result the watering of deltaic plains and the adjoining dry sites of the Aral Sea bottom is violated. The area of the dried bottom of the Aral Sea in the south part is 14000 km^2. The ground water level fell down for 4-6 m, the ground water mineralization has reached 53 g/l.

In spite of the fact that the Amudarya delta borders with Kyzyl-Kum desert in the East, and with plateau Ust-Urt in the West, it is a real oasis in the desert which has great nature potential. Changes of hydrological regimes lead to catastrophic changes in vegetation and soils of the deltaic plains of the Amudarya river. The biological productivity of natural ecosystems of Amudarya delta decreased. Halophytic flora is dominant. Nonstable plant communities (ecotones) appear. Studying of plant communities changes in this situation is an urgent ecological problem.

For understanding the changes in the stucture and composition of the plant communities of Amudarya delta the next tasks were solved:

- The classification of plant communities for each formation was carried out on the base of cluster analysis (with Jakkar coefficient). In this work we used data from the Ecological-Geographical Database System (DBS) for the Amudarya and Syrdarya River Deltas had been created in the Laboratory of terrestrial ecosystems of Water Problems Institute Russian Academy of Sciences. Relational DBS is stored data from 1947 to 1995.
- The clusters and the centres of clusters for each formation were defined (similarity index higher 40%). The results showed the clusters within each formation differ in ecological sense: ground water depth and mineralization, density of sward, soil type, moistening scale and scale of soil salinization (L.G.Ramenskyi).
- The plant communities (ecotones) for each formation were defined (similarity index less 40%). As a rule similarity index is much less 40%.The number of ecotones are 30-35% of all plant communities.
- Similarity degree between ecotones and the centres of clusters were defined on the base of identification algorithm. This algorithm was created in Laboratory of terrestrial ecosystems for identification plant communities of ecotones type.

The results of solving these tasks will let to carry out ecological monitoring in the Amudarya delta and to prognose changes in plant communities, soil salinization, mineralization and ground water depth.

HYDROINFORMATICS METHODS FOR WATER QUALITY ASSESSMENT IN RIVER BASIN

Tskhai A.A., Verjovkin M.N., Solodky O.G.
Altai state technical University

Modern informatics means usage is indispensable condition for creation of water quality monitoring and management system of river basin. There is particularly important to take into account present peculiarities of transition economic period and possibilities of Russian control bodies in nature usage [1-4]

It is formulated the conception of environmental monitoring for river basin. It includes both discussion of modern situation at federal and regional levels and description of tasks and structure of information base containing of different subsystems, functional blocks and instrumental means. It is generalized the principals of the most effective calculation methods used in the world while assessment of hydrochemical runoff and contaminants washoff from different landscape elements of watershed accounting impact of so called non-point sources of pollution.

In report it is developed compromising approach consisting, from the one hand, in strong reasonable simplifications that allows to use standard information of Russian state services as basic data while modeling. From the other hand, elaborated model and information means are based on modern scientific ideas about environmental and economic processes in nature-technical complex of river basin. And verification of the offered models is executed on the basis of monitoring observations data Just at the investigated objects and it is fulfilled at analogous reservoirs in the case of forecasting the qualities of future aquatic ecosystems at the project stage of hydro- power stations.

The matter of application limits of model approximation of the first order kinetics for pollution transformation characteristics was investigated at the example of the data analysis of Upper Ob river basin monitoring.

It is given the creation original technology of geoinformation system for river basin pollution monitoring.

Contemporary water monitoring conceptions are differed by transition from pollution registration as a final result to the assessment of aquatic ecosystem state influenced by antropoginic activity in comparison with functional standards. Original investigations of some Siberian objects aquatic ecosystems state were fulfilled in the course of work by modeling of biogeochemical transformation cycles of nitrogen and phosphorus compounds.

In the work it is offered the scheme of regional water quality' management for river basin. It consists of a) minute administrative and economics mechanisms of water quality management of tile Upper Ob-river basin within boundaries of the Altai administrative region: b) choice of optimum values of economic regulators of water users conduct: values of environmental situation coefficients, return payment norms and so on. c) consideration of enterprise «environmental bankruptcy order, environmental effects analysis and forecast. d) special order of decrease of prior toxic substances concentration level in control river sections: e) «long-term» inculcation of water protection actions, which should be effected only in some years.

It was fulfilled the modeling of interaction in system: an industrial user water-treatment enterprise water protection body. The water treatment enterprise determines tariffs for industrial waste water purification in agreement with regional authorities. And a user may run off the waste water both to the municipal collector and directly to river. The analysis of present situation is carrying out, economic mechanism of river pollution decrease is formulated.

TOXICITY EVALUATION OF ORGANOSILICON COMPOUND SERIES ON BACTERIA, ALGAE, CRUSTACEA AND FISHES

Varezhkin Yu.M., Michailova A.N., Polivanov A.N.
State Research Centre "GNIICHTEOS", Moscow, Russia

Silicone chemistry development promoted fresh contaminants production, which discharge along with treated industrial sewage into natural water reservoirs may affect the latter biocoenosis. Organosilicon compounds affect on natural ecosystem and hydrocoles has not been actually studied yet.

The toxicity of three organosilicon compounds (silazane and siloxane structure): 1,3-bis(dimethylethoxysilyl)-2,2,4,4-tetramethylcyclodisilazane (I); 1,3-bis(1,1,3,3,3-pentamethyldisilazanyl)-2,2,4,4-tetramethylcyclodisilazane (II) and "КЭП-8" (III) was determined in a laboratory experiment with the use of representative hydrocoles by the "from bacteria to fishes" system, which models trophic structure of hydrobiocoenosis and permits to determine allowable concentrations for producers, reducers and consumers. This scheme takes into consideration the distant results of organosilicon compounds affects on species multiplication and genetic mechanism.

When the studied compounds toxicity was tested on fishes (trout larvae, young fishes of under-year age, yearlings) such important factors as teratoma formation for fish embryo and larvae after pecking out, as well as their effect on the genetic mechanism of a number of hydrocoles (chronomids, for instance) and hydrocole tissue-fish crystalline lens epithelium. On this test-object analysis their effect on epithelium cytodifferentiation and chromosomal aberrations, resulting from these substances effect, was found. Fish organs hystology and histochemistry were analyzed after organosilicon compounds toxic affect.

Experiments on trout embryos demonstrated that no teratogenic effect was found under the influence of I, II, III, and embryos development was standard. On comparison of histochemical results no difference in morphological structure of test and control fish livers was found.

I, II and III toxicity was analyzed by biotesting of synchronized culture *Daphnia magna Strays* by mature species survival rate in an acute experiment within 96 hours. II is the most toxic compound (LC50 is close to 0.1 mg/L); I is on the second place in terms of toxicity (LC_{50} is close to 1.0 mg/L) and III is the least toxic compound (LC_{50}= 250 mg/L).

I, II and III affects on primary producers *Chlorella vulgaris*, in particular, were evaluated in terms of cell total amounts (cells were calculated in Goryaev chamber) within 96 hours. I in 1 mg/L concentration was found to suppress *Chlorella vulgaris* cell increase more than 30 % in comparison with the control; II in 0.1 mg/L concentration - by 12% and only III in 0.1 - 0.01 concentration did not promote *Chlorella vulgaris* cells increase drop, and at 0.1 mg/L concentration cell increase grew by 7%.

An acute experiment for the determination of I, II and III effect on heterotrophic bacteria multiplication in the water, taken from Moscow river in the region of Neskuchnyi Garden was conducted within 48 hours. It was found that compound I suppressed heterotrophic bacteria growth at 0,1 mg/L concentration; II- at 0.001 concentration and only III at the analyzed concentrations does not affect heterotrophic bacteria growth.

Thus, on the ground of the conducted research it was found, that organosilicon compounds I, II, III have varios toxicity. Compound II is the most toxic one. Its toxicity is manifested on heterotrophic bacteria, on algae increase dynamics in cultures and on the survival rates of trout forelarvae. The same compound decreased *Daphnia magna Strays* survival rates at 0,1 mg/L concentration. Compound I is of mean toxicity and III - is low toxic.

These compounds can be placed in decreasing toxicity order as follows: III< I < II.

ECOLOGICAL MONITORING OF SEA AREAS NEAR RIVER MOUTHS USING STANDARD HYDROMETEOROLOGICAL AND SATELLITE DATA (THE GULF OF FINLAND, THE VOLGA RIVER DELTA, TAGANROG BAY)

Vasiliev A.S.
State Oceanographic Institute, Russian Federal Service for Hydrometeorology and Environmental Monitoring, Moscow, Russia

A sea or oceanic region being the major chain in the natural water and substance cycles plays an important role in formation of not only the contact zones (bottom, coast, surface), but also the adjacent land strips within the entire water catchment, as well as the atmosphere which participates in transformation and transport of energy and substance within the water catchment and beyond its boundaries.

Composition principles for adaptive-and-learning technologies.

The State Oceanographic Institute, Russian Federal Service for Hydrometeorology and Environmental Monitoring has developed the adaptive-and-learning computer technologies for monitoring the state and phase changes of classes of the sea and oceanic processes (ALAFS).

The technologies allows a reconstruction of the marine environment from surface to bottom using thermohaline, hydrodynamic and other parameters of the sea and atmosphere, an examination of inner links within the marine ecosystem (including its biological component), a formation of

the forecasting rule and forecasting of the state of the marine ecosystem component relating both to living and non-living nature. The technology is based on ecological and mathematical modeling, standard hydrometeorological monitoring by the World Weather Watch and the satellite data on sea surface temperature.

One of the main problems in the marine ecological modeling is reconstruction of the major physical fields (currents, temperature salinity, density) in the mode of continues processes monitoring.

The mathematical models for medium state diagnosis by continues monitoring should meet the following requirements: a fast realization by small computers; a necessity to account for the region orography and topography, water exchange in through the straits and "liquid boundaries", a possibility of using the satellite data of the ocean surface remote sensing and standard hydrometeorological monitoring of the atmospheric pressure for interpretation of the processes both on the sea surface and in deep layers.

Working principles

ALAFS is a human-computer interactive system and is functioning in a dialogue mode.

A prognostic (solving) rule is formed by computer from the learning rule (the Markov's prognostic functional).This learning system requires a teacher whose role is played by a forecaster and system user (a marine biologist, an oceanologist, a hydrologist, a shelf development expert, etc.).

The system models are based on computer perception of vague images of a complex "marine environment - predicant" on its teaching to identify transitions in the state of this system and a forecasting of its possible future states.

The idea of computer perception has been embodied in an adaptive-and-learning automated prognostic system, i.e., an oceanographic perceptor (a simple computer brain) capable of learning and adopting to identify transformations in the living and nonliving nature.

The oceanographic perceptor or the adaptive-and-learning automated prognostic system for ocean monitoring is a set of software items fed in a definite sequence into computers of the same series in order to solve a problem outlined by a researcher or other user.

The perceptor can be taught and adjusted to solving various prognostic, informational and management problems related to the human activity at sea and in the river deltas.

This activity may include fish catchment enhancement, submarine mining of minerals, marine process control, regulation of the freshwater resources, information support under emergency conditions.

The system operation results in a map of the predicted parameter distribution in the sea area.

Scheme for technology realization and some results

A scheme for data links, monitoring, tomography, learning, adaptation and forecasting is realized according to an algorithm composed of a number of subsystems which may be optionally united depending on the required mode of the perceptor's feeding (operation). The main modes of the perceptor's feeding are: monitoring, adaptation and learning, forecasting, management decision-making.

The paper presents a scheme for data links and results of monitoring of the coastal areas of the Gulf of Finland, Taganrog Bay and the Volga River Delta.

MOBILE LABORATORY FOR OPERATION CONTROL OF WATER QUALITY

Vinogradova G.N., Rainin V.E., Yashin V.M.
All-Russian Research Institute of Hydraulic Engineering and Land Reclamation, Russia
Besfamilniy I.B.
Ministry for Science and Technologies of the Russian Federation, Russia

Operation control of quality of both natural and waste water is an important constituent part of the problem of information support of departments and services, securing prevention and elimination of unfavorable ecological situations, associated with determination of water quality.

Mobile laboratory is elaborated within the frames of intergovernmental Russian-German scientific and technical cooperation on the "Oka-Elbe" Project.

Mobile laboratory represents a modern multifunctional laboratory complex, making possible to solve problems of automated operational control of general indices of water quality, implement automated sampling of water in a temporal regime, assigned by the user, and carry out measuring of general indices of water quality in water bodies autonomously with the use of portable devices (including the use of rubber boat with a motor).

Basic characteristics of mobile laboratory are shown in Table.

The laboratory has a system of heating its working space, it is equipped with air conditioner; there are two comfortable working places. It makes possible to work both in summer and winter. Powerful four-wheel drive vehicle gives a possibility to carry out works in not easily accessible areas.

The studies of water quality, carried out in the Oka Basin, including observations over formations of general indices of water quality and their dynamics in the operational ergime (the Oka, Moskva, Protva, Nara, Rechma, and Lopasnya rivers) demonstrated that water turbidity, changing under the influence of floating vehicles and wind regime, was most dynamic index.

Characteristics	Gear, devices
Basic truck	Ural 4320
Power plant	Three-phase generator with Diesel engine; batteries for autonomous powering of measuring instruments
Voltage in electric circuit	400, 230, and 24v
Measured indices of water quality and instruments	pH - pH-meter pH 196T Electric conductivity - conductivity Meter LG 196T; Dissolved oxygen - oximeter OXI 196T; Turbidity - MET 3010; Temperature - measured by mentioned above instruments, except turbidimeter
Water intake unit Sampler	Submersible electric pump Automated sampling at assigned temporal regime - PP MOS 1/12/24T
Accessory instruments and equipment	Portable instrument SV-570 to measure general indices of water quality; rubber boat with motor; compressor
Recording, storage, processing	On-board, computer printer and presentation of information

The availability of such a powerful instrumental base and equipment make possible to solve the following problems with the use of this laboratory:

- programmed water sampling in automated regime;
- control of general indices of water quality in water bodies and investigation of the dynamics of these indices in operational regime;
- investigation of spatial distribution of quality indices in water bodies and watercourses, including revealing the sources of pollution and zones of groundwater discharge;
- determination of stream velocity in watercourses;
- determination of hydrochemical parameters;
- solution of other problems, associated forming of water quality in water bodies and watercourses.

SYSTEM ASPECTS OF INTEGRATED MANAGEMENT OF THE LOWER DON WATER RESOURCES

Volovik Y. S., Zhulidov A.V.
Center of Preparation and Implementation of International Projects for Technical Assistance
Yangulova N.A.
Don Basin Water Association, Rostov - on - Don, Russia
Moskalenko A.P.
Department of Mathematical Methods in Economy and Environment at the Scientific Research Institute of Mechanics and Applied Mathematics, Rostov State University, Russia

Peculiarities of the hydrographic network and hydrological regime of the Don basin rivers cause considerable seasonal fluctuation of the river flow (more than 70% is formed in spring high water period). Hydrological, hydrochemical and hydrobiological conditions of the Lower Don water resources make the area one of the most tense in the basin and are the principle limiting factor of the region development and sustainable functioning of the existing water economy complex.

In the situation of water deficiency, unsatisfactory surface and ground water quality and contradicting demands and interests of water economy complex participants, improving management of the water fund use and protection is becoming one of the crucial factors for rehabilitation and maintenance of the normal state of water supply in Rostov region.

In this connection one of the main objectives of the «Integrated Management and Efficient Water Use in the North Caucasus region» sub-component, currently implemented in the Lower Don, is unification of the existing and/or creation of lacking system elements or instruments that would prepare information for making managing decisions, improving the process of water management by means of applying up-to-date information technologies. The subordinate system formed under centralized government and poor collaboration of various departments of federal water management on the regional (local) level resulted in creation of duplicate departmental systems of water bodies monitoring, information managing systems (including systems of early informing in emergency situations), application of system elements, supporting the process of making and evaluating managing decisions (DSS) on the basis of various agencies.

The principle agencies in charge of the Lower Don water resources management are the following: Don Basin Water Department (all types of managing decisions), Rostov Regional committee for Nature and Natural Resources Protection (Rostoblkompriroda) (norm-setting and economic regulating in emergency situations and for perspective planning), Center of Federal Sanitary control in the Rostov region (Gossanepidnadsor) (sanitary epidemiological control in emergency situations and for perspective planning), Azovrybvod (regulating commercial fish catch and reproduction of fish supply). Hydrometeorological service of North Caucasus does not directly participate in water management, supplying the managing structures with acquired information. Disregarding the vital importance of integrated approach to water resources management, agencies would frequently make decisions which are relevant exclusively for the agencies themselves.

A big defect of the existing water management system is lack of reliable and integral information on water bodies condition and sources of anthropogenic effect. Information and data stored in the agencies are merely sets on various aspects of economy and environment. None of the existing organizations are aware of the actual processes taking place in the water bodes and the scale of their anthropogenic alterations.

To prepare, assess and make most effective decisions in the field of the Lower Don water management (applying the basin approach) in line with interests of different administrative regions it is essential to combine three integral parts of the unified managing system, meant to ensure data and information preparation (regional monitoring system of the Lower Don water resources (LDMS)), their efficient processing and transferring into federal managing departments (integrated information system (IIS)) and preparation and evaluation of decision options and their consequences (decision support system (DSS)).

Integrated water management and its efficient functioning can be implemented if activities of all nature protection agencies will be coordinated and supervised by Rostov regional government. Systems created within the Project (LDMS, IIS, DSS) will be based on systems, already existing in various agencies and their integration will help to provide the following:

- acquisition of reliable information on the Lower Don water bodies condition and on the number of water intake locations and sources of pollution,
- correspondence between information received and managing requirements on the regional and basin level;
- availability of reliable information for federal managing agencies for each type of managing decisions;
- preparation, analysis, assessment and implementation of decisions for various aspects of water management based on the same information;
- streamlining efforts and expenses of the agencies that were focused formerly on separate systems functioning.

DETERMINATION OF TOTAL NITROGEN, SULFUR, PHOSPHORUS IN ENVIRONMENTAL AND DRINKING WATERS

Vorobjova I.S., Gursky V.S.
Scientific-Research Technological Institute named for A.P.Alexandrov, Sosnovy Bor, Russia

The traditional methods of total nitrogen, sulfur, phosphorus determination used usually at environmental and drinking waters analysis require many efforts: for each other element is made individual oxidation procedure to inorganic ion with it's following photometry detection.

In the present work a method of determination of total sulfur, phosphorus and nitrogen in water by oxidation of organic compounds contained the elements mentioned using UV-irradiation in the hydrogen peroxide presence and following ion chromatography analysis of a suitable inorganic anions is developed.

Using the "model" compounds contained sulfur, phosphorus and nitrogen we investigated an influence of hydrogen peroxide concentration and the time of UV-irradiation on the process of a fullness of oxidation of elements determined. Although behaviour of substances investigated has some individual specialties generally two hours UV-irradiation of samples at hydrogen peroxide concentration 0.3% are enough for it's complete oxidation.

The problem of a choice of the conditions of oxidation fullness of nitrogen contained compounds to nitrate ions and polyphosphates - to phosphates is discussed.

As a result of investigations passed a method and optimum conditions for complete oxidation of sulfur, phosphorus and chlorine contained organic pollutants in environmental waters had been chose. The lower detection limit of the components analysed is 100-200 $\mu g \cdot L^{-1}$ in re-count on elements at the direct injection of sample (Chromatograph Cvet-3006, the column "Elsian-6", as the eluent $3 \cdot 10^{-3}$M Na_2CO_3+$2.4 \cdot 10^{-3}$ M $NaHCO_3$). Ion Chromatography concentration after UV-oxidation lowers a detection limit of the elements mentioned to 2-5 $\mu g \cdot L^{-1}$.

Application of UV-irradiation in the presence of hydrogen peroxide for oxidation pays off to minimum the possibility of a casual inclusion of the anionic contaminations that permit to use the scheme offered for sensitive and expressive Ion Chromatography analysis of drinking and environmental waters.

USING OF SAR AND OTHER REMOTE SENSING DATA FOR ENVIRONMENTAL MONITORING OF WATER OBJECT

Yefremov H.A., Shkarin V.E.
NPO Mashinostroenia, Reutov, Moscow region, Russia

It is well-known that SAR is a high-resolution remote sensing instrument which can be used either for global mapping or detail mapping. The main reasons for SAR using are:

- its unique sensivity to surface roughness and slopes;
- its sensivity to the dielectric properties of surface materials for example, to the presence of water;
- its ability to take images independently weather conditions and sun lighting that is especially important for re-

gions where is often cloud coverage or solar illumination is insufficient.

All-weather and round-the-clock monitoring is intended for the following problems:

- Pollution monitoring and biological tank, seas and oceans;
- Periodical observation of flooding areas;
- Meliorative systems control.

The spilled oil on sea surface forms films of various thickness since the oil and oil products are composite mixtures.

The films of oil and oil products cause on sea surface slicks because of the damping of short gravitational and capillar waves of centimetric and decimetric bands. The damping and attenuation of surface waves by films decrease the sea surface roughness, and allow to observe and control surface pollutions using SAR. Since very many oil is left in the sea during its production and transport, the global control or monitoring using remote sensing means is extremely necessary.

Some SAR image thematic interpretation examples are presented below.

NUCLEAR SCIENCE AND TECHNOLOGY IN WATER RESOURCES SECTOR AND OVERVIEW OF THE IAEA's ACTIVITIES

Yurtsever Y.
International Atomic Energy Agency (IAEA), Department of Research and Isotopes

Methodologies based on the use of isotopes in a wide spectrum of hydrological problems encountered in water resources assessment, development and management activities are already an established scientific discipline recognized as "Isotope Hydrology", and proven methods are presently employed as an integral part of water resources investigations and environmental studies. Together with techniques based on the employment of radioactive isotopes for water tracing purposes and use of sealed radioactive sources for in-situ measurements related to water movement, they comprise the overall field of "Nuclear Techniques in Hydrology".

During the last four decades, the International Atomic Energy Agency (IAEA) has been directly involved in efforts towards research and development of nuclear techniques in water sciences, and their actual field applications, and has acted as an international-scale focal point for dissemination of information and promoting their wider-scale use, within the framework of its activities related to peaceful nuclear applications.

The potential role and contributions of isotope methods in the water resources sector can be grouped into the following general categories:

- Determination of physical parameters related to flow, its dynamics and structure of the hydrological system,
- Process Tracing - delineation of processes involved in circulation of water and mass transport of dissolved constituents,
- Identification of origin (genesis) of water,
- Component Tracing - determination of pathways and mixing ratios of component flows,
- Study of "Time–scale" of hydrological events.

"Isotope Hydrology" deals with various methodologies essentially based on the general concept of "Tracing", in which either naturally occurring isotopic species (environmental isotopes) or intentionally introduced isotopes (stable or radioactive) are employed. The use of naturally occurring isotopes, often referred to as "Environmental Isotope Methodologies", has the distinct advantage of facilitating the study of water movement and hydrological/climatological processes on much larger temporal/spatial scales than possible with intentionally injected tracers, which are often used for site-specific, local-scale engineering problems.

The paper provides an overview on the type of hydrological information that can be obtained from applications of nuclear science and technology in water resources assessment /management and related environmental studies. Summary information on the activities of the International Atomic Energy Agency and program components in this field is given.

ISOTOPE - GEOCHEMICAL STUDIES IN ZONES OF EFFECT ON WATER BODIES

Zairi N.M., Gangnus N.P., Vilenkin V.A., Vilenkina Yu.V.
TsNIGRI, Ministry of Natural Resources of the Russian Federation, Moscow, Russia

The system of isotope - geochemical monitoring (IGM) has been developed and implemented at a number of large water bodies (Caspian and Black Sea water areas, river systems in the Russian Federation and CIS , etc.). This system expands the range of potentialities currently shown by traditional geochemical techniques and provides for attaining a new level of assessment and prognostic derivations concerning the state and development of geoenvironmental situation, with ranking natural and technogenic geochemical anomalies (GA) and identification of major anthropogenic contamination sources. IGM programs that have been carried out in Black and Caspian Sea regions have shown that two major types (levels) of geochemical barriers (GB), where drastic changes of physicochemical and thermodynamical parameters occur, can be distinguished, namely: contact zones of river (shore) - sea and water - sediment systems. The results obtained during IGM studies in the Russian zone of the Black Sea area and along the North Caspian current

(NCC) show that major suppliers of continental technogenic products (river systems) are essentially discharged within the shore - sea contact zone. This discharge gives rise to GA showing the increase in concentrations of some 1st and 2nd toxicity group heavy metals from 10 to more than 100 limiting tolerable concentration (LTC) levels (the Vjlga, Sulak and Terek rivers in the Caspian area and the Sochinka, Aderba and Tsemeska rivers in the Black Sea region). Based on the data on sulfur and carbon izotope geochemistry, it has been established that technogenic GA consist of internal zones (identifiable by geochemical techniques) and outer (external) zones, where metal and hydrocarbon concentrations are comparable to LTC but are reliably identified as technogenic contamination from data on $\delta^{34}S^{SO4-2}_{H2O}$ and $\delta^{13}C^{HCO3-}_{H2O}$ - variations. Similar integrated approach (also applicable to continental industrial entities) is used in the interpretation of IGM data accumulated in 2-3 years in order to make prognoses on the development of geoenvironmental situation for 5-15 years ahead.

Another important field of IGM application is the identification of contamination sources. In particular, two major hydrocarbon contamination sources have been identified from data on $\delta^{13}C$ HCO_3^- variations in sea water samples taken in the 1-1.5 - mile zone of the Black Sea, namely, oil terminal in Novorossiysk ($\delta^{13}CHCO_3^-$= -16.5±1.0‰; $\delta^{13}CHCO_{3\ backgr}^-$ = -13.5‰) and a technogenic light hydrocarbon deposit ($\delta^{13}C$ = -18.5±0.5‰) which has been detected later in the Tuapse city. A similar approach permitted the zones of technogenic effect from oil production sites in the Caspian Sea to be outlined with internal zone contours >500m ($\delta^{13}CHCO_3^-$ = -10÷-19‰, $\delta^{13}C_{backgr}$ = -6.0‰) and outer zone up to 3000m ($\delta^{13}CHCO_3^-$ = -7.5 ÷ -12.0‰) along the NCC.

Also reported are data on SO_4^{-2} IGM of sea water in the Caspian Sea accumulated over a period of 28 years (1968-1996). It has been found that significant fluctuations of $\delta^{34}S_{SO4}^{-2}$ occurred during the monitoring period, with threshold changes in 1978 and 1996. The analysis of these data in combination with data on sea water level changes suggests that a regression of this water system started in 1996. Probable causes of sea water plane elevation are analyzed in terms of isotope geochemistry.

THE ANALYSIS OF THE MODERN NUMBERS AND OF THE HISTORICAL DYNAMICS OF THE BIRDS' POPULATION, LIVING NEAR THE WATER, AS THE BASIS OF THE REGIONAL MONITORING OF THE BIOLOGICAL VARIETY OF THE WATER ECOSYSTEM

Zavialov E.V., Shlyachtin G.V., Tabachishin V.G.
Saratov State University, Saratov
The Institute of the Water Problems, Russian Academy of Sciences, Moskow

The anthropogenic transformation of the landscapes and the specifity of the climatic conditions of Low Povolzhie are the reasons of the fact that here are the borders of many birds species's dissemination including Haradriiformes In this situation it is very important to get the information of the modern number of these birds in the limits of the concrete regions, in particular of Saratov region, that will let to predict the tempos and its dynamics's direction in the future. On such a purpose the investigation of the modern history of 7 nesting sandpipers of Saratov region was made: Haematopus ostralegus L., Actitis hypoleucos (L.), Recurvirostra avosetta L., Scolopax rusticola L., Gallinago gallinago (L.), Gallinago madia (Latham) and Tringa totanus (L.). The field investigations were made in the period from 1991 to 1995. The registrations were made up to the time of sandpipers' multiplication, i.e. they cover the period from the third decade of April till the first decade of June.

Haematopus ostralegus L. is a small nesting spesies of Saratov region, its dissemination is connected with the river valleys. It regularly nests on the rivers: Volga, Tereshka, Medveditsa, Malii Uzen, Bolshoi Irgiz and Malii Irgiz, Eruslan. The data from the relevant literature allow to reveal some depressions in the dynamics of the species's numbers which occured in the beginning and in the middle of this century and in the 1990s. It is exposed that the numbers of Haematopus ostralegus L. is stable during the last 10 years and it constitutes about 40-90 pairs of the nesting pairs. For Actitis hypoleucos (L.) the most favorable areas for nesting are the valley biotopes of Pravoberezhie of the region where the coastal zone includes the fields of the open sands and the rivers' river-beds assist to forming of many sandy scythes and sandbanks. That is why the most stable settlements of these birds are on the rivers of the basin Don - Medveditsa and Hoper and on the tributaries of the right bank of the river Volga. In Zavolzhie the dissemination of the nesting populations of the sandpipers has rather wide but mosaic character and Actitis's hypoleucos (L.) numbers in such settlements are significantly less then on the right bank of the river.

The number of Actitis hypoleucos is stable and it constitutes about 21000 birds taking part in multiplication. Nesting of Scolopax rusticola L. is widespread in the north and west districts of Pravoberezhie, there are indications for Scolopax's rusticola multiplication in the environs of Saratov. Probably, the southern border of the species' dissemination on the territory under research is on the latitude of the regional centre. Through the valleys of Don basin's rivers this species can penetrate to the south, reaching the limits of Volgogradskaya oblast (region). The anthropogenic transformation of the places of the birds' living leads to the reduction of this sandpiper's number, that constitutes about 13000 of the nesting birds in the region.

The modern disseminetion of Recurvirostra avosetta L. in Saratov region is connected with small districts of the southern Zavolzhie. In physics- mathematics ratio this territory is situated in the limits of the two geomorphological regions of Nizkaya Sirtovaya plain and Prikaspiiskaya lowland. Besides, some multiplying birds are registered in the limits of Saltova sandy intrazonal area, the space of which is rather large. The general number of the nesting Recurvirostra avosetta L. in the region is not more than 50 pairs. Multiplication of the Gallinago media (Latham) is trustworthly confirmed at present only for two spots of the region: the valley of the river Medveditsa and of the river Volga to the north of Saratov. That is why we can suppose that only 20-25 of these birds take part in the multiplication in the limits of Saratov region.

The most important settlements of Tringa totanus (L.) are in Zavolzhie of Saratov region and the modern number of the nesting population is stable and it constitutes about 10000

pairs. The modern numbers of Gallinago gallinago (L.) is 3500000 birds that take part in the multiplication, its populations are relatively stable. The main limiting factor that determines the southern border of this species' dissemination is the high aridity of the forest-steppe and steppe districts. The area to the east of Saratov region where the Gallinago gallinago (L.) nests is limited by a territory where the general annual amount of sediments constitutes not least than 550 mm. So, the results which were got during researches can serve as the basis for the further monitoring observations over the nesting sandpipers' populations of Saratov region. Besides, it is revealed that the direction of abiotic factors defines the type of dynamics of the areal for each species of sandpipers. For some nesting sandpipers, for example for Avocet, these changes can be considered to be the expansion or the reduction of the arial provoked by the activization of the cycle of its transference or of the processes of its dying out. There are some species (Redshank, Snipe) for which the consequence of the dissemination's reduction in the limits of the steppe zonal complex is forming the spotted areal. Besides, some examples are registered (Oystercatcher) if the long-lasting changes of the species' number have a consecutive cyclical character based on the changes of the reproductive indexes.

CHIRONOMIDAE AS INDICATORS OF RESERVOIRS' STATE IN THE FRESHWATER BIOMONITORING

Zinchenko T.
Institute of Ecology of the Volga River Basin of the Russian Ad\cademy of Sciences,Togliatti,Russia

In any system of biological assessment of water quality in fresh-water reservoirs, chironomids share an essential, if not a leading part. It is reasonable to believe that the use of multi-variate approaches to the assessment of the water quality can be ultimately replaced by a research project which assign a determining part to chironomids.

As to the abundance and biomass, larval chironomids are the first within a bottom fauna and are fed upon by numerous bentivorous fish from inland water bodies. The most abundant species of chironomids from the genera of Chironomus, Glyptotendipes are taken as the objects for specialized international research projects.

Chironomids are effectively used as indicators for the the environmental contamination at an organism-,population,-biocoenotic- and ecosystem levels,as well as for laboratory and field studies(as bioindicators for assessing the levels of toxicity):

- at an organism level, chironomids (as bioindicators for assessing the levels of toxicity):investigations as the markers within contaminated aquatic ecosystems, especially in the presence of point sources of pollution;
- at a populations level, they are used when studying the feeding habits and food behaviour of chironomids, their functional peculiarities in trophic relationships among the invertebrates, and as bioindicators in the presence of different stress impacts upon ecosystems as well.

Investigations of chironomid life cycles and changes (for example, in the rates of their growth, number of generations, timing of escape and emergence) occurring therein under the influence of antropogenic factors demonstrate the extent of impact of organic and inorganic contaminations. In addition, chironomids are known as a basic group of invertebrates to be dealt with studying defferent morphological deformities.

Indicator-based estimation of a reservoir's pollution allows one, first, to compare the rusults obtained with the ones when using the classical system of saprogenic state of rivers and the system of ranking the reservoirs as to their trophic levels, and, second, to improve these systems and to suggest novel biotic and calculation indices.

Chironomids are most often used in the biomonitoring at the level of their species research within bottom communities.

At an acosystem level, chironomids are important objects for controlling the state of reservoirs when conducting, for example, paleolimnological studies.

Changes in the qualitative and quantitative parameters referring to the chironomidal assemblages in a reservoir are highly indicative of the eutrophication processes therein. The results of 30-year studies of the Kuibyshev reservoir are presented in the peper involved.

As the chironomids can easily be incorporated into a culture and adequately respond to different influences, they are known to be ideal test-objects for ascertaining the toxicity of municipal and industrial effluents. In Russia, unfortunately, these aspects are given unreasonably little attention, in spite of the fact that larval chironomids could become an important object when studying the toxicity of water bodies in the field investigations of mesocosms.

A notable finding was that chironomids can become important biological hindrances in drinking-water supply systems and at water-putification stations where they can endure all stages of the water treatment and are specifically indicative of the water quality.

Projects for freshwater biomonitoring irrespective of their reference to rivers, lakes or water-storage reservoirs, should cover more biological variables in addition to the conventional hydrologic-hydrochemical measurements.

All this testifies to the significance of chironomids as a biotic group which undoubtedly deserves to be included into the respective research projects.

CHEMILUMINESCENT METHOD OF COPPER AND NICKEL DETERMINATION IN NATURAL WATER

Zinchuk V.K., Taras O.B., Veselovs'ka O.O., Mytsuk O.A.
Ivan Franko L'viv State University, Department of Analytical Chemistry, Ukraine

Analytical analysis of natural waters as for heavy metals content, particularly, copper and nickel determination, requires their preliminary concentration, which leads to complication of the analysis.

We have proposed chemiluminescent (ChL) method of Cu(II) and Ni(II) determination in natural water without procedure of their concentration and separation from preventive components. The method is based on the measuring of

chemiluminescence intensity in reaction of 3-aminophthalgidrazide (H_2L) oxidizing by peroxomonosuphate acid H_2SO_5 in alkaline medium. Cu(II) and Ni(II) ions catalyze this reaction. Dependencies of ChL intensities *vs* time are typical as for unstationary ChL. Maximum magnitude of ChL intensity (I_{max}) has been used as analytical parameter. Optimum conditions of ChL reaction have been determined as follows: $C(H_2L)=3.0*10^{-5}$ M, $C(H_2SO_5)=7.0*10^{-5}$ M, C(NaOH) = 0.2 M and the order of components mixing when investigating for copper/nickel content solution was added to mixture of alkaline solution of H_2L with peroxomonosulphate acid. Preventive influence of inorganic ions was removed with addition of pyrophosphate and fluoride ions and of organic substances with HNO_3 action on the dry rest after evaporation of the portion of investigating water. Determination of copper and nickel has been performed by the method of standard additions. Lower limit of Cu(II) and Ni(II) contents are 0.64 and 2.0 μg/l, respectively.

Some water samples which were taken from different areas of L'viv region were analyzed by the method proposed. Determined Cu(II) and Ni(II) contents lie in the range of 2.0-9.0 and 5.0-15.0 μg/l, respectively. The error of analyses don't excess 10 rel %.

Reliability of the results obtained was verified by atomic absorption and photometric methods with preliminary water sample evaporation and following nickel sedimentation on $Mg(OH)_2$ or copper diethyldithiocarbaminate extraction with $CHCl_3$.

Proposed method is characterized by high sensitivity, expressivity, simplicity of the procedure and satisfactory accuracy.

THE RECONSTRUCTION OF THE WASTEWATER TREATMENT FACILITIES OF THE CITY OF CHELYABINSK

Zshilin O. V., Bristein L. K.
VODOKANAL Enterprise, the City of Chelyabinsk
El U. F., Shelomkov A. S.
MOSVODOKANALNIIPROJECT Moscow Institute for Water & Wastewater Research & Design, Moscow, Russia

The Wastewater Treatment Facilities of the City of Chelyabinsk have been built and put into operation by turns. At present the construction of the two treatment phases of 625.000 m^3/day design treatment capacity has been finished and both of the lines are in operation now. The third phase of 200.000 m^3/day treatment capacity is under construction. The Treatment Facilities are operated according to the technological scheme that provides complete biological treatment; the fact (from the point of view of quality indices) does not meet the requirements for the water bodies of fishing quality (the River of Miass is such a water object).

A step-by-step plan for the reconstruction and modernization of the Treatment Facilities has been approved in order to improve the ecological situation in the Region of the City of Chelyabinsk taking into account the existing economical situation. The first stage envisages the provision of wastewater tertiary treatment aimed at the removal of nutrients (nitrogen and phosphorus) from the wastewater without any decrease in the existing Facilities treatment capacity. It is planned to achieve these results owing to the introduction of progressive modern technologies and equipment. The second stage envisages the provision of wastewater fine purification in order to meet the MPC requirements for the water bodies of fishing quality, as well as the post-treated wastewater disinfection and sludge utilization.

The reconstruction scheme envisages the introduction of the complex of energy-saving technologies with the provision of electrical and heat energy generation due to tertiary treated wastewater discharge into the River of Miass. The "Pure Water" Program is being developed now under the guidance of the Administration of the Region; it is envisaged to consider (within the framework of this Program but as its separate component) the issues of the water economy balance of the Region taking into account the rational usage of effluent water for the water sources replenishment and process water supply needs. In order to provide maximum facilitation of the design work, the designing in parallel is being carried out: at present the development of the forms and records for existing Facilities reconstruction and modernization is being completed; the Technical and Economic Substantiation for the entire complex of wastewater and sludge treatment facilities is being developed simultaneously. The wastewater and sludge treatment process schemes envisage the application of both conventional and modern progressive methods which have been tested in many respects at the Wastewater Treatment Plants of the City of Moscow.

TASKS AND ORGANISATIONAL STRUCTURES OF LABORATORIES USING THE EXAMPLE OF THE BERLINER WASSER BETRIEBE

Petersohn D.
Berliner Wasser Betriebe, Berlin, Germany

1. The Organisational Structure of the Laboratories Division

The Laboratories Division of the Berliner Wasser Betriebe is sub-divided into the Departments Management, Water Laboratory, Waste Water Laboratory, and into the Service Department Central Tasks.

The Division gives priority to the principal tasks in analytics in the fields of water - these tasks are performed by the Drinking Water Laboratory in Jungfernheide; and waste water - these tasks are performed by the Waste Water Laboratory on the premises of the sewage treatment plant at Falkenberg and by the associated plant laboratories.

The Laboratories Division is a high-performance centre of the Berliner Wasser Betriebe for analytical work and control tasks and provides information to internal and external customers on the evaluation of the quality of their products.

These services are rendered in the following environmental fields:

- drinking water
- groundwater
- surface water
- waste water
- soil
- sludge
- waste
- contaminated sites.

2. Water Supply

The drinking water laboratories check the quality of the drinking water after its treatment in the eleven water works.

These examinations are based on the Drinking Water Ordinance of 12 December 1990 in which the respective parameters with their limit values are listed:

- bacteriological parameters: colony figures at 20 and at 36 degrees Centigrade coliform bacteria and E.coli
- pollutants: heavy metals, cyanide, nitrate, nitrite, fluoride, volatile halogenated hydrocarbons, polycyclic aromatic hydrocarbons, polychlorinated biphenyls and pesticides
- physical-chemical parameters: temperature, pH value, conductivity, capability of oxidation, coloration, turbidity, odour
- chemical parameters: ammonium, calcium, magnesium, sodium, potassium, iron, manganese, chloride, sulphate, phenols, phosphorus, mineral oil hydrocarbons, tensides.

In order to be able to detect pollutants in the drinking water in good time, the untreated water (groundwater), too, is examined regularly partly including the individual wells. This makes it possible to detect groundwater pollutions in the environment of the water works at an early stage.

The drinking water in Berlin is in compliance with the Drinking Water Ordinance, a continuous disinfection is not necessary.

According to the directives issued by the WHO, there must be one water sampling point in the water pipeline system for every 10,000 inhabitants. Every month, the water from 383 sampling points in the water pipeline system, i.e. one sampling point for every 8,880 inhabitants, is checked in respect of selected bacteriological and chemical parameters by the drinking water laboratories.

3. Waste Water Purification

The Waste Water Laboratories of the Berliner Wasser Betriebe check the waste water of the 7 sewage treatment plants.

The purification of the waste water in the sewage treatment plants involves complicated chemical, biological and bacteriological processes which must be in compliance with the composition and quality of the waste water.

The waste water that is sent for treatment to the sewage treatment plant may have a differing degree of pollution at different times or contain different pollutants.

The waste water laboratory and the associated plant laboratories are specialised in the analysing of samples from all technological stages of waste water purification, sludge treatment and fermentation gas generation.

Examinations in the different stages of waste water purification are based on the Framework Waste Water Administrative Regulation as well as on permissions and quality-related ordinances issued by the Water Authority, such as the Sewage Sludge Discharge Regulation.

The Waste Water Laboratory on the premises of the Sewage Treat Plant at Falkenberg has, in compliance with its areas of operation, been sub-divided into the following:

- routine laboratory,
- laboratory for the analysing of individual organic substances,
- laboratory for the analysing of heavy metals,
- biology laboratory.

All the essential cumulative parameters in waste water analysing are determined in the routine laboratory, including for example:

- chemical oxygen demand (COD),
- bio-chemical oxygen demand (BOD_n),
- total and dissolved organic carbon, respectively (TOC/DOC),
- absorbable organic halogen compounds (AOX),
- nutritive substances (nitrogen and phosphorous compounds),
- tensides,
- mineral oil carbons.

The operations department for the analysing of individual organic substances determines the most important organic components in the water as to their quality and their quantity. These include, inter alia:

- monocyclic aromatic compounds (benzol, ethyl benzene, toluol, xylene),
- polycyclic aromatic hydrocarbons,
- volatile halogenated hydrocarbons ,
- polychlorinated biphenyls.

In heavy metal analytics, all heavy metals as well as all other metals are determined. This is also done with alkali elements and alkaline earth elements.

The biology operations department carries out microscopic activated sludge analyses as well as a great number of other biological and bio-chemical determinations. Various bio-tests are also being made (short-time respiration test, degradation inhibition test, luminous bacteria test and nitrification inhibition test).

4. EDP-assisted Laboratory Information and Management System (LIMS)

In order to make an effective access to all relevant information data in an up-to-date laboratory possible, an EDP-assisted information system is an important instrument. A direct access to all information for all staff-members creates the required transparency of laboratory data and enables a large laboratory to handle orders within a shorpt period of time and in a flexible manner and to react to changes in general conditions.

5. Marketing and Customer Servicing

The laboratories of the Berliner Wasser Betriebe as an up-to-date high-performance centre for environmental analytics have been offering laboratory services also to external customers on an increasing scale since 1995. The laboratories have been accredited under the European Standard DIN EN 45.001, thus meeting all the requirements of high quality standards which are essential for the marketing and the competitiveness of laboratory services.

We are offering our services to environmental authorities, research institutions, special-purpose associations in the field of water supply and waste water disposal, operators of water supply facilities and/or waste water treatment plants, waste disposal companies and waste utilisation companies, engineering offices, construction companies, etc.

SECTION IV
ECONOMICS AND LAW

ECWATECH

THE WATER USE RATE POLICY IN THE GCC COUNTRIES FOR QUALITY WATER RESOURCES: ECONOMIC FEASIBILITY

Al-Sayed M.
Kuwait Institute for Scientific Research Water Resources Division Hydrology Department, Safat, Kuwait

The problem of water use policy is becoming a vital subject for governmental sectors and should be reviewed from time to time in order to enhance its impact on the availability of quality natural water resources. Hence, a proper plan is to be suggested to sustain the on going policy and to build a solid financial basis for water sector management and to develop an economical alternatives for water use, water drainage and water protection. This paper discusses the recent water use policy with respect to the water use, water drainage and water protection in the GCC countries. The outcome from this paper indicates that despite the governmental efforts in minimizing the water use, the Social and Environmental Norms (SEN) stands as an obstacle in any future water protection policies. Economically, these Norms draws the unstabillity in the strategic plans along with the unawareness of certain group of consumers. Therefore, the water use rate policy is an effective tool in water resources plans and could be controlled through evaluating the SEN. In this paper also developed is Countries Water COnsumption Chart (CWCP), which helps the decision makers to draw the logical conclusion on how much the SEN and other stresses can impact both the water use policy and cost of production. This will help in the implementation of proper water policy for the government. However, ranking of the water resources is based on the utilization, safety, availability, and operational options. This paper is based on the review of available experienced papers in the gulf region and world wide technology. The significance of this paper is that it will emphasize on the various kinds of economical activities in the GCC countries which could be regulated by SEN.

CHARACTERISTIC FEATURES OF ECOLOGICAL FREE ENTERPRISE

Arent K.P.
Moscow State University of Environmental Engineering, Moscow, Russia

When the ecological situation is quickly worsening and the means allocated from the state budget for environmental protection are limited it is necessary to pay more attention to the ecologically safe production, to the development of the market of ecological machinery and services that will make it possible to use the means of enterprises and non-state investors in solving ecological problems.

The role of the state in this situation consists in creating market conditions and setting the rules of "the play" for the period of transition of the national economy to the stable and ecologically balanced development.

The main directions in the ecologically safe economic development are: strengthening of ecologically safe character of the working enterprises, creating and developing new ecological productions, ecological free enterprise and ecologically safe consumption (see the picture).

The characteristic features of ecological free enterprise are the following:

profit is not always the only and main aim of the businessman, frequently the necessity of ecological problems solutions the society is faced with stands first;

ecological measures frequently require a lot of scientific research and investments, they are time-consuming;

many ecological problems can be technically and technologically solved, however from the economic point of view their realization is not always effective;

the ecologically safe character of production frequently conflicts with interests of large and important for the country branches of economy and economic complexes (Military Production Complex, Agricultural Production Complex) and the natural monopolies (Fuel and Energy Complex, Water Economy);

there is a possibility of branch, regional and temporal discrepancy between places of development of ecological free enterprise and places where the ecological effect of this development is displayed;

branch of economy and regional features connected with peculiarities of services and of production, machinery and technology of production, as well as natural and climatic features of the region.

For considering the pointed out and other possible characteristics of ecological free enterprise it is necessary for the country to have the economic mechanism of nature use limiting or stimulating the development of certain enterprises, branches of economy or regions.

It is also necessary to state the conception of development of the national economy in future - either the further increase of power resources production to which Russia still adheres or a more economical use of resources by their savings, i.e. the way accepted practically by all advanced countries.

A new tendency of enterprise activity is coming into existence, a field for market competitiveness, as ecologically "pure" production in some cases appears more preferable (more expensive but more useful) and the prices are being regulated by social purposes. The tendency of the social development will be in the direction of the global ecological safety and it is here that the advantage of the market and its ecological constituent part is.

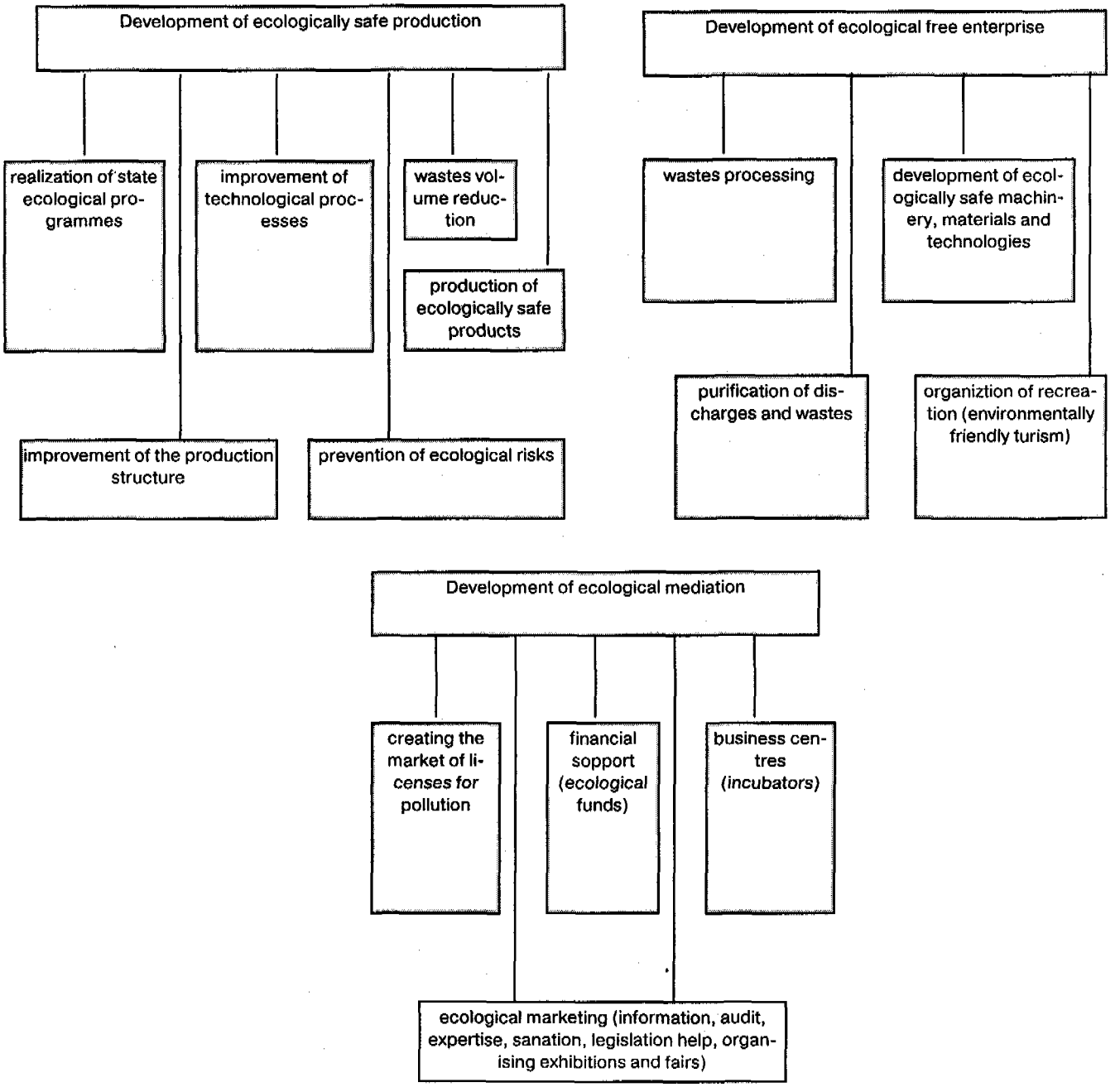

Fig. The directions of development of ecologically safe economy of the country

REVALUATION OF FIXED ASSETS

Bartz K.F.
Berliner Wasserbetriebe, Berlin, Germany

1. Importance of the valuation of fixed assets

- Impact of the valuation on the price of water
- Impact of the valuation on financing
- Allocation of the individual economic assets to the groups of assets
- Determination of the value of initial inventories on the basis of replacement values

2. Procedure concerning the valuation of the non-real-estate fixed assets

- Determination of current replacement values by a certified auditing firm
- Determination of residual value factors and value deductions taking into account their use to date, technical obsolescence and periods of use in accordance with official AfA tables (depreciation for wear and tear)
- Calculation of the opening inventories for the opening balance sheet on the basis of the aforementioned criteria.

3. Procedure for the valuation of the immovable capital assets

Real estate	Classification according to regions, types of building land, infrastructure and other specific features
Buildings	Differentiation according to type of construction and year of construction as well as the expected rehabilitation requirements
Sewerage and distributing pipes	Determination of valuation factors on the basis of the type of sewers and pipes, dimensions, type of materials, periods of use, soil class

4. Procedure for the valuation of fixed assets under construction/ unfinished assets

- Investigation of fixed assets under construction in respect of their further use taking into consideration technical requirements
- Reduction of the inventory of fixed assets under construction by means of depreciation
- Revaluation of the remaining stock

SETTING OF PRICES AND PRICE STRUCTURE IN THE FIELD OF WATER SUPPLY

Bartz K.F.
Berliner Wasserbetriebe, Berlin, Germany

1. Basic principles for the setting of prices
- Prices as a control instrument
- Cost recovery
- Safeguarding of revenues
- Accounting for performances

2. Price structure
- Bulk price
- Basic price
- Standard price
- Zone rates/graduated price
- Financing by means of contributions

3. Price components
- Costs of electric energy, personnel and material
- Investments
- Taxes and charges
- Financing

4. Price adjustment
- Subsidising in customer groups
- Subsidising by the government
- Prices in international comparison
- Price adjustment within the reform process

DRINKING WATER CONSUMPTION STUDIES AND ACCOUNTING FOR THE SUPPLY OF DRINKING WATER

Bartz K.F.
Berliner Wasserbetriebe, Berlin, Germany

1. Initial situation - planned economy/market economy
- Comparison of legal bases
- Comparison of economic bases

2. Customer relations/ basic terms of contracts
- Contractual relationship - real estate owners
- Contractual relationship - apartment owners

3. Accounting procedure
- Reading of meters
- Billing and receipt of payments
- Correspondence with customers

REGIONAL STANDARDS AND OBJECTIVES OF WATER BODIES CONDITION

Belyaev S.D.
CPPI, Ekaterinburg, Russia
Chernyaev A.M.
RosNIIVKh, Ekaterinburg, Russia

Condition of the majority of the operating water bodies in Russia is a demonstrative proof of inefficiency of the used principles and mechanisms of water management activities regulation. Has given a certain effect in due time, the policy of pollutants discharge regulation, based on the MPE-MPC ideology, requires some considerable changes.

From one hand, it impose quite hard limitations on pollutants discharge. In this case the actual situation at a water body (geochemical specifications, depth and nature of technogenic transformations, particularities of maintenance) is not taken into consideration. For the best motives, practically all the most important water bodies are considered as the fishery water reservoirs with the appropriate requirements to the water quality. It leads to a paradox: enterprises should often discharge water of better quality than they have ab-

stracted before. The obviously unfair game provokes breaking the rules by all means.

From the other hand regulation leads to legalization of the pollutants discharge whereas in modern understanding and according to the world positive experience, water management must be oriented towards permanent minimization of pollutants discharge till strategically prospective cease of their discharge. The objective factor like incomplete knowledge on multiple processes in hydro-sphere and mechanisms of pollutants influence on man should be taken into consideration. There always is a possibility of "underestimation of a danger".

The principally other approach is proposed. It has two major directions of implementation.

The first is to refine the order of regulating raw waters quality. All-state regulation should be of a framework nature. In the appropriate documents the definition of regional (or/and basin, reservoir) water quality standards should be fixed, where in full extend regional hydro-chemical peculiarities, depth and reversibility of technogenic transformations, etc. should be considered. Methodology of defining such standards is the subject for profound scientific research, and evidently shall provide for the fundamentals of documentation concerning water quality state regulation. The indicators of "natural" (or considering technogenic history "quasi-natural") back-ground could be the basis of regional standards. Conformity to this standard is actually one of the final objectives of the regional (Oblast, basin) water management policy. Thus, the ideological meaning of the standard is shifted from "now, immediately and notwithstanding anything" to "in the end, that is finally".

The second direction is to develop the ideology of the objectives of water bodies condition. The core of it is as follows. After identifying the regional water quality standard for each individual water body (or before adoption of regional standards those existing are valid) the condition of every water body is assessed, point and diffuse sources of pollution undergo inventory (with the analysis of the main industrial technologies and effluents treatment, if applied). Further on the analyses of technologies for production work and effluents treatment which are used abroad is carried out, and the technical and economic aspects of their applicability in the region are evaluated. On the basis of carried investigations the economically substantiated technological scheme allowing to improve water body condition indicators is identified. The period of its implementation and prospective objectives (those may be definite concentrations for this or that range of ingredients or certain integral indicators) are calculated. These indicators should be approved by the Government of a constituent as objectives for the calculation period.

The basis of payments calculation for pollutants discharge into water bodies is not MPC but objectives. In this case only the costs for implementation of the recommended technology (adopted when identifying the objectives) on effluents treatment or recommended changes in technology of the production work are set off as the payments made by an enterprise. Better technologies than those recommended and shorter terms are additionally encouraged. The mechanism of economic incentives should include not only the system of fines, penalties and offset but also preferential credits from a specially created purpose oriented fund and perhaps other incentives. When reaching objectives or finishing of the planned period the procedure should be recurred.

Thus, the idea of permanent and step-by-step minimization of pollutants discharge into water bodies can be implemented. The economic and technological substantiation of objectives and terms of their achievement and mechanisms of implementation provide good motivation for all the subjects of water management activities.

We should specially underline that it is possible to start this ideology implementation now in the frameworks of current standards and norms not waiting the restatement of questions of regulating water bodies condition on the state level. For this purpose we can use widely spread practice of establishing so called "temporary agreed discharges" (but somehow changing it). The "temporary agreed discharges" parameters themselves are determined as mentioned above.

the ideology of objectives of water bodies condition gives an economically substantiated ground to implement the policy of orderly reduction of destructive impact on water bodies and should become the core of water management policy.

URGENT MEASURES ON RESTRUCTURING OF THE EKATERINBURG WATER SUPPLY SYSTEM

Belyaev S. D., Yandyganov P. Y.
UB CPPI, Yekaterinburg, Russia
Hoffer Y.
"AQUANET", The Netherlands

Ekaterinburg is declared by Sverdlovsk oblast government the risk territory by drinking water supply. The main and the most general reason of water supply problems is that the existent management systems of water resources and of city water sector do not satisfy requirements of the present situation. The current institutional economic and legal basis of water sector functioning do not permit to generate sufficient finances for protection and regeneration of water supply sources, for efficient water infrastructures management, their renovation and extension.

Passage to the path of sustainable development of water management sector demands considerable investments. However no one investor will invest money until he receives guarantees of its reimbursement. Only the clear system of property relations and cost-effectiveness may become such guarantee.

Within the frameworks of the Environmental Management Project of the Russian Federation (Project) the following proposals on restructuring of city water sector of Ekaterinburg are worked out:

- A non-commercial Fund "Water sector management" is created at the city administration. The Fund represents the interests of population and municipality as the owner of main water supply and sewage installations. It is responsible for management of the correspondent infrastructure including planning of its development, investments, extension and renovation.
- The Fund concludes an agreement on entrusted management of municipal property (main water supply and sewage operating installations) and a contract on operation with the operating company (Vodokanal). Procedures of relations of the parties, responsibility, controlled operation indicators etc. are clearly and in details described in these documents.
- The tariff for water supply and sewage consists of three components:
  - Operator tariff - covers costs of Vodokanal for realization of water supply and sewage services, corresponding part of collected payments comes to Vodokanal.
  - Owner tariff - part of the tariff meant for funding of extension and renovation of principal operating installations, repayment of loans received for these purposes etc. Corresponding part of collected payments comes to Fund. Separation of this part of finances from both Vodokanal and municipality increases the guarantee of its collection and purpose use. It creates favorable investment atmosphere.
  - WRM tariff - part of the tariff caused by payments for raw water use and for effluents discharge.
- Tariffs determination procedure.
  - The list of measures for planning period (5-10 years) and its priority is determined on the basis of detailed analysis of the situation.
  - Preliminary evaluation of these measures cost is made.
  - The cost of one cubic meter of water is determined by the division of estimated cost by planned volume of water consumption (diversion).
  - Its economic acceptability is evaluated. If it is unacceptable the revision of plans is carried out (less priority measures are excluded).
  - The source of financing is determined. If necessary the borrowing at financial markets is carried out.
  - A competition for realization of package plan is conducted.
  - By the results of competition the final cost of measures is determined and final calculation of the tariff is made (considering credit rates in case of its realization).
  - Procedures of pre-term tariff change are determined (for example, in case of considerable decrease of water consumption).
  - The cross-financing principle (overstatement of tariffs for enterprises, understatement - for population) is step-by-step expelled, as it has no economic reason and is ineffective.
  - Hopeless non-payments are counted by increasing coefficient in the tariff (at present, non-payments in Ekaterinburg make 35-40%). This coefficient constantly decreases and is brought to the unity during the planning period, say, 3-5 years.
- For elimination of not properly use of payments it is proposed to bring "transit" accounts (for example, water supply and sewage services should be in separate line in rent bill and in determined proportion are entered to the accounts of Vodokanal, of Fund and of the water resources management bodies).
- The priority task is the renovation of distribution pipelines. Condition of pipelines is the main reason of accidents of the water conduct, leakage and secondary drinking water pollution.
- Strategic task is setting of water meters in each flat as the mostly efficient measure to stimulate resources economy.

Proposed scheme being the adopted French model in authors' opinion is the mostly suitable to the present conditions. Sharing of water management enterprises may be efficient after achievement of stabilization of water management sector.

Project implementation Team worked out and referred for analysis to the city administration, Vodokanal and to other interested parties the drafts of legislative acts (decrees, constitutive documents, contract, methods of tariffs calculation etc.), providing transition to the proposed system of relations in the city water sector. Implementation of this scheme will result in clarification of property rights, responsibility and mechanisms of expenses recovery, which will permit to attract necessary investments.

If we speak about preliminary evaluation of possible tariffs changes for population they remain within acceptable limits. Simple example. For repayment only at the expense of population of the loan of 100 million US dollars (it is the preliminary evaluation of costs for rehabilitation of 500 km of distribution pipelines) received on standard terms of the World Bank, each inhabitant of the city must pay extra 0.35 - 0.40 US dollars per month.

Thus we proposed the mechanism founding sustainable development of the Ekaterinburg water sector, opening real ways for cardinal improving of drinking water supply in foreseeable terms.

APPROACHES TO IMPROVING ECONOMIC INSTRUMENTS IN MANAGING WATER USE IN UKRAINE

Bilotkach U.
Water Resources Program Manager, USAID-funded Environmental Policy and Technology Project,
managed by CH2M HILL International Services, Inc.

This paper presents a rational and recommendations regarding approaches toward improving application of economic instruments in managing water use in Ukraine, and is based upon findings of relevant studies, funded by the U.S.

Agency for International Development, as well as reports and recommendations of Organization for Economic Cooperation and Development.

The following are recommended actions to improve applications of economic instruments in water protection sector of Ukraine:

1. Revise water quality standards to provide for their harmonization with European Union legislation. Economic instruments (charges) in Ukraine depend on whether pollutant discharge exceeds Maximum Allowable Discharge (MAD), which is strictly related to the Maximum Allowable Concentration (MAC). The MACs, still the same as in the former Soviet Union, are much stricter for many pollutants than ambient standards recommended by the European Union (EU). Therefore, in many cases MADs are set at levels that are difficult or technically impossible to achieve.

2. Revise the list of pollutants subject to charges. Ukrainian legislation defines practically unlimited list of pollutants subject to charges. Too long list of pollutants creates a major administrative burden on both environmental protection agencies and industries/entities, and increasingly builds up costs of their monitoring. The list of pollutants subject to charges should be cut down, leaving only those on the list which bring the major part (say 95%) of the revenues, and monitoring of which is well established and widely exercised.

3. Revise charge rates. Since Ukraine combines economic instruments with regulations, charging for pollutant discharge below the limit (MAD) loses its role as an economic incentive to reduce the load, and should be considered as a tool for raising funds that the industries/entities can use to finance their projects to reduce pollutant loads. This should be the main criterion for calculation of the basic (below MAD) charge rates.

4. Revise charge rate multipliers for the exceeding MADs. Charges for exceeding MADs should serve as an economic incentive to reduce pollutant load, therefore they should be high enough to ensure that cost of load reduction is less than the emission charge. This is achieved by introducing multipliers for the basic charge rates. These should be different from the presently existing multipliers (set between 1.1 and 5.0 by local governments), and should have nationally uniform value for all pollutants. Since most Ukrainian industries cannot afford paying high charges for exceeding MADs, along with introduction of these charges a provision should be put in place defining that the industry is exempt from paying increased pollution charges, through a waiver granted by the environmental agency, if it demonstrates undertaking all possible measures to reduce the pollutant load. MEPNS should oversee implementation of these measures.

5. Replace existing "compensation of losses infringed to the state by violating water protection legislation" with corresponding penalties levied on industries/entities. A serious disadvantage of this "compensation" is that the industry always has an opportunity to avoid punishment for violating legislation by proving to the court that "the state" did not incur actual losses (which is true in most cases). The other disadvantage is that bringing a lawsuit to the court and proving the fact of the losses require much time and resources, while introduction of a simple penalty on industries would have been much easier.

6. Create a National Environmental Protection Fund. Ukraine's system of collecting charges for environmental pollution by numerous off-budget funds in proportion practically prevents industries from using the collected revenues as a source of investing in projects to reduce pollutant load, because these revenues are dispersed among thousands of locations, and local governments tend to use them for needs other than environmental protection. To become a real source of financing for environment-related projects, charges for pollutant discharges (as well as other similar payments) should be collected by the National Environmental Protection Fund, that would consist of central headquarters and oblast offices, and be managed by a Board of Directors -- official representatives of relevant ministries and agencies, chaired by MEPNS representative. The Cabinet of Ministers of Ukraine would approve the Regulations on the National Fund and the membership of the Board of Directors. The Board of Directors would:

- approve rules of financing grants and loans from the National Environmental Protection Fund, and set priorities and project selection criteria;
- appoint executive manager and department heads of the central headquarters, and managers of the oblast offices;
- approve a list of projects to be funded in the current year, and financial reports from the previous year.

WATER MANAGEMENT ORGANIZATIONAL STRUCTURE AND ECONOMIC MODELS

Binka P.

VHOS a.s. — Water Supply and Business Services JSC, Moravská Třebová, Czech Republic

The state of water management in the Czech Republic before privatization:

Water management organization in the Czech Republic before privatization, division of the regional companies, government steps before privatization, the forms of subsidizing water supply companies.

Two types of privatization of water supply and disposal enterprises in the Czech Republic, the advantages of each type:

Private and collective water supply organizations, privatization process and the rise of new private companies, splitting companies.

Changes in pricing and consistent turn of the State to self-financing:

Government steps in water use and sewerage price formation. State subsidies, gradual price rise.

Privatization practice:

Internally acquired experience from privatization of VHOS a.s. and other companies. Reduced water consumption and losses.

Capital investment and the development of water supply and sewer companies:

Investment financing forms in the Czech Republic, the renovation and repair of water supply and sewer systems, mounting of waste water treatment plants.

Foreign models, conclusions:

Comparison between the Czech model and some foreign ones, conclusions.

The following maps and charts will be used in the report:

A map of the Czech Republic and allocation of water supply and sewer companies, a map of water supply systems in the Czech Republic.

A chart of consecutive increase in the number of water supply and sewer companies.

Water supply and sewer price rise and water consumption and waste disposal reduction charts.

Charts of investment growth in the vicinity of the city of Svitava since the beginning of the privatization, State and private shares.

WATER MANAGEMENT REFORM AND DEVELOPMENT IN CHINA

Guoliang T., Zhengze T.
Information Research Institute Ministry of Water Resources, Pekin, China

1. During a long period the water management development in China has run up to a large scale. Before 1995 there were constructed the water reservoirs with the total storage of 480 km3 that is 17% of the average long-term river run-off volume.

Water management objects and works can supply the consumers with 540 km3 of water in a year. The area of irrigated lands is 50 mln ha. The capacity of hydroelectric power stations is 50.85 mln kW (works that are under the jurisdiction of the Ministry of Water Management supply with 40% of the total capacity).

As for the protection against floods all main rivers in China are controlled; there were organised the measures which enabled to reduce the erosive processes and erosive wash-out of soil by 1.1 mln t in a year.

The scales of hydroengineering and water management building do not reduce. In 1991 the construction of hydrosystems at the rivers Hwang Ho and Yangtze was finished.

2. At present there is the structural-economical reform in water management. It is aimed at the organising of market-oriented socialist economics in China. The main results are as follows:

a) On 28 October 1997 the State Council of China adopted "The Policy concerning property in water economy". It appointed water management as the basic branch of the economy in China.

b) The multi-channel system of water management building financing has been organised. The State Council of China approved "The Order of financing and using of the fund for the water management building". In December 1997 the company of water management investment of China was founded.

c) The pricing system has been formed and the chargeable water use has been put into practice. The water price is determined by three factors: cost price, tax and benefit. In different provinces the new water tariffs were published, they were worked out together with the authorities of price policy and water management.

d) The system of water legislation is under the development. The Water Code, Law on protection against soil erosion, Law on prevention and liquidation of water pollution have already been adopted. In 1998 the Law on protection against floods started to be developed.

The system of water use licensing is applied in the majority of towns and districts in China.

e) There are the reform and restructuring of the property in water economy. The water business is developing.

3. The strategy of persistent sustainable water management development and long-term plan of water management development are worked out in accordance with "The agenda of the 21st century in China". The basic concepts are the following:

a) to find the latent reserves of the available water management objects and to increase the efficiency of water resources use;

b) to continue the rational exploitation of water resources in accordance with the requirements of the national economy development;

c) to strengthen the water protection against pollution, conservation of water resources and improve the water environment.

By 2010 it is necessary to increase the capacity of water management objects to supply water consumers up to 640 km3 in a year and the area of water-saved irrigation over the whole country up to 26.7 mln ha.

COST ACCOUNTING AND COST REDUCTION POTENTIALS IN THE FIELD OF WATER SUPPLY

Hennig B.
Berliner Wasserbetriebe, Berlin, Germany

1. Tasks and objectives of cost accounting

- Instruments used in cost accounting
- Recording and allocation of costs in conformity with the principle of causation
- Economics and technology/technical equipment

• Analysis of cost structures of individual sectors and/or of the whole company as the basis for economic decisions
• Cost unit statements of operating results
• Cost comparison methods
• Forecast accounting
• Price calculations

2. Cost reduction potentials
• Determination of savings possibilities in individual cost types
• New construction or re-construction
• Setting of technical standards

POPULATION'S ABILITY AND DESIRE TO PAY FOR IMPROVED SERVICES IN THE WATER SUPPLY AND SEWAGE SPHERES

Jackobsen M., West-Hansen K., Stepanishchev S.
COWI Co., Lyngby, Denmark

Initial information

In Russia and other CIS countries water supply was always considered traditionally a social service that is rendered to the population at very low prices. Domestic consumers paid less than one cent for a cubic metre of potable water, and usually there was no dependence of the payment rate on the amount of water consumption.

The system functioned well. However, in the setting of the transitive economy, the state subsidies for municipal services' operational cost are reducing or have already considerably reduced. On many occasions the water supply and sewage systems are old enough and in a poor condition, which further increases the operational cost. At the same time, the fact that the population of urban areas consumes daily 200 to 300 l of water *per capita* confirms that the consumers spend too much water. For instance, the *per capita* daily water consumption in the West is 110 to 160 l.

As a result of these antagonistic trends, the water management trusts are faced with ever increasing difficulties in rendering adequate services to their consumers and treating sewage water in accordance with the existing requirements.

These trends and developments will be briefly described in the presentation.

Solution

There is no simple solution of the aforesaid problem, but it is necessary to take a whole series of measures, including restoration of systems, explanation campaign, changes in payment rates, organizational and institutional changes. As far as the payment rates are concerned, the principle of full repayment of the costs and dues for environment pollution has been adopted principallyat the general political level but has not been realized for various reasons.

The presentation will emphasize the necessity of all-round consideration of the problem and combination of engineering, financial and organizational approaches.

Population's ability and desire to pay for public utilities

COWI Co. analysed population's ability and desire to pay for improved services in the water supply sphere in several CIS countries.

In the presentation the methods will be presented of analysis of the ability to pay on the basis of a real evaluation of families' income using the methodology of assessment of alternative incomes.

Besides, the methods will be presented of quantitative evaluation of the desire to pay for improved services, e.g., water supply for more hours per day, less seasonal fluctuations, better quality of water (taste, odour, pressure, etc.), improved treatment of sewage waters, which will improve the environmental situation, reduce the disease risk, etc. The presentation will be based on the modern methods of investigation and statistics, already tested in several countries, including Denmark, Ukraine and Belorussia.

Investment planning in the water sector

The presentation will touch also interconnections between detailed analyses of the consumers' desire to pay for improved services and technical designing. The said analyses contain valuable information on a general increase in incomes, which will be acceptable to the consumers, depending on the type, quality and rapidity of the perfection achieved due to certain investments.

LEGAL REGULATIONS OF WATER MANAGEMENT ACTIVITIES FOR A BETTER WATER MANAGEMENT, LET'S TALK ABOUT WATER LEGISLATION IN EGYPT

Kady M.E.
National Water Research Center (NWRC) MPWWR - Government Of Egypt, Cairo, Egypt

Egypt's location in the semi-arid region as well as being on the tale end of a river shared by ten different countries makes it suffer from very limited water resources. Egypt is also one of the countries which suffer, inspite of all the efforts, a tremendous increase in population, which led to a policy and an action plan for agriculture expansion to increase food production as well as job opportunities. The government of Egypt also adopted a policy for increasing industries to help the nation's economy. More people, agriculture and industries means a greater demand for water quantities and more deterioration of water quality.

Since more than six thousand years ago irrigation and drainage have been practiced in Egypt. Thus irrigation engineers in Egypt are very skillful, but with the water scarcity

condition Egypt is going to face in the near future it is quite a challenge for the whole nation in general and for irrigation engineers in particular to set an integrated water management strategy. Such a strategy would not be possible without the strong support of a legal framework that provides the water managers with guidelines and tools for the planning of new developments, the allocation of water, the operational management and maintenance of both the irrigation and the drainage system and the management of water quality activities.

Egypt has a very long history which is full of legislation actions and agreements which took place since the Pharaonic era. Some of these agreements and historical rights have been enforced, others have not been.

During the last ten years the water quality deterioration indicated clearly that there exists several holes in these laws and Egypt needs a real action plan to correct and inform and enforce the appropriate laws to keep up its water resources and its environment.

Several laws have been issued:

- Law No. 213 of 1982 concerning the Issue of the Law on Irrigation and Drainadge";
- Law No. 213 of 1994 regarding Farmer Participation;
- Law No. 48 of 1982 concerning the Protection of the River Nile and Waterways from pollution;
- Law No. 4 of 1994, law for the Environment".

Issuing relevant laws are not the instruments to manage Egypt water resources, though public awareness and law enforcement can help reaching the optimum utilization of this resources.

At the present time, Egypt is facing the challenge of developing a mechanism to enforce different water and environment laws.

There has been always some different perspective to many cases between water resources specialist, experts, lawyers, and legislation experts. Normally no one combined the two.

This paper will present the perspectives of a water resources specialist, and it will discuss the following issues:

- A historical review of irrigation (water resources) legislation in Egypt;
- Water scarcity conditions in Egypt;
- Obstacles and challenges of water law enforcement;
- Water and the environment laws;
- Challenges to face and actions to take.

SEVERAL QUESTION OF THE ECONOMICS OF THE WATER SUPPLY AND SEWERAGE ECONOMY OF SAINT PETERSBURG

Karmazinov F.V.
The SUE "Vodokanal of Saint Petersburg", Saint Petersburg, Russia

For the solving of the main tasks of the city water supply and sewerage economy, i.e. the provision of the regular water supply and sewerage of the city, a number of programs is developed and carried out (the improvement of drinking water quality, economy of water, the stopping of non-purified sewage discharge into reservoirs, reconstruction of deteriorated water supply and sewerage nets). Many programs are to be financed from the federal budget (e.g. the program of the protection of the Baltic Sea waters, upon which the governmental obligations exist, the program of the reconstruction of water supply and sewerage nets, mainly in the central part of the city as the part of the Program Center). Other programs are to be financed from the city budget, e.g. the programs of the increase of the capacities of the water supply and sewerage head constructions in order to give the city the possibility of development. But at the present time the operation expenses of water supply and sewerage economy remain the real source of investments. I.e. the cost of water supply and sewerage economy services increases, what leads to the increase of tariffs. Such practice exists nowadays in the West, where for the purpose of urgent programs of the improvement of water supply and sewerage economy services they use credits, which are included in tariffs together with per cent. The SUE "Vodokanal of Saint Petersburg" also uses such practice, and this partly explains the size of water supply and sewerage tariffs. At the same time the work upon the decrease of the cost of services at the expense of energetic and material resources economy is effected at the SUE "Vodokanal of Saint Petersburg". E.g. the expenses for the purification of sewage sharply decrease owing to the change of aeration system, i.e. instead of aerators made as steel pipes with holes the aerators from porous glass-plastic pipes are mounted. The regulation of quantity of electric motor revolutions is introduced at pump stations. The expenses for flocculents are decreased for 20 % owing to the creation of the unit for the production of flocculents for centrifuging of sewage precipitation. The doze of reagents decreases owing to the use of small doses of flocculents during the purification of natural waters. And on the whole the process of purification becomes cheaper. The energy economical technology of sewage precipitation burning, which needs fuel only for the period of incinerator kindling, and further on the burning process is carried out owing to the burning of precipitation organic component is being introduced. The measures upon the utilization of the heat from the process of precipitation burning are foreseen.

The program of the material and energetic resources economy allows to increase the allocation of the part of operation means for investments.

Investments decrease considerably owing to the introduction of new technologies upon the renovation of water supply and sewerage nets. The experience of the work upon the reconstruction of water supply and sewerage nets on the central street of the city on Nevsky Avenue showed that, besides the reduction in price of works owing to the decrease of many accompanying works, the possibilities for the creation of the areas for the laying of new nets appeared. The works were fulfilled within 1.5 year without closing of traffic along

the avenue. Now this experience is expanded for other streets of the city.

For the involvement of investments for the development and reconstruction of water supply and sewerage constructions the means of many constructors of the city are involved by laying down the demands when issuing technical conditions for their construction or development.

BALANCING WATER SECTOR NEEDS WITH RESOURCES: THE ST.PETERSBURG EXPERIENCE

Karmazinov F.V.
SUE "Vodokanal of St Petersburg", Saint-Petersburg, Russia
Cullen R.J.
Mott MacDonald

In 1995 Vodokanal of St Petersburg (VK), supported by the European Bank for Reconstruction and Development (EBRD), prepared a Project aimed at Short-term improvements to the water supply and wastewater systems in St Petersburg. This has resulted in a loan of DM 158 million to VK which was signed in July 1997. The package also includes grants which add a further DM 20.2 million.

The 1995 studies included a recommendation that VK extends its planning horizon, as a result of which VK and EBRD set up an arrangement whereby six European consulting firms carried out a long-tern strategic planning exercise for VK's water supply and wastewater functions throughout VK's area of operation. This included the City of St Petersburg and the majority of the area of St Petersburg's suburbs.

From this a long--term strategy of prioritised investments for the period 1998 to 2015 was prepared for each sector, covering both treatment and water distribution and sewerage. A medium-term investment plan, covering the period 2001 to 2005 was then prepared in more detail.

Amongst other development objectives, these studies were aimed towards achieving:

- safe and reliable water supplies;
- meeting the wastewater effluents standards set by the Helsinki Commission (HELCOM);
- long-term increases in operation efficiency and associated costs savings: and
- transition of VK to a modern and financially strong utility.

This work was supported with grants from the governments of Denmark, Finland, France, Germany, Sweden and the United Kingdom. It also included a component aimed at reducing industrial water consumption and improving the quality of associated effluents. The work started in June 1996 and was completed in July 1998.

Initially each of the four sub-sectors - water treatment, water distribution, wastewater collection and wastewater treatment - were considered separately, with long-term development programmes designed to modernise and expand each of them to a "steady" and efficient state. Inevitably rates of progress and priority in one sub-sector impacts on the development of another, and planning criteria overlap; (for example ensuring that collector sewers were ready in time for commissioning a new wastewater plant). These aspects were considered whilst planning the sub-sectors.

When the four sub-sector plans were considered together, the total investment required by 2015 was about US$ 4.5 billion, excluding taxes and duties. This is a massive sum, and was deemed to be untenable because of a combination of funding limitations, implementation capacity, and the unacceptable level of tariff which would be required to fund it.

Accordingly an integrated view was taken of:

- tariff levels and affordability, and the limits of increases from one year to another;
- a manageable level of annual capital investment spending;
- possible levels of foreign investment support and loan repayment arrangements.

As a result it was decided to target an investment programme of about US$ 3.0 billion for the period 1998 to 2015. Whilst reducing the original spending target by 33%, this is still a very large and ambitious package.

From a combination of technical and financial considerations, the period from 2001 to 2005 was considered in detail to design an integrated investment programme for the "medium-term." This is intended, ultimately, to provide the stepping stone for designing a second phase loan to Vodokanal.

A financial model developed from an EBRD prototype was used as the principle financial planning tool, aimed primarily at maintaining an acceptable cash-flow profile and balance sheet. It was invaluable as a means of testing the sensitivity of the annual investment profiles to changes in the tariffs regime.

The reduction of the "desired" capital development budget by one third posed many difficulties to the investment planners: how does one balance priorities for competing funds between, say, the water supply and wastewater sectors? How does one select the best mix of projects within a given funding limit to maximise benefits and returns from the sums invested?

This paper will discuss the approach taken to establish s strategic overviews to both water supply and wastewater sectors, and then to prioritise the various types of intervention which could be identified.

It will also discuss the way in which these priorities were related to the available funding, and the choice of process selecting pirouette components within these limits, and determining the order in which they should be programmed.

The paper then discusses the financial modelling process, and the limitations which different tariff policies impose on the size of investment. This led to the identification of a range of different investment packages between two tariff limits: a "pessimistic" limit based on the VK's current tariff development policy, and an "optimistic" limit based on tariff increases which are thought to be affordable (but which would require considerable promotion, publicity and discussion between all concerned parties before they could be

submitted for formal endorsement by the City Administration).

The next step will be to discuss the tariff issue with consumers, improve the current estimates of funding availability from interested IFIs and bilateral donors, and then to take a view on a likely tariff regime, and then revise the volume of work and get a consensus for this between VK, the City Administration and funding agencies. Then, and only then can the next loan package be finalised.

It is the first time that such an integrated, holistic and financially-driven approach has been made to the water supply and wastewater sectors in St Petersburg.

SINGLE INTERDEPARTMENTAL LIST OF NORMALIZED HARMFUL SUBSTANCES IN WATER MEDIA

Khromchenko J.L., Didenko Y.A., Maximov A.I.
Testing Centre, Municipal Water Supply and Treatment Research Institute

At present in Russia to normalize content of harmful substances indifferent water media (raw water, waterworks tap water, sewage, etc.) they use many departmental lists of normalized contaminants which may greatly differ in structure, often have serious semantic and terminological errors, abound in trade names of products which in the stated from cannot be present in water medium.

For a majority of departmental lists used to-day, common features are:

- mechanical increase in number of normalized contaminants without considering modern hydrochemical ideas;
- absence of conception called up to ensure possibilities for effective control of a given water medium;
- normalized substances are usually enumerated in alphabetic order without considering their relation to various chemical classes, as it in used in international practice. In absence of a unified terminology this has led to setting up different normative values to the same substance but named according to different nomenclature.

With a view to ensure effective control over water media, to normalize substantially the content of contaminants in water, and to determine property amount of payments for using water resources and for pollution of water bodies, it is necessary to establish a single structure and form for the list of normalized harmful substances for all water media. It mast be based on state quality standarts, common requirements for methods of control, and on classification of chemicals adopted in international practice.

Development and implementation of a single list in practical work of various departments will ensure a uniform basis to solve control and analytical problems, including:

- methodological and metrological provision;
- establishing substantiated norms (criteria);
- determination of design parameters for developing allowable concentration and discharge of contaminants in waste water;
- calculation of payment rates for discharge of waste water into water bodies and community sewerage systems.

Introduction of a single structure and form of the list and its implementation will

Terms used:

- single - unified in one document;
- inferdepartmental - referring to several departments or agencies;
- normalized - having norm or criteria (of maximum allowable concentrations) approved by surveillance agencies.

raise the quality of developing and approving the norms by departments or agencies, taking in consideration their functions of surveillance and control.

Adoption of such single structure and form of the list will also have a positive effect on the work of organisations and enterprises, which in process of their activities interact with several surveillance agencies.

Some approaches of principle to formation of structure and form of the single list were used in Sanitary Regulations and Norms 2.1.4.559-96 "Drinking water. Hygienic requirements for water quality of centralised drinking water systems. Quality control".

In the single list of normalized harmful substances in water media the following problems mast find their solution:

- single nomenclature of normalized harmful substances;
- on mixture and trade names, containing normalized and non-normalized individual substances;
- on transformation and decomposition products of normalized harmful substances in water media;
- on normalized organic dissociating compounds;
- on accordance with the nomenclature and list of Chemical Abstracts Service (CAS).

The principle of building up the single list, its structural and terminological basis for all water media must be supported organisationally by regulations for its implementation. Thus a claim for working out a new norm of harmful substance discharged into water bodies or present in them must previously obtain a position on the list corresponding to the structure of the substance. It must be confirmed by expertise that the claimed parameter represents an individual chemical which may be present in water medium in the stated form (or that the claimed parameter represents a mixture of chemicals) and also that the given substance is absent on the list (or that there are no components of the claimed mixture of substances) under some other name (synonym), etc.

Considering interdepartmental character of the problem, the necessity of effective coordination by agencies in developing and implementing the single list of normalized harmful substances in water media, it is feasible to form a corresponding commission to solve the stated problem. The commission must be formed out of representatives of Ministry for natural resources of Russian Federation, Ministry of Public Health of Russian Federation (State sanitary and epidemiological surveillance), State Committee of Russian Federation on environmental protection together with scientists and specialists in the given field.

Development and approval of absolute values of the norms (criteria), as before, must be a prerogative of corresponding departments.

ON LEGAL DEMANDS FOR WATER BODIES AND ENVIRONMENT PROTECTION IN INDUSTRY

Kruglov V.V.
Urals State Law Academy, Yekaterinburg, Russia

The Russian Federation transition to market economy, variety of water bodies property forms, industrial enterprises privatization stipulate the necessity to form a qualitatively new water legislation. Due to this it is important to have legal guarantees for water bodies and environment protection in economic management, above all in industry. Being the leading branch of economy, industry has a great impact on water bodies and environment as a whole.

An important part as to this is played by the Russian Federation Water Code, adopted in 1995 as the head water protection act.

Unlike the previous Water Code it includes numerous demands for industry to protect water bodies. They render concrete the general ecological demands while developing, designing, constructing and reconstructing, putting into practice and maintaining factories, enterprises and plants, contained in the Russian Soviet Federal Socialist Republic Law on Environment Protection, taking into consideration peculiarities of water bodies protection. These demands are to be classified as follows.

Number one, they include general and peculiar legal demands for water bodies protection. General ones stipulate that when developing, designing, constructing, reconstructing, putting into practice and maintaining industrial enterprises as well as when using new technologies, one should take into consideration the impact on water bodies and environment, take measures to prevent their pollution, clogging and depletion, hazardous water impact.

Peculiar legal demands for water bodies and environment protection are stipulated in the Russian Federation Water Code as regards separate stages of economic activities in industry: development, design, construction and reconstruction, putting into practice and maintaining of industrial enterprises. When designing and constructing (reconstructing) them and using new technologies, affecting water bodies, the development of closed technical water supply systems is provided for.

It is prohibited to put into practice installations non-equipped with devices, treatment plants, preventing pollution, clogging, depletion of water bodies and hazardous water impact. While maintaining enterprises it is not permitted to discharge into water the wastes that have not been treated and rendered harmless according to waste water norms, containing substances without stating ultimately affordable concentrations or causing infectious deseases as well as intake water from water bodies thus affecting their state.

Number two, they include demands for the water bodies and environment protection when industrial enterprises use water in some peculiar ways, in particular, for industrial needs, waste waters discharge, raw materials extraction, performing some other jobs.

Number three, they include demands for industrial enterprises to protect water bodies and environment while using some other nature resources. For instance, earth and forest ones within the limits of water reserve zones, earth resources, etc.

The demands mentioned above should be added by the demands for water bodies and environment protection, contained in some other laws and normative legal acts of the water legislation of Russian Federation and its subjects, taking into account specific conditions of the latter. These demands are, for instance, formulated on the Regional Law Project on Water Relationship Regulation in Sverdlovsk Region, developed by the region itself.

Demands for the water bodies and environment protection, contained in the water legislation, should be rendered concrete under the normative acts of civil, economic, administrative, labor and some other branches of legislation, regulating arrangement, design, construction and reconstruction, putting into practice and maintenance of industrial enterprises. At the same time the system of organizational, legal(including juridical responsibility), economic, technical, ideological and other measures, aiming at realization water bodies protection demands, has to be developed.

ECONOMICAL STIMULATING OF TECHNOGENIC DEPOSITS EXPLOITATION

Pakhalchak G.Yu.
Government of the Sverdlovsk Oblast, Russia
Ignatyeva M.N.
Urals State Mining Academy, Yekaterinburg, Russia

In spite of the high efficiency of the dump waste products recycling wastes are utilised in small volumes that leads to the essential losses of valuable ingredients, premature exhaustion of mineral resources, increase of expenditures for the maintenance of tailing-tanks and dump economy, deterioration of the ecological situation.

Measures of the government regulation aimed at the completeness and complexity of the entrails use include the legal order of the entrails use paying. In accordance with it the rate of payments for the right to use wastes of mining and recycling industries, is determined by 25-50% of payments for the right to extract appropriate minerals. It is allowed the partial or complete exemption from payments for the use of overburden and holding rocks, wastes of mining and appropriate recycling industries.

The proposed approach to the calculation of the payment rates for the wastes recycling provides for the use of the coefficients system that forms the reduction value of the regular payment base rate for the recycling of ferrous solid

and liquid wastes, recycling of non-metallic wastes and exploitation of technogenic deposits.

The complete exemption of the entrails users from payments for the wastes recycling is recommended in the cases as follows: 1) one of the wastes recycling aims is to improve the ecological situation at the territory or 2) the recycling wastes were acquired by the entrails user as a result of the fulfilment of the available licence to use entrails.

ON LEGAL REGIME OF WATER BODIES USE

Pokatova V.P.
Urals State Law Academy, Yekaterinburg, Russia

The right of water use is the most important component of the right of nature use and is regulated in accordance with its general objectives and principles. At the same time it has the specific features caused by the peculiarities of water as an object of the use.

The legal regime of the right of water bodies use takes into account the features as follows:

1) The strict target character of water use that (according to the article 85 of Water Code of the RF) is carried out for the purpose of drinking and economical water supply, public health service, industry and power engineering, agriculture, forestry, hydroenergetics, recreation, construction, fire safety, fish industry, hunting industry, timber rafting, minerals extraction and other purposes. Drinking and economical water supply has the priority.

2) The use of water bodies with the application of engineering works and technical facilities or without such. The legal regulations of water use are formulated accordingly.

3) Detached or joint use of water bodies by enterprises and citizens.

Meeting requirements on the water bodies protection (provided for in the art. 94 of Water Code of the RF) are of great importance for the legal regulation.

In our view the special water-protection requirements are of fundamental importance. They should define concretely the general requirements on water bodies protection taking into account the individual kinds of water use.

The special water-protection measures should be provided for in the laws of the constituents of the RF or in the other normative legal acts of the RF and its constituents regulating the individual kinds of water bodies use.

INVESTMENT POLICY OF WATER-PROTECTION AND WATER-MANAGEMENT PROGRAMMES IMPLEMENTATION

Prokhorova N.B., Pozdina Ye.A.
RosNIIVKh, Russia

The contribution presents the approach to the solution of the problem concerning the investing of the water-protection and water-management programmes giving an example of the Complex Target Programme "Ob".

The solving of this problem is very important as regards the programme implementation, since the vagueness in the investment issues makes difficulties in the process of the formulation of programme implementation steps and in the choice of priorities in the programme measures.

The sequence of the programme expenditures calculation is supposed as follows:

- to calculate every measure expenditures;
- to distribute the total expenditures by years;
- to calculate the expenditures in blocks by years;
- to calculate the total yearly programme expenditures taking into account the expenditures in blocks;
- to calculate the planning amount of investments in the programme by years;
- to calculate the balance between the necessary expenditures and possible investments;
- under the deficit of investments the programme measures are postponed by the next year (taking into account the proirity of the objectives);
- when the programme terms and financinghave been co-ordinated, the programme implementation steps are approved finally.

At present the financing sources are limited. Budget deficit in all levels causes the reduction of expenditures of nature-protection purposes. The exit is supposed as the introducing of the economichal mechanism oriented on the market regulation.

Such the mechanism enable to increase the efficiency of the water-protection activity stimulation and includes the following main key factors: water use requiring payments; market of water use licences; subsidies including the taxation stimulation and low-interest loans; compulsion measures (fines, bonds of activity); flexible policy of the price formation. Consequently the possibility of organising of the special fund of water bodies rehabilitation and protection will appear. This fund will concentrate the basic portion of expenditures which will be directed on water programmes of the Russian Federation constituent.

The real financing sources today are the own means of water users, means of non-budget funds (ecological funds in particular), loan means, private and foreign investments.

It is supposed that the fundamental and branch researches should be financed by means of the State central-

ised resources (budget, the Russian ecological fund, loan means). The other researches should be financed by means of the territories and water users resources.

It is evident that the means, acquired as the payments for water use, cannot cover total expenditures on the sustainable water management in the basin water system for a long time (and may be never cover). Therefore the policy of self-financing of water programmes and water management organisations, serving the water supply and sewarage in settlements, should become the strategical direction of such programmes financing.

The present contribution contains the information concerning the financing of the Programme "Ob" implementation in the borders of the single constituent of the Russian Federation - the Sverdlovsk oblast: necessary means and investment sources during the whole period of the programme implementation.

Analysing the available financing mechanism, the forecasts of the Programme financing during the whole period of its implementation may be the followings:

1. The portion of the expenditure part of the Federal budget on ecology has been reducing in consequtive order since 1994. In 1994 0.6% of the expenditure part of the Federal budget was directed on environment protection. In 1996 this portion was 0.5%, in 1997 it was planned as 0.4% that is less than minimum permissible level in several times. There is no expenditure on the ecological programmes financing, on the support of nature-protection authorities, on the renewal of the depreciated and imperfect technical-technological and material bases.

The principle provision is the aspiration to self-financing of the Complex Target Programme "Ob" concerning some programme measures for the Sverdlovsk oblast.

2. Financing by means of the regional budget resources at the beginning step of the programme implementation (1997) will remain at the former level or will reduce by virtue of the financial resources transition into the other social-important spheres (agriculture, housing and communal services, etc.)

3. Financing of nature-protection measures by means of the own resources of enterprises, and share holding of enterprises in construction of nature-protection objects are the most suitable and essential in general amount of investments in the region. Introduced the payments for the water use in accordance with the new Water Code, it is expected that the entrance of means to the Oblast budget on the special accounts of water bodies rehabilitation and protection will be equal to 79.103 milliard roubles in minimum and assignments to the Federal fund of water bodies rehabilitation and protection will equal to 52.736 milliard roubles only for the use of the Ob water potential. In total it is equal to the common investments into the protection and rational use of water resources in 1995 in the Sverdlovsk oblast at the expense of all financing sources (145.9 milliard roubles).

4. The possibility of financing from the ecological funds remains at the former level.

5. Last years the foreign help in relation to the environment protection in Russia has increased essentially. According to the forecasts of the Committee of the Sverdlovsk oblast social-economical development, it is expected that the portion of the foreign investments into our economy will increase. The objectives of the nature-protection programmes including water-protection programmes can be reached by means of the increase of investing amount into the development of the regional high-technological and science-consuming production base.

6. Credits for the programme implementation can be acquired under the certain economical conditions. The favourable crediting is not possible. In contrast the current financial policy in Russia is oriented on the reduction of any privileges as maximum as possible.

ON QUESTION OF FORMULATION OF REGIONAL LEGISLATION ON WATER RELATIONS REGULATION

Romshin I.A.
RosNIIVKh, Yekaterinburg, Russia

The Water Code of the Russian Federation as a general legislative act of water law has been functioning for two years. In order to develop it the Government of the Russian Federation has adopted a number of the legal acts regulating water relations.

There is a legislative activity at the Federal level concerning the regulation of water relations (we shall not concern the substantial aspect of these acts in the present contribution).

And what about the regional water legislation, in the Sverdlovsk Oblast in particular? In accordance with the legal provision that the water legislation is under the joint power of the Russian Federation and its constituents, the Sverdlovsk Oblast has also decided to have the own law on water which would take into account the peculiarities of the Sverdlovsk region, correct the Federal Water Code errors, make some additions and perhaps offer the new ideas in regard to the management of the utilisation and protection of water resources. There is the objective of the new Oblast Law "On the regulation of water relations at the territory of the Sverdlovsk Oblast".

The development of the regional legislation has two alternatives: either to adopt small acts as the Law "On drinking water" or to adopt the universal, comprehensive law which would contain the common, uniform principles and approaches to the water relations regulation at the territory of the Sverdlovsk Oblast and at the same time would not repeat blindly the norms of the Federal Water Code. It appears that it is necessary to chose the second way. It will lead 1) to the saving of the legislative materials (it will not necessary to adopt a lot of small acts) and 2) to the uniformity and coherence of the legal regulations of water relations in the borders of the Sverdlovsk Oblast.

It is also reasonable to complete the draft Agreement between the Ministry of Natural Resources of the Russian Federation and Government of the Sverdlovsk Oblast concerning the power delimitation in the field of water relations and water resources management.

PLANNING, CONSTRUCTION, FINANCING AND MANAGEMENT OF A MUNICIPAL SEWAGE TREATMENT PLANT IN THE URBAN DISTRICT SOUTH BUTOWO IN MOSCOW ON THE BASIS OF THE BOT MODEL

Schroeder R.
SHW Hoelter Wassertechnik, Berlin, Germany

1. The Project:

The project concerns the construction of a new sewage treatment plant for 250,000 inhabitants with a treatment capacity averaging 80,000 m^3 of waste water per day. This sewage treatment plant will be the disposal facility for a new residential settlement in the South of Moscow.

2. The BOT Model:

The entire project will be planned, built and operated as well as fully funded by the SHW Wassertechnik. The sewage treatment plant will be commissioned by December 1998. Its management has been agreed upon for a period of 12.5 years, i.e. up to the year 2011.

3. The Contract Situation:

With a view to implementing the project, the SHW Hoelter Projektgesellschaft Sued Butowo with headquarters in Germany was established. Through it, the entire construction on a turn-key basis will be done at the site of the sewage treatment plant. The investment contract was concluded between the City Government, the City of Moscow and the SHW Hoelter Projektgesellschaft. The management for a period of 12.5 years will be the responsibility of a separate operating company in Moscow in cooperation with the SHW Hoelter Projektgesellschaft and Mosvodokanal.

4. Financing:

The entire project with an investment volume of more than DM 60 million was financed to 100% by the SHW Hoelter Wassertechnik. The financing was secured by a German consortium of banks. The risks involved in a foreign country were reduced by an 80% Guarantee by the Land and by a Federal Capital Investment Guarantee. The own financing share of SHW amounts to 25% of the contract amount.

5. Execution of the Project:

The entire project will be built within a period of 18 months. The building work was awarded to two companies. The major part of the work will be performed by a Russian building company. In spite of winter, all deadlines have so far been kept. Engineering and electrical engineering work will

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also be performed in a Russian-German cooperation. An on-site Project Management of SHW in Moscow will be in charge of all types of work.

6. Summary of the Advantages of a BOT-Model:

a) The execution of the entire project will be ensured within a stipulated period of time - the shortest possible period of time - by a professionally qualified staff from the Russian as well as from the German side.

b) Due to the availability of the required funds and the tight schedule, a great number of jobs will be secured in the area of the investment since the major portion of the investments will be carried out by regional companies.

c) The infrastructure for the inhabitants will be improved within a comparatively short period of time.

d) There will be an easing of the strain on the municipal budget by means of the project financing since re-payment will cover a period of 12.5 years.

e) The contracting partner in Moscow lengthens his guarantee period which is normally 2 years to the entire term of the project, i.e. to 12.5 years, through the BOT Model. The operating company will be in charge of the reliable operation of the plant, including its maintenance and repair.

f) The plant will be built in conformity with international standards, i.e. in conformity with the state of the art, taking into consideration local regulations.

MECHANISM OF ECONOMIC STIMULATION OF RATIONAL UTILISATION OF FLOOD-RISK TERRITORIES AND RECOVERING OF FLOOD DAMAGE

Shalikovsky A.V.
ROSNIIVH, Chita, Russia

The introducing of control mechanisms concerning the flood-risk territories supposes the necessity of the economical stimulation. Beside that the economical mechanism of organising of measures aimed at the flood protection must ensure the recovering of the flood damage.

The available economical mechanism provides the usage of three interdependent methods: specialised insurance, Governmental assisstence, taxation (land and immovable property).

The necessity of the use of three above-mentioned methods simultaneously is caused by the followings:

- voluntary insurance against floods cannot be spread widely while the strict order of the Governmental assistance allotment, encouraging the insurance, is abcent;

– territories, having the engineering defense, create the wrong impression that there is no danger; it reduces the insurance activity as well. At the same time the defended territories have the higher value of lands, it creates the prerequisite for using of higher taxes. Besides the defensive constructions increase the market cost of the immovable property and consequently the taxable base.

The system of the State specialised insurance against floods should not only provide with guaranteeing recovering of the damage but stimulate the fulfillment of regulations concerning the flood-risk territories utilisation.

Among the possible schemes of insurance organising the Federal scheme of the State insurance meets the requirements. The insurance organising using the traditional scheme of the property insurance ("insurer" - "insurant") does not enable to use the economical stimulation of the rational utilisation of the flood-risk territories and restricts the responsibility of the insurer concerning the insurance against floods up to 3-7% from the obligations to all insurance types in connection with the real threat of the bankruptcy under the catastrophic flood.

The scheme of specialised State insurance worked out provides the obligatory and voluntary insurances. The obligatory insurance should be used for the objects of the immovable property, constructed over again or purchased in the borders of the flood discharge, and objects constructed formerly at the flood-risk territories. Under the voluntary insurance the owners, keeping to regulations of the flood-risk territories utilisation, have privileges realised as the insurance tariffs subsidising. A portion of insurance payments is sent to the State fund of the insurance against floods (Federal and territorial) and used to balance the insurance conditions, to cover the losses and to finance the measures aimed at the flood protection and reduced the insurance unprofitableness.

The main insurance principle is the use of differentiative insurance tariffs that is the measure of the regulation of the flood-risk territories utilisation.

The land and immovable property taxes from the territories, that have the engineering defense against floods, should take into account the increase of these lands value and the immovable property cost at the expense of the flood frequency reduction. The minimum size of these taxes increase should be equal to the mathematical expectation of the residual damage and ensure the forming of the reserve fund for the emergency removal.

The Governmental assistance should provide with the guaranteeing support to the victims of floods, stimulate the wide spreading of the insurance and support the insurance system at the first steps. Consequently it is reasonable to divide the assistance into the following directions:

- restoration of the property lost;
- covering of expenditures on the temporary dwelling;
- paying of allowances.

The assistance for the restoration should be given only to the owners of policies of the insurance against floods as well as to the owners paid the taxes on land and immovable property by hightened rates.

ECONOMICAL MODEL FOR LICENSING A RIGHT TO DISCHARGE SEWAGES

Shchukina A.J., Shchukin V.P.

Economical mechanism of Environment Quality Control, substantiated on authorized limited rate and norms of payment, is a static one. It does not allow to use market stimuli in achieving ecological purposes.

Market principles are possible to be used by introducing a system of licensing, auctioning or issuing the shares for sewages. Implementation of this system allows enterprises to acquire shares, that give them a right to discharge toxic compounds in specified rates and concentrations. These shares are simultaneously an object of buy-and-sell operations at stock exchange.

Mathematical model for this approach should include technique to calculate scientifically substantiated limit for each component (M_n), for which shares are to be issued, and estimation of the share price (ç).

Specified limit of allowable contamination can be determined on the base of existing norming system for Environment quality, and for each component can be calculated by formula:

$$M_n = m_1 + m_2 + \ldots + m_i = \sum_1^i m_n , \quad (1)$$

where m_i - is a mass of discharge for i^{th} source for n^{th} component, determined by inventory of discharges (LAD - Limited Allowable Discharges - projects).

Average share price for the component with sufficient accuracy can be determined as a ratio of integral for the city payment for the component to specified limit of allowable contamination.

$$\text{If } \Pi_n = \sum_1^i M_n * P_n \text{, roubles,} \quad (2)$$

$$\text{then } ç = \frac{\sum_1^i M_{ni} * P_n}{\sum_1^n m_{ni}} \text{, roubles/ton,} \quad (3)$$

where Π_n - integral payment for n^{th} component, P_n - payment norm matching n^{th} component.

Economic evaluation, conducted in accordance with this model, lets to calculate share price for each toxic component being discharged, and to recommend cities' administrations to issue annually necessary quantity of shares to be distributed through stock exchange, where they are sold for the price on the basis of demand and proposal balance.

This approach lets avoid shortcomings, characteristic of existing economic mechanism of Environment defense, significantly simplify system of generating permissions and to put into practice mechanism of regulating ecological cost of production by regulating discharges of sewages to reservoirs. Approach encourages the producer to reduce toxic sewages.

ORGANIZATIONAL STRUCTURE AND METHODS OF MANAGEMENT IN WATER SECTOR

Sinclair M.
PADCO, L'viv, Ukraine

Many of the financial difficulties that Vodokanals in the Russian Federation are now experiencing can be traced to the nature of their institutional relationship with local government. In the past, Vodokanals were conceived of solely as operating organizations, and were functionally subordinate to the local government structure. The local government, and not Vodokanals, were responsible for the technical design, financing, or execution of water and wastewater infrastructure projects. Vodokanals also had no responsibility to operate on a financially-sustainable basis by charging and collecting adequate tariffs. Tariffs for the general population were heavily cross-subsidized by tariffs for industrial customers, which were in turn subsidized by budget transfers. The rules for setting tariffs did not take into account the need to recover fully all costs of service.

The economic environment of the Russian Federation within which the earlier institutional arrangements arose is changing radically, and the legal and institutional framework of Vodokanals have been slow in adapting to those changes. The Russian Federation has now moved toward a policy of full cost recovery by Vodokanals from all customers. State and local government budgets are no longer able to finance needed Vodokanal capital repairs and capital investments. Poorly planned and constructed infrastructure facilities require extensive repair and replacement, infrastructure capacity needs to be increased.

The rules for setting tariffs tend to impede Vodokanals from fully recovering the actual cost of providing services. As the economy of the Russian Federation has contracted over the last six years and input prices (especially for energy) have moved toward market levels, real incomes of Vodokanal customers have decreased and real water and wastewater tariffs have increased. At the same time, Vodokanal customers are being asked to bear a greater proportion of the increasing cost of deteriorating services. As a result, Vodokanal collection rates have fallen drastically, and barter accounts for an increasing proportion of collections. Considerations of electoral politics unknown in former times now tend to make local governments reluctant to approve tariff increases or to support aggressive Vodokanal efforts to improve cash collections. Customers are increasingly reluctant to pay higher tariffs for lower levels of service that they feel are unresponsive to their needs and that are being provided by inadequately regulated monopolists. The institutional framework within which Vodokanals in the Russian Federation currently operate, and the rules for setting water and wastewater tariffs, are inadequate to deal with these issues.

This Paper will describe the principal issues with respect to the institutional relationships between Vodokanals in eight cities in the Russian Federation and their respective City Administrations that should be addressed in order to enable the Vodokanals to operate as more autonomous, commercially-oriented utilities and to give the City Administrations more appropriate, transparent, and effective control over their operations. This Paper will also discuss the most likely models for resolving those institutional issues under current Russian Federation law, and will recommend solutions for the short and medium term that can, in the longer term, enable City Administrations and Vodokanals to make the transition to a model of "corporatized", financially sustainable utilities subject to appropriate local tariff and service regulation with customer participation.

This Paper will also describe some of the most important issues that need to be addressed to improve the current framework for water and wastewater tariff-setting in the Russian Federation, and will propose how those issues might be addressed so that Vodokanals can move closer to full cost recovery for their operations and for capital repairs of, and capital investments in, water and wastewater infrastructure.

LONG-TERN BORROWING FOR RENOVATION AND DEVELOPMENT OF WATER AND WASTEWATER UTILITIES

Svistunov P. V.
Fund "Institute for Urban Economics"

The very nature of utility services makes substantial reduction in volumes or deferral in delivery impossible, and therefore, there is no alternative to the housing communal sector reform. Postponement of the reform leads to progressive accumulation of losses.

In this situation, the only realistic solution is borrowing for renovation of the utilities and implementation of energy-saving technologies. An additional argument in support for long-term borrowing may be that such arrangement spreads the burden of financing capital investments equitably among several generations of consumers.

Borrowings may be structured both in the form of loans and through bond issues made by the local administrations or utilities.

The housing communal economy permits debt financing of energy-saving projects with loans repaid at the expense of funds saved in the course of their implementation. It is necessary to identify the utility units which can produce substantial reduction of operation costs through renovation with the use of novel technologies and materials;

organize the renovation at the expense of borrowed funds;

apply the funds obtained through cost-saving mechanisms to payment of interest and principal on the loan.

Example:

Renovation of a city's water pipelines with subsequent repayment of the debt from the funds saved as the result of reduction in the production costs.

Savings are generated by:

- electricity saved in the delivery process as a result of lower hydraulic traction;
- water saved through recovered hermetic sealing of the pipes;
- money saved from not having need to replace the pumps;

Taking into consideration that the said renovation of pipelines is a part of regular planned repairs, the loan may be repaid or taken in a smaller amount through use of the money saved in the utility's repair fund as the result of the renovation project.

The project involves renovation with the use of progressive technologies: without excavating trenches, applying cement-sand coating, relining, etc. The parties involved in the projects are: oblast administration, city (rajon) administration, the housing organization collecting payments for housing and utility services, water supplier, and the building company.

The main source of loan repayment will be payments of the population, because only the population pays for utility service with "real" money, rather than surrogate instruments. For the purpose of appropriation and use of savings it is proposed to retain the utility tariffs at the current level (adjusted for inflation) during the entire loan term.

The project is supposed to be financed with the bank loan taken by the utility company (vodokanal) or oblast (city) administration.

ON EXPEDIENT USE OF WATER ENERGY IN MOUNTAINOUS REGIONS (ON EXAMPLE OF ARAGATSOTN REGION OF ARMENIA)

Tockmajyan H.V., Jrbashyan E.T., Nazinyan W.R.
Association of Water Problems and Hydraulic Engineering Republic of Armenia

Rivers of Armenia are typically mountainous and are distinguished by their disproportionate discharge with strongly expressed spring flood and with steady winter low water.

The main hydro-energetic potential of Aragatsotn region is the river Kasakh with its inflows, the chutes on the irrigation channels and irrigation dams. The energetic use of the river Kasakh and its inflows is an important and target water-supply program.

A scheme of development of small waterpower energetic is worked out, the economical efficiency of small water works is proved, and the priority of their designing and construction is indicated.

Parameters and technical-economical indexes are refined on the base of additional and scientific researches.

The hydro-energetic potential of the region is estimated of 43MWt with average production of electricity of 136 MWt/h, from which 33MWt and 104.2MWt/h on channels, 6.98 MWt and 24.4 MWt/h on irrigation channels, 0.3MWt and 1.6 MWt/h on cross-heads of drinking and economical waterlines. In the research the water-supply system, water-energetic and economical indexes of small waterpower stations of the region are worked out.

The detail locations of small waterpower stations of all rivers of the region are presented. A full of information is presented enough for adoption of the current program.

PROBLEMS OF ASSESSMENT OF WATER-MANAGEMENT AND WATER-PROTECTION PROJECTS (MEASURES) EFFICIENCY

Vyvarets A.D., Distergeft L.V.
Urals State Technical University, Yekaterinburg, Russia

A scientific concept should be the basis for the working out of the methodology to assess the efficiency of water-management and water-protection projects (measures). This concept is based on the fundamental provisions as follows:

1. The efficiency of any process as a quantitative category is a relative value and could be assessed either as a ratio of the eventual result to the costs of its achievement (in this case the efficiency characterises the achieved level of "economy" and "ecological compatibility" that is the ecological-economical efficiency of a decision), or as a ratio of the same eventual result to the goal (and in this case the efficiency characterises the extent of the objective achievement).

2. The effect is the eventual useful result acquired in consequence of the implementation of a project (measure) and defined as the difference of positive and negative consequences of this implementation.

3. Under the quantitative assessment of the effect value it is used the well-known principle of a correlation between costs and benefit. According to this principle the concept "costs" (c) means the aggregate of financial resources expenditure and expenses of natural-resource potential (negative consequences) which arise in the process of the project (measure) implementation, and the concept "benefit" (b) means the total economical and ecological results (positive consequences). So both the costs and benefit include the economical as well as the ecological elements (components). The value of the effect (E) in this case is defined by the difference between the benefit (b) and costs (c) that is: E=b-c, and the efficiency (e) is defined by their ratio that is: e=b/c.

4. The principle of the parity of economical and ecological results should be kept in the process of the total effect calculation.

5. In order to consider all factors formed the benefit as well as the costs it is necessary to take into account the principles of the system approach, working out the methodology of the effect assessment. The principles of the system approach together with the "parity" principle ensure the real possibility to assess impartially the value of the integral ecological-economical effect which is the result of the abovementioned projects (measures) implementation.

6. Assessing the effect of the project (measure) implementation it is necessary to take into account the time factor, using the well-known method of discounting, since the costs and benefit belong to the different instants (they are nonsimultaneous). It enables to increase the objectivity of the assessment both of costs and benefit and consequently the integral ecological-economical effect. The assessment of the costs and benefit elements diversity should be carried out in different ways depending on their types. Since "the economical elements" "loose" their value eventually, so the more distant period of the economical result achievement from the present time, the lower its cost assessment. In contrast the value of ecological costs and benefit increases eventually (a drink of water and fresh wind is more "expensive" today than yesterday and tomorrow it will be more "expensive" than today). So in the first case the reduction of economical costs and benefit should be carried out by the discount multiplier, and in the second case (that is under the reduction of ecological costs and benefit) by the accumulating multiplier.

ON THE ESTIMATION OF MAXIMUM PERMISSIBLE HAZARDOUS EFFECTS ON SURFACE WATER BODIES

Yakovlev S. V., Nechaev A. P., Myasnikova E. V., Maksimov A. V.
Research and Engineering Institute for Water Supply, Sewage Systems, Hydraulic Structures, and Engineering Hydrogeology (VODGEO Russian Federation Research Center), Moscow, Russia

At the present time, the majority of Russia's natural surface water bodies do not comply with the standards. Excessive anthropogenic load is the main cause of this situation.

The maximum permissible hazardous effect on water bodies is the threshold estimate of the total anthropogenic effect on a water body, which does not result in changes exceeding the established level and does not prevent the use of the water body for the required purpose.

The main requirements, which should be kept in mind when estimating the maximum permissible hazardous effect on a water body, are:

- determination of the value of maximum permissible anthropogenic load;
- establishing the maximum permissible load for each water body or its part for protection of the ecosystem from degradation;
- analysis of the conditions of isolated water boies used for technical purposes with the aim of establishing maximum permissible loads for them;
- determination of the objectively oriented goal decomposition of establishing the maximum permissible load;
- protection of water bodies from pollution and depletion;
- protection of the interests of economic entities under the increased anthropogenic load on water bodies and their drainage areas;
- compliance with the environmental standards;
- adherence to the basin concept for the entire water body and its parts with the aim of planning of a complex of water conservation and environmental protection actions directed to remediation of ecosystems and protection of them from degradation;
- selection of estimation sites on the basis of water supply requirements;
- orientation to calculation of the water resources budjets of river basins and their parts, schemes of integrated use and protection of water resources, and planning of the remediation of water bodies;
- licensing and limitation of water use and permissible disposal of wastewater;
- application of advanced techniques to location, designing, and construction of new water management facilities and reconstruction of existing facilities;
- establishing the permissible rates of water withdrawal, environmental water passes, etc.

When estimating the maximum permissible environmentally hazardous effect on a water body, it is necessary, above all, to take into consideration the specificity of the economic activity, which may influence differently the water body, for example:

- all types of water withdrawal from and water disposal to natural water bodies irrespective of the sector of economy involved;
- the regime of operation and the technological level of hydraulic and water resources structures;
- development of mineral deposits, dredging, etc.;
- navigation and timber rafting;

- all types of systematic and emergency pollution of drainage areas and ground water;
- pipelines laid on the bottoms of water bodies;
- transformation of the pollution of atmospheric air into the pollution of water bodies;
- timber felling, land cultivation, pavement, and recreation accompanied by changes in the hydrographic, hydrological, hydrophysical, and hydrochemical characteristics of water bodies.

Estimation of maximum permissible hazardous effects on a water body as applied to a given hydraulic section should be made proceeding from the requirements established for fishery water bodies.

ON ORGANISATIONAL-ECONOMICAL AND LEGAL BASIS OF WATER PROBLEMS SOLVING

Yandyganov Ya.Ya.
Ural State Economical University, Yekaterinburg, Russia

The solution of water problems in the region as well as the nature use problems in the whole is caused by the realisation of the organisational-economical, legal basis. The most important elements of this basis are the followings:

- realisation of the right to dispose of natural resources and objects, its differentiation between the levels of the available State management system (the author thinks that it is not correct to use the word "property" in relation to natural resources and objects; the most acceptable category is the "disposal" of them by virtue of their natural function to meet the demands of the whole humanity without any borders) ;
- putting into practice the principle of the democracy, federalism, principle of the relative economical independence of the regions, municipalities, economical subjects;
- increasing the economical, social, "life" activities of the appropriate territories population on the base of the business principles.

The laws of the federal State system are caused the resigning State's commission regarding the disposal of natural resources and objects to the regions and the consequent differentiation of this disposal right between the economical subjects within the constituent of the Russian Federation. In accordance with this (impartial and perspective) principle the "owner" of natural resources and objects – the population of the appropriate territory – forms and elects the executive body accountable to it. As the constituents of the Russian Federation cannot solve the problems of the rational nature use in full measure only by their own efforts they delegate the portion of their functions concerning the nature use to the body of the joint authority of the nature use – to the federal level having the appropriate responsibility and accounts (i.e. they "engage" somebody to fulfil some functions) in contrast to the "preference" of the federal State bodies to dispose of natural resources.

On this base the further step of the problem solving is to stir up the activity as regards the nature use on the directions as follow:

- achieving the adequacy of the measures aimed at the nature protection to the speed and scale of the economical activity (impact on the ecosystems);
- the development of the ecological business activity aimed at the extension of the field of the economical activity and the increase of the efficiency of the creating use value realisation under the use of the natural resources and objects properties and characteristics.

SECTION V
EMERGENCY SITUATIONS AND ECOLOGICAL SAFETY OF WATER RESOURCES

ECWATECH

CHARACTERISTIC FEATURES OF ECOLOGICAL RISKS

Arent K.P.
Moscow State University of Environmental Engineering, Moscow, Russia

Ecological risks are the danger (the possibility) of the firm suffering losses and even going bankrupt when a certain ecological event takes place:

- infringement of the ecological legislation by the firm;
- changes in the ecological legislation;
- actions on the part of the public under ecological slogans that affect the activity of the firm;
- the possibility of the firm taking upon itself the ecological responsibility as a result of civil operations - sale and purchase, lease, mortgage operations with property (land, buildings and constructions, equipment);
- ecological incidents and catastrophes, which can result in environmental damages, damages of property or health of people and others.

The characteristic features of ecological risks are:

- the necessity of taking into account the requirements of ecological legislation when considering and estimating risks, though this can be not enough;
- their far-reaching consequences affecting not only the property of enterprises but also people, animals, plants (acid rains, greenhouse effect and others);
- the possibility of not only direct but also indirect consequences;
- the presence of threshold doses of pollution which can lead to catastrophic consequences;
- territorial attachment (river basin) and a possibility of pollution transfer over borders;
- the possibility of long-duration effect of pollution (the period of half-disintegration);
- high costs of protective measures and long terms for their realization;
- some measures are inefficient within short periods of time but effective within long periods, and the effect of their realization can be observed in other branches of economy or in other regions. Moreover, the effect of realization of nature protection measures can not be always estimated in terms of money (people's health improvement, improvement of recreational possibilities of the territory, increase of service life of materials and others).

The ecological risk control is a part of a more general process determining the community development strategy in a region or in the country as a whole. The concept of "the stable development" is a short representation of the purpose - "creating conditions ensuring the satisfaction of everyday needs without subjecting to risk the ability of the environment to support life hereafter, i.e. without putting under threat the ability of future generations to satisfy their needs".

For estimation of an ecological risk and its consequences expert opinions are used as well as statistical, calculational and analytical methods. While estimating and controlling ecological risks it is necessary to stick to a number of rules (approaches) in considering the above mentioned characteristic features, some of which are:

- the ecological approach demanding the observance of the existing restrictions on the nature influence in risk control;
- the integrated approach ensuring the inclusions of all existing dangers in one risk, as well as the types of the expected losses - economic, social and others;
- the rational approach meaning the comparison of probable losses and profits resulting from risk control;
- the valid character of the approach - the existence of scientific and practical as well as ecological and economic foundations of the proposed measures;
- the probable character of the approach and the alternative character of the offered measures - the necessity of evaluation of practically all possible ways of struggle against causes for occurrence and consequences of risks;
- finding the main point in the risk control program, i.e. the priority directions and measures, on which first of all their efficiency depends, requiring the concentrated use of the available resources.

The methods of struggle against ecological risk losses depend on the following:

- the form and the specific character of the risk - chemical, radioactive, thermal pollution;
- its scale - local, regional, global;
- the type of danger - direct, indirect, controllable, non-controllable;
- the time of its occurrence - potential, real;
- the tendency of development - increasing, decreasing and others.

The methods of risk control also depend on the amount of available resources - material, labour, financial and temporal.

The main types of risk control measures include: monitoring and rating of nature use, the rational character of nature use and protection of natural resources, creation of reserves of material and other necessary resources, responsibility insurance and, at last, putting an end to or diversification of activity of some enterprises.

PROBLEMS OF INFLUENCE OF OILGENOUS POLLUTION OF LAND WATER AND WORLD OCEAN ON GLOBAL CLIMATE CHANGES

Barenboim G.M.
State Centre for Water Management & Monitoring of Russian Federation Ministry for Natural Resources, Moscow, Russia)

Use of oil occupies one of the key places in world power engineering. A side consequence of this role of oil is the pollution of superficial water of land and world ocean by oilgenous substances, by formation water of oil deposits, and also substances, which are used in technological processes of production, transport and processing of oil. On the expert data about 6 million tons of oil are discarded annually in world ocean. Film and stains of the oil origin covers not less

than 1/4 of world ocean surface. The significant number of superficial water of land contains oilgenous pollution and in Russia, as a rule, in concentrations considerably exceeding permissible norms.

The estimated accounts show, that oilgenous pollution influences on the exchange of energy and mass between atmosphere and ocean, on the balance of exchange of oxygen and carbonic gas. They result in reduction of activity or destruction of phytoplankton, which plays the important role in manufacture of oxygen, and also disruption of process of biochemical circulation in ocean. Flying components of oil enter into structure of atmosphere microimpurities, participating in formation of the thermal screen of planet and destruction of ozone layer. Earlier this influence of oilgenous pollution of water was not taken into account among the factors influencing global climatic changes.

In connection with high rates of development of oil industry, with increase of oil production in a zone of sea shelf, and also in connection with growth of number of large-scale emergency oil spills, it is necessary constantly to take into account the factor of oil pollution in formation of global climatic changes and to develop measures on decrease of negative influence of this factor.

THE AUTOMATED SYSTEM OF EARLY DETECTION AND MONITORING OF EMERGENCY OIL SPILLS ON WATER OBJECTS

Barenboim G.M., Protozanova L.A.
State Centre for Water Management & Monitoring of Russian Federation Ministry for Natural Resources, Moscow, Russia
Shul'zhenko P.F., Anfilov N.V., Polyakov Yu.M.
Russian Federal Nuclear Centre of Russian Federation Ministry for Atomic Energy, Sarov, Russia
Galkin A.V.
Gubkin's State Academy of Oil and Gas, Moscow, Russia

The system is developed by the State Centre of Water Management & Monitoring (SCWMM) and Russian Federal Nuclear Centre (RFNC). The system determines pollution of natural waters by oil, oilwater mixtures, oil products and by some ecologically dangerous components of formation water at excess of the contents of controllable substances in water, since value of MPC (the real threshold of registration is established depending on specific conditions and as agreed with the Customer). It allows to use the system in non-emergency period as constantly working monitoring system of pollution of water by oil and oil products.

Besides traditional methods of the control of oilgenous hydrocarbons and their derivatives, essentially new technological feature of the system is the application of methods of registration in controllable natural water its electroconductivity and radio-activity. The changes of these characteristics in case of pollution are caused by mineral components of formation water and radionuclides, contained in formation water and in oil. Such approach considerably increases reliability of early detection of failure and reduces cost of the system at the expense of use of more simple and standard sensors, especially at their installation in a zone of crossing of a water obstacle by an oil pipeline.

The communication complex provides the collection of the information approximately from 50 posts of the control and transfer of the data on distance up to 300 kms (at line or radiorelay communication) and on considerably large distances at use of the satellite communications.

The reception terminal is supplied with a database including large volume of the reference materials and mathematical models, allowing, in particular, to predict the transfer of oil in water flow etc. Eventually information maintenance enables preparations of the managing decisions, minimizing ecological risk.

As detectors the system uses standard Russian and western devices tested in real conditions. The complex of the data transfer is checked up in those information and managing complexes, which were developed and made by RFNC for joint-stock company "GASPROM". The system is supplied with physical protection of system elements, with opportunity of their location on a surface and in thicker waters, at the bottom and on land, with coding of the transmitted information, with autonomous electric power supply (about one year) and wide temperature range of job (-50 + + 50°C). By way of conversion there are applied in system a number of high technologies created by defensive complex of industry and science in Russia.

The offered system can be in principle supplemented also by detectors on other types of pollution and consequently can use as an infrastructure, on the basis of which can form automated systems of water monitoring with wide functions. Under development of the system as applied to conditions of territory and requirements of the particular Customer the work is carried out in 4 stages:

- inspection of controllable territories, definition of specifity of the control, coordination of the requirements with the Customer;
- designing;
- installation and comissioning on a place of the pilot module of the system, including all types of detectors and a communication line with the reception terminal, and its examination;
- installation of the subsequent elements of system, input them in action and introduce the system as a whole into service.

The organizations - developers (RFNC and SCWMM) provide guarantee and subsequent service of system, and also its development.

BIOREMEDIATION OF HYDROCARBON-POLLUTED WATER AND SOIL WITH BIOSORBENT "LESSORB-BIO"

Chugunov V.A., Kondrashenko V.M., Jigletsova S.K., Martovetskaya I.I., Mironova R.I., Yermolenko Z. M., Zhirkova N.A., Kholodenko V.P.
State Research Center for Applied Microbiology, Moscow region, Obolensk, Russia

In last years, different biosorbent-based biotechnologies for treating chemically polluted environments are widely used. Biosorbents are carriers with immobilized cells of degrading microorganisms. Having been immobilized, cells acquire higher resistance to unfavorable factors. Moreover, in many cases biosorbents enhances greatly the process of biopurification.

Biosorbent "Lessorb-Bio" was tested to clean up oil-polluted water and soil. Lessorb, the product of thermal moss processing, was used as a carrier. Due to its good ability to eliminate oil spills (8-10 g of oil/ 1g of sorbent), the pure biosorbent is applied to the treatment of surface water polluted with oil and oil products.

A technique for making-up a product involving cells of hydrocarbon-degrading microorganisms and Lessorb (Lessorb-Bio) was offered. The microorganisms used were *Mycobacterium flavescens*, *Mycobacterium sp.* IG-4, *Acinetobacter sp.* NB-1, and *Rhodococcus sp.* 56D. The final product contained bacteria in concentration of 6 10^9cells/g. Oil-oxidizing activity of the product was found to remain almost unchanged after a month storage at room temperature.

The biosorbent is harbored by a surface oil film, making thus substrate available to the active agent. Laboratory water tests demonstrated that oil degradation was twofold speeded in the presence of «Lessorb-Bio» compared to that when bacteria and sorbent were used separately.

The product was also tested on soil polluted with oil hydrocarbons by using oil-oxidizing strain *Rhodococcus sp.* 56D. Specimens of podzolic soil (5% and 20% pollution) were treated with the biosorbent (10^7 cells/g). Some specimens were supplemented with nitroammofoska to provide an additional source of nitrogen and phosphorus. After 1-, 3-, and 6- month treatment, residual hydrocarbons were extracted with chloroform in a Soxlet apparatus to measure biodegradation by weight.

AQUABEL, A REPORT AND ALARM SYSTEM FOR EMERGENCY SITUATIONS

Huijser P., Dijkstra A.
Riza, Lelystad, Netherlands

The economical importance of the Netherlands waterways can easily be illustrated by the density of population in the region, the density of industrial activities in the Rhine and Meuse river basin and the density of ship traffic along these rivers. More than 150.000 ships yearly pass the German-Dutch border of the river Rhine, with some 180 million ton good. In addition, river water is used for preparation of drinking water for the major part of the population in the region. The water is used by farmers to irrigate their fields, and as drinking water for cattle. Companies use it as cooling water for machines and water managers use it to maintain waterlevels in locks and canals at the required mark.

An emergency situation caused by an accident on the water (e.g. an accidental pollution) will affect many interests in a relatively small area in a short period of time. In these cases it is very important that responsible authorities are alerted quickly, so that measures can be taken in time. The Netherlands Ministry of Transport, Public Works and Water Management developed the AQUABEL information system, which intends to support responsible bodies to deal with emergency situations on the Netherlands waterways.

The AQUABEL system assists in the collection and processing of data on reported incidents. A reporting system gathers relevant information; details are passed to emergency srvices, authorities and drinking wtare companies via various communication lines.

AQUABEL also contains details of chemicals (database), which provide emergency managers with a quick insight into the seriousness of the pollution and the measures to be taken.

AQUABEL has a GIS interface, which displays the management district of the regional body in charge. The GIS interface provides a large number of functions (such as searching and retrieving local data, communication via GIS).

The AQUABEL system is linked to other information systems which play a role in water management in the Netherlands. These include the system that registers the details of ships and cargoes, and the information system connected to the Netherlands discharge licensing system (including data on waste water discharges and on discharging companies). At the moment, AQUABEL is only used in the Netherlands. Proposals have been submitted to international river commissions to enable the system to be used along the Rhine, the Meuse, and the Scheldt rivers.

The rate of oil biodegradation was found to increase significantly after 6 month treatment with the biosorbent (up to 23%) compared to control (soil + oil), and the addition of nitroammofoska stimulated markedly bioremediation (by 50% in average compared to control). Biodegradation was 63% and 58% for specimens with 5% and 20% oil content, respectively.

The product was successful in bioremediation of sand and soil polluted with machine grease, using so called "bioplots". After 3 month treatment of polluted sand (2.5%) and soil (10%) with biosorbent (initial cell concentration 1 10^9cells/g), biodegradation was found to be 48% and 60%, respectively, that was much higher (by 2-3 times) compared to control.

Results suggest that the biosorbent is highly promising to be used for bioremediation of oil-polluted water and soil.

Investigations were performed in the framework of Project #119-95 of International Science and Technology Center (ISTC).

ON SAFETY OF OPERATION OF SPILLWAY'S OF ARMENIA

Kalantaryan T.A.
Association of Water Problems and Hydraulic Engineering Republic of Armenia

37 dams with total volume of 1950 Mm^3 are operating today in Armenia. As the area of the republic is less then 30,000 km^2, safety of operation of the dams is one of the most important problems in the republic. Service spillways are assumed as the most important element for safe operation of dams, inadequacy of which can cause dam overflow and collapse of the whole construction.

Maximum flood calculation methods based on the river discharge series are used in the designs of service spillways. Today's requirements of international organizations (as the World Meteorological Organization) to flood calculation methods are based on precipitation series and catchment properties and are known as PMP (Probable Maximum Precipitation) and PMF (Probable Maximum Flood). The difference between these methods gives inadequate results: generally results counted by PMF method are few times more then the results counted by river discharge series method. It is very important to notice that the results are non-correlated, which probably is caused by the differences in geological and geographical conditions not used in PMF. In case of Armenia, which has a complicated, multi-morph geology, it is practically impossible to estimate loses of precipitation, that's why the methods based on river discharge series are assumed preferable.

In the other hand, as the PMF methods are normative in many countries and organizations in the world, the further research of these methods is actual for explaining the reasons of results differing and to suggest a common solution in case of the republic.

ECOLOGICAL CATASTROPHES IN DANUBE LAKES IN 1995-1997

Kapochkin B.B., Nagrebetsky V.S., Isakov M.I., Kucherenko N.V.
Transcontinental Seismoprognosis Bureau (TSB), Odessa Regional Academy of Sciences (ORAN),
Odessa Hydrometheorological Institute (OHMI), Ukraine

The chemical structure of the surface and underground waters depends both on natural and antpropogenic factors, many of which are well known, which allows not only to control, but also regulate the quality of potable water.

In the report there is observed the widely spread, but not yet thoroughly studied situation, when chemical structure of the natural waters is exposed to the influence of the geodynamic processes in terrestrial crust. These processes are capable of changing the salt-, gas- and microelement composition of the hydrosphere for a short period of time (about 10 days), that leads to the extreme situations in water exploitation. In the report there is used the information on the systematically originating extreme situations connected with water exploitation in the south of Odessa area, which have the characteristics of natural catastrophes, stipulated by natural pollution of the surface and underground waters, accompanied by a massive loss of hydrobions.

The catastrophic situation of May, 1995 on Danube Lakes, that are the main source of water for Bolgradsky Region of the Odessa Oblast, is observed in details. At the end of April and in the beginning of May there took place a massive loss of fish. The potable water intake from the lake was stopped for a long period of time. The analysis of water samples, taken during this time has shown the essential modifications of gas regime of the lake's waters. In the samples there have been found the restored forms of nitrogen and sulphur, that are unnatural in the oversaturated with oxygen waters. The maximum allowed concentrations were exceeded in copper, chrome, ammonia nitrogen, and sulphur. The cause of such modifications could be the activation of geodynamic processes in the observed region, accompanied with the series of destructive earth-quakes in south-eastern sector of Europe. The interdependence between the regime of underground waters and the variations of geodynamic processes is universally recognized and has acquired the name of Vartanian-Kulikov's Effect.

In the report there is also observed the problem of surface and underground waters quality control in the conditions of geodynamic tensions variations. There have been described the measures on increase of waters quality control during water intake for potable water supply by receiving information on geodynamic processes in the region.

It was proved that well-water supply is not the best substitute for water-supply from rivers and lakes in geodynamically active regions.

ENGINEERING HYDROGEOLOGICAL SUBSTANTIATION FOR HAZARD UNDERFLOODING AND DEVELOPMENT EMERGENCIES PREDICTION ON URBAN TERRITORIES

Kazakova I.G.
Production & Research Institute for Engineering Construction Survey (PNIIIS), Moscow, Russia

Engineering hydrogeological substation for prediction of development emergencies during underflooding on urban territories, should be based on qualified engineering hydrogeological investigations of every concrete natural-technogenic situation. Therefore it is necessity to take into consideration the character of possible development emergencies, and mechanism of it's appearance.

The character of displaying of emergency is rather different and depends of principal disagreements on a hydrogeological development of underflooding devices (scheme), which defined by regime, mode of occurrence and character of subsurface water spreading.

For scheme 1 underflooding development caused by rising of subsurface water level of first from surface pressure free aquifer, which carries considerable of many years and seasonal fluctuations in subsurface water levels on the territories, where this levels placed at a depth of less 10-15 m.

For scheme 2 underflooding develops due to moistening rocks of aeration zone and/or forming a new technogenic aquifer with rising level on the territories, where subsurface waters spread sporadic or absent till the surface of stretched impermeability layer, or if the first from surface aquifer level lays at a depth more then 10-15 m.

The principal distinction of underflooding development predetermine specific and methods of research, which make for estimation and prediction for hydrogeological conditions changes, forecast the character of negative consequences, estimate quantitative hazard of underflooding development on preliminary construction design stages that reduce emergency risk.

For estimating the appearance of emergencies on built-up territories, it is necessary to define the reasons of underflooding process and its development features. Its also important to know the degree of assimilation of the territory, if it is exploiting for a long time or constructing only.

Hydrogeological methods of studying the natural-technogenic environments of build-up territories, suggested by us, define the way of research during hydrogeolodical substantiation the prediction of underflooding emergencies.

During substantiation of emergencies development prediction on certain urban territory, it is necessary to use our worked out special plan, which includes all necessary parameters for schematising natural conditions and technogenic factors, and making calculated geoseepage scheme.

It is very important stage, because accuracy of this scheme determines the reliability of prediction. It gives conception about forms and scales of permeability region, specifics and quantitative characteristics; information of water balance; specifics of subsurface and surface water regimes in seasonal and many years cycles; hydrodynamic flows of subsurface waters; calculated hydrogeological parameters; engineering preparation of territories... After this it is necessary to solve the complex of reverse and direct problems on the model.

For scheme 1, the main aim of prediction - to estimate the maximum subsurface water level rise impact of technogenic and natural factors (seasonal fluctuations of surface and subsurface water levels) for the period of constructing and exploitation the territories and concrete structure on it. It is necessary to note, that taking into consideration the dynamic of construction has important meaning, because changes of internal and external hydrodynamic limits. The method of prediction of subsurface water level rise is worked out and tested on many objects.

For scheme 2, there is no need to predict the first of surface aquifer subsurface water level rise. In this case it is necessary to predict the change of rocks properties with different intensity of technogenic load, chemical composition of technogenic water and with possibility of subsidence and swelling. And, of course, the prediction requires taking into consideration the influence of external hydrodynamic limits of certain area or built-up territory as a whole.

The prediction of changes of hydrogeological conditions is a base for estimating emergencies during ungerflooding on urban territories, therefore reliability of this prediction is very important. That is, why the hydrogeological method worked out by us, the estimation of appearance and development of underflooding based on factual materials and confirmed by practice and scientific investigations.

DRIFT STREAM WAVE PARAMETERS CALCULATION FOR BREAK OF AN EARTH DAM WITH TAKING IN ACCOUNT BED TRANSFORMATION

Sanoyan V.G., Tockmajyan H.V.
Association of Water Problems and Hydraulic Engineering Republic of Armenia

A numbers of articles are devoted to considered problem, in which for solving Sant-Venon equation explicit and non explicit schemes of numerical methods are used, supposing, that the bed structure is changed within the time, without taking in account the drift. However the well-known methods are not applicable in mountainous conditions, in particular in Armenia, where the reservoirs have mostly earth dams and as rule they are high. The last circumstance brings to situation, when after dam destruction wave stream with very high speed is formed, after which the liquid stream from the reservoir is enriched not only with hard particles, but also with materials of the bed caused by the flood. In the result the problem is becoming considerably more complicated, as it's necessary to take in account the existence of the drift as well as the bed deformation.

For taking in account the weighted drift an equation of stream transformation ability is used for irregular and non-standard motion, which are founded by the authors the first. The bed transformation is used by the balance equation of the hard part of the stream.

The problem is solved numerically with the use of characteristic method. In the result finite-difference formulas are obtained, which allow to define the depth, speed and altitude of the bottom of the bed depended from time and distance, separately for quiet, critical and stormy regimes of the motion. As an example an accounts are made on initial data of Azat dam, Armenia.

INVERTED SIPHONS UNDER WATER OBJECTS - ZONE OF HEIGHNED ECOLOGICAL DANGER

Segal H.
State Scientific Research Institute "Vodpolimer",Latvia, Jelgava
Lyakmund L.
SRGC ,"Unicone", Latvia, Riga

1. Inverted siphons with their purpose to separate transported liquids or gases and water in natural or artificial water object are dangerous for the environment. This problem is especially urgent for Latvia, the economics of which is oriented now on different materials transit from the East to the West, including by pipe line transport.

2. The number of inverted siphons grows with the industrial and communal communications development, and due to that the extent of their danger for the environment also grows. Even if all normative technical demands for inverted siphons building and exploitation are observed, nobody is insured from natural calamities and the most incredible coincidences.

3. As an example of absolutely unpredictable accident can be taken an incident that took place in February, 1980, in Riga port aquatory. Greek vessel "AEGIS BLAND" was going in fairway with anchor not full taken out. In the result of bottom ploughing, the anchor hooked an inverted siphon that consisted of two lines of steel pipes with the diameter of 700 mm. The inverted siphon was aimed for sewage water pumping from the right part of Riga to purification plants on the left bank of the Daugava. As the result, sewage water got into the river, and pieces of 20 and 250 m long (a longer one had not been found) were pulled out of both pipe lines. The inverted siphon repair had taken almost 2 years.

4. Another example of inverted siphon accident that had catastrophic consequences dates back to the end of 1981. On the 5th of November product pipe line, that erases the Daugava (the West Dvina) in the region of Novopolotsk (Byelorussia) had been damaged. The accident had not been found out at once and water, polluted by oil products, managed to reach under ice the territory of Latvia. Inspection in November, 14 certified mass fish death for a distance of almost 80 km of the river in Byelorussia. The analogous inspection on the territory of Latvia in November, 25 and 26 found out an entire fish death and its food base for a distance of 90 km more. Total damage was defined as more that 2 million roubles (in prices of that time). But this figure is too understated, because the pollution of spawning places, hydrochemical regime long time changes, additional expenditures on taken, water purification, etc. had not been taken into account at damage calculation.

5. At the beginning of 1997 an essential part of nature measurements and their analyses in connection with washout in the outlet of the inverted siphon by which nature gas (under the pressure of 40 atm.) is transported through the water- body of Riga HEPS has been made. One doesn't need rich imagination to think about consequences of gas pipeline damage. The elaborated technical proposals must raise the level of inverted siphon exploitation safety.

6. The mentioned examples and other ones witness that inverted siphons practically always, are the zone of heighned danger for the environment. That is why constant control of the situation must take place, most likely by Civil Defense sub-units.

7. It is advisable to generalize experience of inverted siphons accidents and make changes in the existing normative documents on this base.

EXPERIENCE OF THE FIRM "ECOBIOS" IN ECOLOGICAL SAFETY ASSURANCE AT THE WATER OBJECTS

Zinberg M.B., Ivanovskaya I.B., Skripka N.B.
Firm "Ecobios", Orenburg, Russia

Water objects contamination by oil products is one of the burning ecological problems of today, contamination takes place as a result of emergency spread of oil, gas condensate, mazout, and etc. That brings enormous harm to water organisms covering great areas with thin film and making an obstacle for oxygen penetration into water. One of the main tasks of the control for contaminations is preventing of oil spot spread over water surface. For that purpose first of all quick and in time localize oil contaminations outcome by the known methods. The next stage of oil contamination control is local treatment of contaminated area.

The firm "Ecobios" has been occupied with liquidation of different oil products emergency spreads consequences for six years. The basis of our works is the use of the biotechnological methods. Efficiency of these methods depends on many factors, and first of all on the degree of contamination.

Practice showed that the most effective is a combination of several treatment methods. By that reason two stage system for oil contaminations treatment at the water objects has been developed.

On the first stage of treatment localization and collection of contamination take place by means of sorbents. The second stage of treatment is after treatment by biotechnological methods.

Ecological safety depends to a great extent on in time and right choice of procedures, that give an opportunity to localize contamination spread on water pool surface in the most short period of time.

In connection to that we conducted experimental investigations of possibility of use of different type sorbents of native and foreign origion for localization and liquidation of oil and gas condensate emergency spreads.

In the first series of experiments two sorbents "Primsorb" (Primsorb, Inc., USA) and "Lessorb" (CIS) were under investigation. In the second series - different grades of activated coal and synthetic materials. Results showed that investigated sorbents have different sorbitizing capacity. Material "Primsorb" at one time use sorbitizes 15 volumes of gas condensate per 1 volums; for oil 1:10 by volume. It could be used many times, and at the same time 50-60% of sorbitized oil products could be used once again.

Never the less about 10% of adsorbated oil products are given back to environments again. For the sorbent "Lessorb" the adsorbating capacity was 1:10 by weight for gas condensate. Regeneration is impossible, and practically nothing is given back into environment.

Activated coal adsorbating capacity is a little bit lower, and depends on contact time and makes up for condensate 1:7 by weight; for oil - 1:5; but in comparision to "Primsorb" oil products adsorbated by coal are not given back into environment. Activated coal is used one time and after application could be used as fuel.

Sorbent on the basis of synthetic materials tested by us showed practically the same adsorbating capacity as "Primsorb", but they give back less adsorbated oil products to environment.

Nowadays pilot tests of a new sorbent are under preparation and these test will help to confirm results of laboratory investigations and state technical and technological parameters of the process.

ROUND-TABLE MEETING: "WATER QUALITY AND PUBLIC HEALTH"

ECWATECH

TOWARDS THE PROBLEM OF WATER VIRUS CONTAMINATION

Amvrosieva T.V., Gurinovich A.D., Amvrosiev P.A., Diakonova O.V.
Byelorussian Research Institute for epidemiology and microbiology, Belvodokanalremnaladka , Byelorussian Research Institute of sanitary and hygiene

As it is known, human infectious pathogenic agents can wide circulate in different water bodies, penetrate in drinking water and create a high risk of infectious diseases. Pollution of water by viruses is of most danger in comparison with the other microorganisms because of their greater resistance to disinfectants which are of common use in plants for water purifying.

Surface river water-intakes are subjected to microbial penetration rather strongly in the result of sewage or other spills. Given investigations of river water-intakes in Minsk and Gomel cities in 1997 year found out that current technologies for water disinfecting are inefficient with respect to viral contamination. So, virus-positive samples of purified river water constituted 11,8% in the period from February till November. Although, at the same time bacteria were not detected. The obtained data accord with previously published evidence and indicate to the fact that current water purifying is appropriate just for bacterial reduction, and can not provide epidemic safety against virus pollution of water.

Quality of water from underground water-intakes is a very actual problem, as well as it can be also polluted by viruses. Common causes of such a problem may be as follows: pollution of water-bed levels when soil water seeps through aeration areas; «hydrageologic windows» availability in water-permeable cover lay of exploited level; defects of wells and also contamination of clean water reservoirs as the result of various technical failures. Conducted sanitary-virologic studies for water of two underground intakes in Minsk pump stations (level II) in 1997 confirmed the presence of virus contamination. It varied according to the period of year and reached its maximum in March (the period of snow melting) and June (the period of downpours). Besides, intermediate year range of positive samples was 12,1% by cell culture isolation, and 30% by detection of enteroviral RNA.

Water quality in water distribution network is of prime importance in the recent years. It depends on a range of peculiarities such as: arrangement of network, operating conditions, degree of net emergency and providing of preventive repair in time. A lot of researchers proved the possibility of virus penetration directly into water-network by investigation of water in infectious sources. In this conditions the necessity to exercise appropriate, adequate sanitary-virologic control over all stages of water-flow from intake to consumers is beyond questions. This control is of great value not only for studying water pollution to assess its safety in a certain moment, but for predicting water-associated viral diseases for long lasting period as well. Neglect of this fact, as the reality implies, may introduce serious complications of epidemic situation. It was the situation that occurred in Gomel in July-November 1997, when the penetration of enteroviruses in drinking water went unnoticed on account of water quality control imperfection. Performed sanitary-virologic and epidemiologic studies showed that there were enteroviral contamination of drinking water being the main cause for large outbreak of aseptic meningitis involved more than 600 man. Dominant epidemic strain was Echo-30 isolated from clinical samples, and also drinking water of infectious sources, that confirmed waterborne of this viral disease. Further deepened investigations made possible to define Echo-30 along with the other viruses of less common (Echo-30, -12, -16, Coxsackie B2, A23) both in water-network and intakes, and not only in purified river water but in it from three works of underground water. The power of drinking water contamination correlated to that of disease. Its maximum was in August (85,7%) just while the top of outbreak.

From the above it might be assumed that it is obviously needed to improve water purifying and disinfecting technologies, solve some ecological problems of water pollution and increase sanitary-technical indices of water-supply exploitation , and also to improve the control system of water quality for adequate safety estimation.

PARASITOLOGY-RELATED PROBLEMS OF INLAND RESERVOIRS OF MOSCOW

Be`er S.A., Romanenko N.A., Shigin A.A., Novosilcev G.I., Roitman V.A., German S.M., Melnikova L.I., Zazornova O.P., Kasakov B.E., Tseitlin D.G., Sergeeva E.G.
Institute of Parasitology RAS, Martsinovsky Institute of Medical Parasitology and Tropical Medicine, MH RF, Moscow, Russia

Inland reservoirs of Russia cities (first of all, Moscow), are found to be contaminated with causative agents of different human and animal parasitoses. The main reason for deterioration of parasitology situation in Russia cities is due to destructive changes of ecology and sociology situation under severe urbanizated ecosystems.

It is shown what there are gelmint's eggs (Ascaris, Toxocara, Trichocephalus, Theniarinhus e.a) and cysts (Lamblia, Balantidia, oocysts Cryptosporida) in the water of any king of water sources. High extensive and intensive factors of drinking water contamination by eggs and cysts were detected non only in industry and driking water sources but also in public rest areas. It is found what main ways of getting parasitic pathogens into surface water sources are throws of non-cleared or partly cleared waste water, water transport fan throws, animal farms and complexes and surface flows for populated areas. There are about 50 eggs and 600 cysts in one litre.

The main reason for deterioration of cercariosis situation in Moscow: combination of unfavorable factors, namely: 1 -

low level of sanitary control over inland reservoirs' condition, their cjntamination and growing wich promote increase of mollusk numbers, schistosomidae intermediate hosts; 2 - heavy numbers increase of wild ducks (mallards) being a main source of infection on account of birds'escape from breeding farms, suppression of their migratory abilities and intensive reproduction in city boundaries. According to our data no less than 2000 humans are infected with cercariosis in Moscow annualy.

In reservoirs of Moscow the intense situation on many parasitosis of fishes is marked. For example, in majority reservoirs has the intensity source of Dipiostomosis. Their intensity of well above than in natural reservoirs in Moscow region.

HYGIENIC PROBLEMS OF UNDERGROUND WATERS USING FOR PURPOSES OF DRINKING WATER SUPPLY

Karhanin N.P., Suhacheva J.F., Shestakova N.A., Shteinberg B.J., Matunina J.O.
Samara, Russia
Amochaeva G.A.
Novokujbyshevsk, Russia
Nikichin V.A.
Ulianovsk, Russia

Experience of collaboration at subject of underground water using between Samara scientific research hygiene institute and sanitary inspections of Samara, Novokujbyshevsk and Ulianovsk allow to mark out some factors that is necessary to take into account for arrangement of drinking water supply from underground water horizons:

- Discrepancy the quality of underground water to standards for mineral composition indices (dried residuum, sulfates) and to iron. It is showed that using of stations for decreasing iron quantity for water preparation not do solve problems for other metals;
- Antropogen pollution of deep horizons of drinking underground water by chemical substances (ammonium, nitrate, oil, organic substances, cadmium, leaden) sometimes can exceed the limits;
- Deterioration of underground water in the course of years according indices of mineral composition, contending of organic substances, metal and other antropogenic ingredients in the underground water indicates that underground water horizons are not pollution protected. In that case, using of underground springs for drinking water supply of population is only possible after correspond preparation of water;
- Absence of sanitary zones for water springs keeping;
- Set the fact that exchange of antropogenic chemical substances occur along the chain : atmosphere air-snow-soil-underground water horizon.

Penetration of antropogenic chemical ingredients to underground water horizons is extreme situation of the antropogen influence to surroundings of settlement.

MODIFIED BIOTESTING METHOD AS PART OF TOXICITY ASSESMENT OF WATER POLLUTANTS

Krasovsky G.N., Egorova N.A.
Sysin Ecology and Environmental Health Institute, RAMS, Moscow, Russia

Performing tests on aquatic life that are currently most widely practiced as a simplest method of toxicity assessment and via that of water safety assessment, it is often suggested that results of acute effects studies of test organisms be used to predict toxicity to man. Thus in case a water sample proves toxic to the former, it necessarily is regarded that to the latter.

However, such an approach turns out invalid, if LC_{50} or EC_{50} values of substances in acute aquatic tests are contrasted against maximal allowable concentrations (MACs) or chronic threshold concentrations (TCs) for humans. Approximately a 100 substances checked, test systems have occurred either to be affected by concentrations harmless to man or, more often, prove resistant to substances of extreme or high hazard, i.e. those with delayed effects and MACs ranging between 0.0001 and 0.01 mg/l. It sometimes takes concentrations hundreds of times greater than the established MACs to produce any impact on hydrobionts. For instance, Daphnia 48h LC_{50} values have exceeded those of the relevant human TCs 312 times for benzene, 583 times for tetrachloro-methane, 1880 times for heptanol and 13167 times for 1,1-dichloro-ethane. It is only for a limited number of chemicals with MACs > 0.1 mg/l, that there is a possibiliy to directly extrapolate from Daphnia to man.

Attempts to improve the method by prolonging exposure, altering temperature conditions, etc., do not commonly contribute to more effective hazard determination, even with substances at TC levels, while increasing the amount of pseudopositive responses of hydrobionts.

To render biotesting truely apt for hygienic purposes, a technique has been proposed of concentrating samples on polymeric porous sorbents before assaying. In the course of studies performed, we have established fixed values of water samples maximum concentration, depending on the organism used in testing. For Daphnia 96h LC_{16} tests, the maximum concentration value was found to amount to 200, for guppy 10000, for luminescent bacteria 40000. Testing is carried out

as concentrated samples of studied water and the control are consecutively diluted.

To assess the results of hygienic biotesting, the following water safety criteria have been worked out:

- No observed effect on aquatic life within the fixed maximum concentration values.
- Equal toxicity of the studied water and the control for test organism.
- Correspndence between the toxicity determines by biotesting and that predicted based on chemical analyses of the studied water.

If Daphnia tests show toxic effects with less diluted samples only, it testifies to the presense of highly hazardous chemicals whereas toxicity at higher dilution levels is evidence of substances less harmful for humans.

Modified biotesting method can be helpful while studying penetration of chemicals into water out of materials or equipment, assessing sewage toxicity against toxicity indices of the water above the discharge point or estimating potable water toxicity. The latter case contemplates use of water purified by means of polimeric sorbents as the control, while analitical methods are utilized to detect inorganic compounds.

In summary, extrapolation of human effects from results of acute tests on any aquatic organisms shall be based on fixed values of maximum water samples concentration determined for each test object. If biotesting is done to indicate some specific effect (embriotoxicity, neurotoxicity, mutagenitciy, etc.), again specific maximum concentration values shall be determined and relevant extrapolation requisites grounded.

THE HEALTH OFURBON POPULATION AND QUALITY OF THE RIVER VOLGA WATER

Kuryanova N.N.
Astrakhan State Medical Academy

In Astrakhan State Medical Academy a constant analysis of health state of the population of Astrakhan is carried out in accordance with the level of influence of environmental factors, including quality of the river Volga water. It's necessary to underline that toxical microelements are constantly defined in the river Volga water - lead and cadmium, their level is exceeded permissible coefficient for last years - cadmium - in four times, lead - in one and half time. Average exceeding of permissible coefficient was observed according to the following essential microelements: to iron -in 2,3; to zinc -in 2; to nickel - in 2 times.

^fi It's necessary to indicate that in last years appreciable tendency of growth of the coefficiency of general mortality of urban population is drawn attention to; 1978-1979 - 12,35'/oo, 1988 -10,97%o, 1992 - ll,69'/oo, 1955 - 20,l%o. Cardio - vascular diseases, oncopathology, traums had considerable specific gravity in the structure of general mortality of urban population.

Table I Mortality of urban population from its main causes.

	Cardiovascular diseases			oncopatholo		^	traumas			general mortality		
	1979	1989	1995	1979	1989	1995	1979	1989	1995	1979	1989	1995
0-14	0,005	0,008	0,04	1,2	0,07	0,19	0,42	0,28	0,44	3,22	1,84	2,17
15-59	1,61	1,33	2,73	1,1	2,0	1,68	1,78	1,43	3,68	5,28	4,37	10,16
60...	35,0	30,67	43,71	8,99	7,9	10,5	1,5	1,48	3,30	48,8	43,5	71,32
0-100	7,06	7,34	9,99	2,28	2,1	3,05	1,4	1,18	2,9	12,3	10,9	20,12

Mercury, lead, cadmium, fluirine, arsenic mustn't be presented in the objects of natural medium (including water) in accordance with recommendations of the Programme of the Organization of United Nations in environment. But realized investigations showed significant level of lead and cadmium in the river Volga water, that affects the health of population in Astrakhan undoubtedly.

RAYONING OF THE IVANKOVSKY RESERVOIR OF WATER CONSERVATION ZONE ON A DEGREE OF EPIZOOTICAL DANGER OF SIBERIAN ULCER

Musoyan S.G., Shmidt E.L.
Joint-stock company "Interwater researching", Moscow, Russia

Main Points

From the old times the central and European parts of Russia have been potential areas of siberian ulcer propagation among animals and people. Despite of significant achievements of epidemiological and veterinary sciences for the last decades, the danger of repeated outbursts of epizooties and epidemics of this disease are still actual now. The origin of these outbursts is the huge quantity of burial grounds infested with siberian ulcer, largerely spread in the basin being a zone of developed stock-raising from the ancient times.

The study of this problem in the Ivankovskaya water conservation zone, located in the south of Tver area and being one of the basic sources of Moscow water-supply, has allowed us to formulate some main ideas about a territory rayoning prospects according to the danger degree of repeated outburstsof the disease among domestic animals and to determine criteria, on the basis of which such a rayoning is carried out. To the number of the main criteria were referred:

n - the number of settlements unfavorable from the point of view on a siberian ulcer;

N - the number of outbursts of disease on the given segment for period of observations stipulated by availability of an factual material;

T - the period of observations equals to 141 years (from 1852 to 1992)

F - the area of the segment described by certain combination of unfavorable factors.

The factor of epizootical danger (I) expressed by relation:

$$I = nN/FT \qquad (1)$$

For the registration of natural conditions and modern economic activity the empirical way adopted raising factors of danger

$K_1 = 1,8$ - cattle-breeding load;

$K_2 = 1,5$- recreation load;

$K_3 = 1,4$ - sinking up of territory;

$K_4 = 1,2$ - water-front crumbling and erosive processes.

So the formula has become:

$$I = K_1K_2K_3K_4(nN/FT)10^4 \qquad (2)$$

The general area of water conservation zone is equal to 600 square km. It is possible to divide on following categoria of danger:

- Harmless 269,4 sq.km (wood) with an index of epizootical danger 0;
- Low danger 168,3 sq.km (tilthes, gardens) with an index of epizootical danger up to 100;
- Mean danger 87,4 sq.km (meadows, pastures) with an index of epizootical danger 101-200;
- High danger 74,9 sq.km (cattle farms, stock-raisings, territories of settlements, industry and other territories with a high antropogeneous load) with an index of epizootical danger 201-800.

Because of these facts the map "Rayoning of the Ivankovsky reservoir of water conservation zone on a degree of epizootical danger of Siberian ulcer " is constructed.

The map of rayoning can be puted in the basis of organizational, technical and medical-sanitarian activity, especially with the part, which is going with large volumes of earthwork both on land, and in reservoir's basin. Such activities in this zone are involved in direct opening of forgot or lost burial grounds infested with siberian ulcer and fast propagation spores of a siberian ulcer on a surface of the ground and in water environment of reservoir and outburst of epizootia and epidemics. At a certain combination natural factors and economic activity this epizootia and epidemic of a siberian ulcer are now probable.

COMPARATIVE RESISTANCE OF VIRUSES AND BACTERIA TO OZONE IN THE PROCESS OF DRINKING WATER TREATMENT

Nedachin A.E., Dmitrieva R.A., Doskina T.V., Sidorenko S.G., Sukhareva E.A.
A.N.Sysin Institute of Human Ecology and Environmental Health RAMN, Moscow, Russia

Studies of the virucide effect of ozone on the most epidemiologically significant viruses:poliomyelitis virus Jsc2ab, rotavirus SA-11, hepatitis virus A, Has-15, DNA-containing (T-1) and RNA-containing (MS-2 and f-52) coliphage and colibacillus used as an indicator of microbic water contamination, were carried out in experimental conditions on a pilot technological device simulating waterworks functioning according to one-stage and two-stage technological schemes of water treatment.

The water under study was artificially prepared, turbidity being 29.3-36 mg/l, colour - 43-48 degrees, pH - 7.6-7.9 and alkalinity - 3.6 mg-equ./l. An inactivating effect of two concentrations of free residual ozone (0.74 mg/l and 1.1 mg/l) was studied. Samples were taken 4, 8, 12 and 20 minutes following the beginning of exposure (20 minutes being the maximum duration of exposure).

It was found, out that as result of the maximum duration of exposure (ozone concentration being 0.74 mg/l) it was colibacillus (99.96%), poliomyelitis virus (99.91%), coliphage T-1 (99.85%), coliphage MS-2 (99.67%) that were most intensively inactivated; rotaviruses (98.99%) and coliphages f-52 (98.75%) were the most resistant organisms. Under exposure to higher concentrations of ozone (1.1 mg/l) inactivation processes were similar, however, the percentage of inactivation for the most resistant microorganisms (rotaviruses, coliphages f-52 and MS-2) increased up to 99.99%.

Ozone resistance of hepatitis virus A was studied in natural water which had gone through complete reagent treatment and chlorination. Water concentration of hepatitis virus A was 100000 virlones/ml, which provided the possibility to observe the dynamics of its inactivation depending on the ozone dose.

It was found out that for the free residual ozone dose 0.17 mg/l the inactivation value of hepatitis v.A was 28.57%; for the increased doze of ozone - 0.23 mg/l the inactivation value of hepatitis v. A was 90%, while the ozone concentration 0.51 mg/l caused its complete inactivation.

Therefore, colibacilli are inactivated by ozone much more rapidly than viruses which pose epidemic risk. In water treatment practice it is reasonable to assess the efficiency of water decontamination from viruses using RNA-containing coliphages, the ozone resistance of which is similar to that of viruses.

CONCERNING THE METHODS OF WATER FILTRATION

Novoseltzev G.I., Romanenko N.A.
A.N.Sysin Institute of Human Ecology and Environmental Health, RAMS,
State Committee of Sanitary and Epidemiological Surveillance of RF, Research "ECOTEH-Moscow", Moscow, Russia

Two methods of water samples proliminary filtration were compated in order to find the optimal way of drinking water filtration a Conside the parasitological control according to Sanitary regulations 2.1.4.559-96 "Drinking water. Hygine requirements to the water quality in drinking water central supplies. Quality control". The first method was based on Methodological gindelines 4.2.668-97 "Sanitary and parasitological water study" and presupposes manual filtration of 50 litres (1 water sample) using memebrane filters with apertuves diametre 3-5 microns) Goldman funnel, the retorte for carrying out vacuum filtration and the ejector. The second method (used in the USA) presupposes the use of textile cartridge filtors, spectral water sample concentration supplied with a water - gauge and either elecric or petrol compressor.

Model liquid was used, in the experiment, water taken from the nekwork of Moscow water supplies to whide the suspension (?) of Giordia (Lamblia) cysts was added. 10 samples of model liquid were filtrated by each of the above mentioned method.

It took 140-160 minutes to manually filtrate 1 water sample, while the same process using the american technique required no more than 30 minutes.

On the other hand, it should be noted that the number of cysts lost, and, consquently, the decrease in the efficiecy of parasitological control, does not exceed 18% as contrasted to 44% of cysts loss under the American method.

The researd confirmed the need of introducing new technologies for drinking water treatment with the observation of parasitological control over its quality, the technology that would combine efficiency expenditure.

PRINCIPLES OF HYGIENIC PLANNING OF TERRITORY OFRIVERS BASIN INTO DISTRICTS

Pinigin M.A., Cherepov E.M.
A.N.Sysin Research Institute of Human Ecology and Environmental Health, RAMS

Division of territories into districts envisages their division into smaller parts - taxons with similar properties or/ and characteristics according to which these taxons can be ascribed to a certain group (type, class of the characterized terrirories). It is natural, that depending on the selected properties (characteristics, criteria) division of territories, and therefore, rivers basins into districts may have significant differences.

Hygienic division of a rivers basin into districts, with an ultimate aim of implementation of health promoting measures, is a very complicated task. Its solvation should be based on cause-consequence relationships between the quality of individual territories of the rivers basin as habitat and health status of the population living on these territories. When the information on such relationships is available,, typization of territories can be maintained both on the basis of results of environmental quality assessment and/ or on the basis of health status of the population. Unfortunately, at present such information is available only for a very limited number of factors pertaining to the composition of natural waters, for example, fluoride, excess of which in water increases the risk of fluorosis, and deficiency of it causes dental caries. While with respect to the majority of components of natural composition and chemical pollution of water quantitative assessments of their influence on demographic indices and indices of noninfectious morbidity of the population are quite limited, which, on the one hand, stresses the importance of dividing river basins into districts based on those indices, since it promotes the development of health improving measures, but on the other, makes this process more difficult.

Alongside with this, indices of health status of the population, including demography and noninfectious morbidity, being an integral reflection of exposure to the whole variety of external and internal character, are associated with the natural composition and chemical contamination of water only to a certain degree of probability. Therefore , division of territories into districts according to the mentioned above indices should be based also on other characteristics of the basin as habitat, in particular, on those which confirm the probability of the relationship between demographic indices and noninfectious morbidity indices with the natural composition and chemical contamination of water (climatic-geographic, geochemical peculiarities of a rivers basin, peculiarities of its socio-economic development, quantitative and qualitative characteristics of the composition of municipal wastes, industrial discharge and emissions, river boats effluents, peculiarities of watersupply etc.).

While dividing a river basin on the basis of demographic indices and indices of noninfectious morbidity of the population associated with the natural composition and chemical contamination of water , peculiarities of organization of statistics pertaining to health of the population should be taken into consideration. As is known, the information on health status is formed according to an administrative division of the territoty, the basin territory included. Therefore, division of the rivers basin into districts based on demographic and morbidity indices requires consideration for its administrative division, for, among other reasons, it is important to take into account administrative division because preventive and river s status promoting

measures are implemented, in the first place, within the administrative boundaries of the territories with various sources of financing. However, it should be mentioned, that the administrative division does not coincide with division of the territory according to criteria determining peculiarities of the natural composition and chemical contamination of the water in a specific river basin.

Therefore, the following principles can be proposed for dividing river basins according to demographic and morbidity indices associated with the natural composition and chemical contamination of water:

1. Taxonization of a rivers basin according to parameters of the natural chemical composition of surface and underground waters within the administrative division of the basin.

2. Taxonization of a river basin with an account for peculiarities of the natural selfpurification of water within the boundaries of the administrative division of the basin.

3. Taxonization of a river basin according to the level of socio-economic development, sources and parameters of chemical water contamination within the boundaries of the administrative division of the basin.

4. Analysis of risk of the influence of the natural composition and chemical contamination of water on the demographic and noninfectious morbidity indices within the boundaries of the administrative division of the basin.

5. Division of a rivers basin according to the degree of changes in demographic and noninfectious morbidity indices associated with the natural composition and chemical contamination of waters, with a development on a sound scientific basis of preventive and water status improving measures, and determination of sources of financing, taking into consideration administrative division of the basin.

METHOD OF ASSESSMENT OF WATER USE CONDITIONS IN RESIDENTIAL AREAS IN STUDYING THE EFFECT OF DRINKING WATER CHEMICAL COMPOSITION ON HEALTH OF THE POPULATION

Rakhmanin Yu.A., Mikhailova R.I., Kirianova L.F., Sevastianova E.M., Ryzhova I.N., Karpova E.A., Kochetkova M.T., Smirmov K.K.
A.N.Sysin Research Institute of Human Ecology and Environmental Health RAMS, Moscow, Russia

Intensive introduction of hygienic standards for a lot of chemicals into the water use practice, on the one hand, and frequent surveillance over them, on the other, require the development of studies aimed at prediction (risk assessment) of negative effects of unfavourable chemical composition of drinking water on health status of the population.

Therefore, studies of water health effects should be preceeded by study and assessment of the conditions of of water use of the population in previously selected settlements, including two major stages: thorough investigation of the dynamic conditions of the formation of chemical composition of water of the water source (I) and of drinking water quality (II). Hygienic requirements to the water used by the population are specified in the water sanitary legislation.

The following methods are recommended for a thorough analysis of water quality of the water source:

- chromatomass spectrometric and chromatographic techniques providing the use of comparative assessment according to the principle of "finger prints" identification, and the characteristics of transformation processes, total number and quantitative ratios of regulated and nonregulated chemicals;
- screening techniques of bioassays on hydrobionts and in Ames test (to asses real biological risk of exposure to the water medium);
- use of multifactor mathematical analysis for formalization of laws according to which the composition of waste waters is formed, for revealing peculiarities of the transformation of their main ingredients in the treatment process, in the water of water reservoirs (primary anthropogenic burden) and in the sludge - bottom sedimantation (secondary chemical burden), and influence on the formation and spreadin of contamination, and for tentative determination of the input of individual components into quality formation.

The main purpose of hygienic assessment of drinking water quality is setting its quality into categories according to the degree of the possible unfavourable health effects.

Therefore three major types of investigation are performed: thorough chemical analysis according to SanPin 2.1.4.559-96 and taking into account WHO recommendations; study of the possible transformation products of chemicals; water bioassays on hydrobionts and in Ames test; quality assessment on the basis of differentiated complex indicators. A more complete hygienic assessment of the chemical composition of drinking water should include the following parameters (to follow recommendations stated above):

- determination of the content of chemical components for mandatory determination;
- determination of the concentrations of additional pollutants characteristic of the local water source due to peculiarities of its use (in accordance with the requirements of SanPin 2.1.4.559-96);
- differentiated integrated indicators (odour, taste, turbidity, colour, total mineral composition, hardness, alkalinity, pH, organic and inorganic carbon, permanganate oxidizability, volume α- and separately β -radioactivity, total mutagenic activity, hydrobionts bioassays);
- calculated complex indices (a sum of parts from MAC separately for metals, nitrites and nitrates, chlorides and sulphates, trihalomethanes, chlorine-containing

pesticides, phosphorus-containing pesticides, carbamates, other chemicals of uni-target action).

Thorough analysis of drinking water quality is conducted with an account for results of studies of the quality of water of watersources, as well as with an account for a barrier role of water pipeline process equipment.

To characterize chemical drinking water composition averaged values within the analysed time interval are used with an indication of the minimal and maximal values of the indice, its seasonal and annual dynamics, percentage of nonstandard samples, the order of exceeding the MAC.

METHODOLOGY OF ASSESSMENT OF DRINKING WATER CHEMICAL COMPOSITION EFFECTS ON HEALTH STATUS OF THE POPULATION IN EPIDEMIOLOGICAL STUDIES

Rakhmanin Yu.A., Mikhailova R.I., Kirianova L.F.
A.N.Sysin Research Institute of Human Ecology and Environmental Health RAMS, Moscow, Russia

The quantity and qualitative water composition characterizing the conditions of water use by the population are considered as a water factor providing for a normal human living activity due to a balanced water metabolism,including the water route of administration of essential (physiologically) macro- and microelements on the one hand, and potential source of administration of harmful chemicals into the organism, which may cause unfavourable changes in human health - on the other.

Health of the population is determined by a number of factors (biological, social and economic, medical etc.), which requires identification of the role of of the water factor in this process. This can be achieved by a comparative assessment with a control group (determination of relative risk) or theoretical substantiation on the basis of the mathematical modelling.

The major stages of an epidemiological study are as follows:

- determination of intensive indices characterizing health changes typical for a general totality on the macropopulational level;
- formalization of the input of the water factor into human exposure to comprehensive environmental factors;
- revealing of the reagional significance of the water factor into the formation of health status of the population.
- At present only the last stage can mainly be implemented on a wide scale in the following aspects:
- assessment of the total 24-hour dose of the chemical burden on the organism by the water route of administration on an individual and populational level;
- identification of specific groups of the maximal risk of health changes associated with the chemical composition of drinking water (indicatory groups);
- revealing of priority chemical water factors and accumulation in the biological media of the organism;
- giving the scientific basis for the markers and proxy-substances administered through the water route for the biomonitoring system on the population level;
- giving the scientific basis for marker test-systems providing for the diagnosis premorbid states to be able to reveal health damage risk in the population for the biomonitoring system on the individual and population level;
- introduction of measures preventing water factor related health damage.

In selecting the type of epidemiological surveillance one should give preference to nonall-round (with respect to coverage of units of the totality of the population) and dynamic (from the point of view of duration) surveillance providing for establishing a relationship between the environmental factor and health status of the population even in case of a long interval between the exposure and health change. Registration is conducted systematically (continuously or with regular intervals) in one and the same totality of people during a long period of time usin both retrospective and perspective types of study or one of them.

It is also possible to study a large group of the population at a certain moment of time, which gives information on the incidence. This type of study is usually carried out in case the phenomenon under study does not have a tendency for changing rapidly, usually to assess chronic morbidity, in prophylactic type of examination of the population, in examining individual (say, occupational) groups, in studying indicators of the physical development and functional state, and thus can serve as the basis for a dynamic type of study.

An official source of information on health status of the population is records of treatment and prophylactic establishments : clinics, polyclinics, etc.

The choice of this or that type of the population for dynamic or current surveillance is determined by tasks and possibilities and is usually based on samples differing in drinking water quality (mainly in different areas), age, sex (including the pregnancy parameter), which provides a conclusion on prevalence of this or that phenomenon among the entire population.The population as a whole should be representative and arbitrary choice of individuals for the surveillance is not allowable. The population sample should be large enough and should be formed on the basis of a non-biased means approach to the formation of a sample.

Since assessment of the health status of the population on the basis of individual parameters (mortality and birth rates, physical development) does not give a full answer about health status, a complex characteristics of health status should also include the dynamics of the possible premorbid (prepathological) functional states of various systems of the organism: for the kidneys - study of nontraditional biomarkers in urine, for the immune system - screening techniques, or oncogenic pathology - assessment of the carcinolytic ability of intestinal microflora, for the psychic status - psychic diagnostic tests.The efficiency of implementation of preventive health-improving programs at the federal level should also be evaluated on the basis of health indices.

HYGIENIC PROBLEMS OF USE OF UNDERGROUND WATERS FOR WATER SUPPLY OF THE POPULATION

Sheremetev V.M.
SPGC "Geology of Kuban"
Zemlanskaja V.S., Lesheva G.A. Pshenichnij V.N., Kinter O.V., Balaeva M.I.
Center of Sanitary supervision in Krasnodar, Russia

For water supply of Krasnodar underground waters of Asov-Kuban arthesian pool are used. In maintenance is more than 100 of arthesian chinks. 56 % of water is selected from sources of the 2-nd class, rest I -St.

The results of researches of water from chinks for the last 5 years which have been carried out (spent) by us with use of the application MS EXCEL, show the tendency to increase of a content in water of iron, manganese, chlorides and others, normalized by State Standard " Water drinking ". The industrial pollution of underground waters from firms pollutants reaches (achieves) 40-80 m. A geoecological estimation and monitoring, confirm a high degree of pollution of ground and earth waters.

We have studied about 100 factors of the enclosing Environment with the purposes of installation of influence them on health of children. The greatest effect of effect has the complex of metrics in atmospheric air and drinking water. The total chemical pollution of water unfavorably is reflected in a state of health of children: disbalance of components raised(increased) a content of sulfates, chlorides, manganese results in increase of incidence by infections, illnesses nervous, of the urinary system and bodies of digestion. Coefficients of correlation (r) on quota of children 0,44-0,65.

The direct authentic link between a level of incidence acute enteric infection with not recognized ethiology and quality of water on microbiological metrics (r = 0,52) is detected.

Our experience shows, that use of underground sources does not eliminate unfavorable effect of water on health of the population and confirms, that the imperious structures have all basis for development of target programs directed on saving and improvement of quality of water.

PREDICTION OF POTENTIAL EPIDEMIC RISK OF APPEARANCE OF INTESTINAL INFECTIONS ACCORDING TO NEW CRITERIA OF DRINKING WATER QUALITY ASSESSMENT

Talaeva Yu.G., Rakhmanin Yu.A., Artemova T.Z., Nedachin A.E., Tishkova N.Yu., Sidorenko S.G., Sukhareva E.A.
A.N.Sysin Research Institute of Human Ecology and Environmental Health RAMS, Moscow

Updating of the system of assessment and prediction of risk of intestinal infections spreading associated with breaking hygienic rules in drinking water use is an urgent problem, taking into consideration that the role of the water factor in infectious pathology has ever been increasing.

In the "Methodological Guidelines on Epidemiological Assessment of Sanitary-hygienic Conditions Aimed at Intestinal Infections Prevention"№ 28-6/20, developed in 1986, the following indicators of drinking water quality assessment were proposed for the analysis and generalization of retrospective data in the process of identifying the degree of potential epidemic risk (DPER) of the district wateruse for household and drinking purposes: percentage of samples with coli-index exceeding 3 prior to getting into the distribution system and in it; percentage of samples in the distribution system with coli-index exceeding 20; mean values of coli-index and total microbic count. Such indicators of the water supply system as the regularity of water supply, availability of district water sypply, mean 24-hour water use.

The methods have been widely used in the system of the state sanitary and epidemiological surveillance. Quantitative values of the generalized indices are converted into relative values; integrated DPER indices are summarised and calculated, which makes it possible to compare epidemic situations associated with wateruse conditions in various regions, settlements, city districts in quantitative units; to obtain the dynamics of DPER for years, seasons, months and to identify time periods with the highest epidemic risk, to predict the epidemic situation and set priorities and the most optimal dates for preventive measures.

In association with the implementation of SanPin 2.1.4.559-96 "Hygienic Requirements to the quality of water in district systems of drinking water supply. Quality control" new indicators of epidemic safety were proposed, expressed in a different measurement system. A new principle of setting standards was given - absence of microorganisms in the water volume approved for testing, which brings those requirements closer to the international recommendations.

Therefore, a necessity arises that the assessment methodology of DPER should be revised and a new edition of the guidelines taking into account the SanPin drinking water quality criteria should be prepared. It seems reasonable to carry out research and practical studies aimed at making adjustments to and specifications for the indicators depending on the regional climatic and technological peculiarities of wateruse; at giving the scientific basis for assessment criteria according to the new indicators; at the development of new assessment systems for identification of DPER; at giving the scientific basis for the quantitative assessment of the situation according to the integrated indicator of wateruse conditions on the whole and for individual components.

Alongside with the expert type of approach, values of indicators should be be adjusted while making comparison with the existing epidemic situation, with the population's morbidity with respect to intestinal waterborn diseases, using

an approved method of prospective controlled epidemiological surveillance.

An important aspect is the development of approaches to DPER assessment not only with respect to bacterial, but also viral infections and parasitic diseases, since requirements for the use of respective indicators are introduced to SanPin, and water quality standards based on those indicators are given.

Therefore, a methodology for the assessment and prediction of DPER is important for the state sanitary and epidemiological surveillance system in giving the scientific basis for requirements to implementation of preventive measures and maintenance of current and perspective epidemiological surveillance over intestinal infections, in particular, making use of automated systems.

URGENCY OF THE PROBLEM OF SPREADING OF WATERBORNE DISEASES IN RUSSIA

Talaeva Yu.G., Rakhmanin Yu.A., Nedachin A.E.
A.N.Sysin Research Institute of Human Ecology and Environmental Health RAMS, Moscow

World Health Organization (WHO) notes, that within the last 20 years more than 30 new representatives of pathogenic microorganisms have been identified, in particular those ranging from the most dangerous viruses Abole and AIDs to rotavirus - the most common virus causing diarrhea in children all over the world. WHO initiated a World Health Day on April,7, 1997 with the following slogan: Infectious diseases are attacking - everybody to combat a global danger!"

In Russia the problem of infectious diseases is also of great concern. Infectious diseases incidence is 33-44 million cases a year. Annually the direct and indirect economic damage resulting from infectious diseases amounts to about 15 billion roubles (Monisov A.A., 1997).

Transmission of infectious diseases by the water route poses real risk to the population in Russia. Studies of both sources and systems of district water supply show that not infrequently the population is supplied with water not meeting hygienic standards and requirements. The portion of nonstandard samples within the total amount of tested water samples, unfortunately, has been stable in Russia during the last several years, and mean values for the years 1991-1995 were as follows: 11.5%, 13.5%, 13.5%,13.3%, 13.1% respectively. The most unfavourable water quality indices were in the republic of Karelia (20%), Novgorodskaya oblast (16.5%), Smolenskaya oblast (26%), Kaliningradskaya oblast (24.1%), Astrakhanskaya oblast (18%), in Primorsky region (22.4%).

Recently, due to an increased number of emergency situations associated with intensive contamination of water sources, the importance of sanitary-virological studies has been increasing. Significant virological contamination of sources of drinking water supply and of drinking water was detected: in 1993, 1994 and 1995 the mean percentage of tap water contamination with enteroviruses was 1.6%, 1.4% and 1.28%; contamination with hepatitis virus A - 7.6%, 7.8% and 5.8%; with rotavirus antigen - 3.6%, 3.7% and 7.68% respectively.

Drinking bad quality tap potable water not infrequently causes outbreaks of inteastinal infections among the population on a mass scale. For example, in the city of Staritsa, Tverskaya oblast, 217 cases of intestinal diseases were registered in May 1995. The outbreak was caused by a disturbance in the regime of water chlorination and the presence of infiltration of water from the Volga river into an underground water source. The total of 32 waterborn outbreaks of diarrhea were registered in Russia in 1995, the total number of cases being 4823, while in 1992 16 outbreaks of the disease were registered, the total number of cases being 1242.

During the latest 5 years the number of waterborne infectious outbreaks is increasing every year since the percentage of water pipelines not meeting the hygienic norms and rules is still high. The increasiong level of contamination of water sources and frequent introduction of hyperchlorination regime of water are of particular concern. The outcome of emergency introduction of hyperchlorination regime was the fact that, for example, in water pipelines of Nihzny Novgorod in 1995 in 7.9% of samples chloroform was detected in concentrations exceeding MAC (E.N.Belaev et al., 1996).

The existing situation with drinking water quality in certain regions of the country reqire immediate legislative measures, as well as activities aimed at scientific-technical reconstruction of water supply systems.

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INTERNATIONAL OZONE ASSOCIATION CONFERENCE: "OZONE EMPLOYMENT IN WATER TECHNOLOGY"

ECWATECH

MODERN INDUSTRIAL OZONE GENERATORS WITH ENAMEL COVERING OF ELECTRODES

Abramovitch L., Danilin V., Kokurkin M., Pashin M.
VEI, Russia

For reception of great amount of ozone with high concentration the application of ozone generators using barrier discharge in oxygen is the most effective. Thus for achievement of the maximum output of ozone from the unit of electrode surface it is necessary:

1. To ensure the intensive removal of heat from discharge gap, excluding ozone decomposition because of overheating;

2. To place a dielectric barrier, having high electrical strength and heat conductivity from both sides of discharge gap;

3. To lower the length of discharge gap. The distance in the whole zone of discharge must be constant.

In VEI on the basis of a complex of researches on study of electrical synthesis of ozone both experience of work in the field of electrophysics and high voltage engineering the ozone generator with high technological characteristics is developed. The electrodes of lamellar form (Fig. 1) are made from stainless steel with thickness of 0,5 mm. The electrodes are made by punching that allows to provide rather high accuracy of the geometrical sizes at the length of discharge gap about 500 microns.

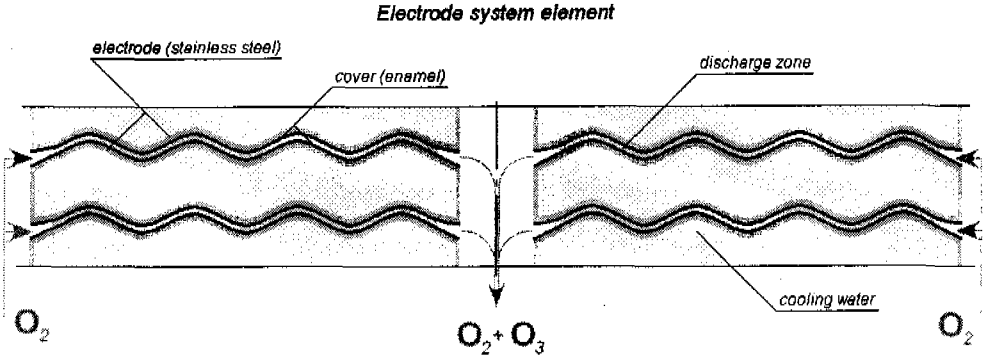

Fig. 1

Dielectric barrier is formed by the enamel of special structure. Enamel is put on the surface of lamellar electrode by a method of electrostatic evaporation with subsequent baking at temperature about 1200 K. The thickness of enamel covering is 0,5 mm.

The reduction of discharge gap up to 0,5 mm at sufficient uniformity of a gap between electrodes has allowed to increase ozone concentration and to lower specific power losses because of more uniform distribution of discharge intensity in the gap and improvement of heat transfer from discharge zone. The high uniformity of the discharge gap excludes local overheating leading to reduction of ozone concentration and safety of dielectric barrier.

Besides, the reduction of discharge gap length allows to reduce the operating voltage. It raises reliability of work of the equipment as a whole; the high accuracy of installation of electrodes allows to increase specific discharge intensity by increasing of frequency (up to 8 kHz), that also promotes to increase the insulation reliability.

The design of the ozone generator is protected by the patent of Russian Federation, on the 45-th World Exhibition of the Inventions, Research and Industrial Innovation "BRUSSELS EUREKA-96" it is marked by the silver medal.

Tests of ozone generator model are spent. During these tests oxygen with concentration 90...95% was used. The due point was 205...210 K Temperature of oxygen on an input of ozone generator was 295 K. For electrode cooling the flowing water in quantity of 3 m3/h with temperature on an input 290 K was used.

The spent power (with the account of the power supply efficiency) was defined by two ways: by the counter of electrical energy and by calorimetric method.

For the reception of low amount of ozone (up to 200...300 g O3/h) we used ozone generators with tubular electrodes. Ozone generators with tubular system of electrodes by productivity 60, 100 and 200 g O3/h are developed and are let out in VEI. Electrode systems with enamel dielectric barrier and bilaterial water cooling were applied.

Our ozone generators are successfully maintained for clearing of drinking water for beer production, at processing of rubber products, and also in research laboratories for clearing waste waters, polluted with heavy radioactive elements, for cellulose production and others.

NUMERICAL MODELLING OF OZONE AND NITROGEN OXIDES FORMATION IN STEADY-STATE GLOW DISCHARGE AT ATMOSPHERIC PRESSURE

Akishev Y.S., Grushin M.E., Deryugin A.A., Karalnik V.B., Kochetov I.V., Napartovich A.P., Trushkin N.I.
Troitsk Institute for Innovation and Fusion Research

The ozone yield is known [1] to be limited by NO_x formation in air-fed ozonizers and the concentration of NO_x attain 10% of that of ozone in the output of ozonizer.

Possibility of successful using of the steady-state glow discharge at atmospheric pressure (SGDAP) for the ozone generation has been shown in [2]. The range of the reduced electric field E/n for existence of SGDAP is about 70 - 100 Td [3]. These fields are lower than the field on the streamer head in barrier discharge and pulse corona. Low fields in SGDAP lead to decreasing effectiveness of the molecule O_2 and N_2 dissociation, however, because of the considerable difference between energies of the O_2 and N_2 dissociation the rate of the N_2 dissociation decreases more larger than of that of O_2. This fact must lead to decreasing NO_x generation and increasing effectiveness of the ozone generation. This question has been studied in the presented work with numerical modelling of processes of ozone and nitrogen oxide formation.

In detail this numerical model has been described in [3]. The results of the calculations of the G-factors of oxygen atoms, nitrogen atoms and electron-exited nitrogen molecules generation are presented on Fig.1. One can make two important conclusions from analysing results presented. The first, electron-exited molecules of nitrogen result in considerable contribution to the oxygen atoms generation and, therefore to the ozone generation. The second, the region of optimal meanings of reduced electric field (E/n), where E/n is about 100 Td, corresponding maximum G-factor of oxygen atoms generation (G_O) and maximum ratio G_O/G_N where G_N is the factor of nitrogen atoms generation. Ozone, oxygen atoms, nitrogen atoms and some exited molecules kinetic curves are presented on Fig.2. The NO_x kinetic curves in glow discharge at dry air are presented on Fig.3. The ozone concentration experimentally measuring on the output of glow discharge at atmospheric pressure are presented on Fig.4.

The results presented on figures can be summarised as follows: the ozone concentration stationary saturates itself in about 0.5 ms, so that the NO_x concentration is about 1% of that of ozone, i.e. approximately in 10 times lower than that one for barrier discharge. It should be noted that the calculated ozone concentration are in good quantitative agreement with experimental measured ones and ozone generation effectiveness in atmospheric glow discharge is rather high - the energy cost for ozone molecule generation is 20 eV or 12 kW*h/kg O_3.

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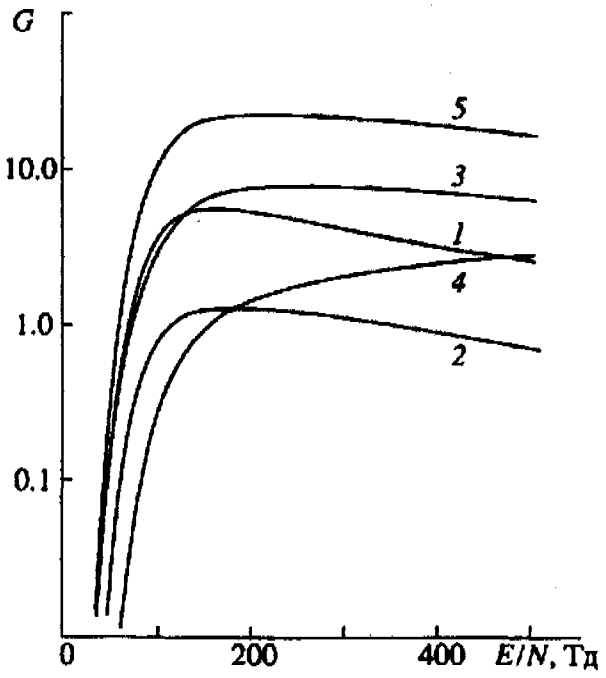

Fig. 1. G-factors versus a reduced electric field in a dry air electric discharge.
(1) oxygen atoms generated by electron impacts; (2) electron-exited nitrogen molecules $N_2(A^3\Sigma)$;
(3) electron-exited nitrogen molecules N_2(esum); (4) nitrogen atoms;
(5) effective G-factor for oxygen atom generation involving secondary processes.

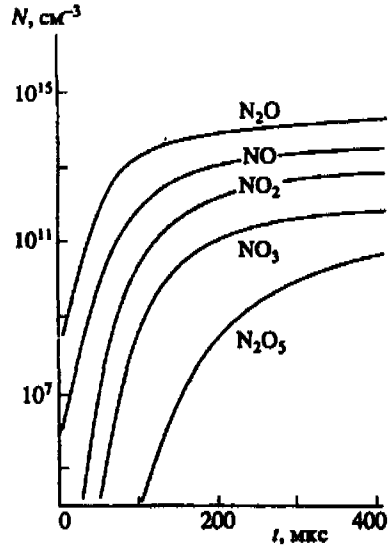

Fig.2. Particles kinetic curves.

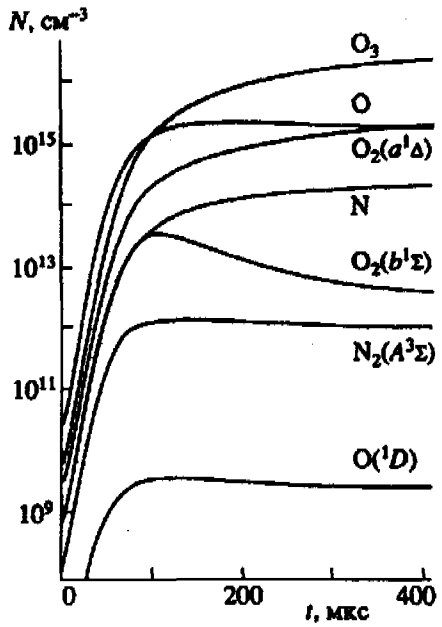

Fig.3. NO_x kinetic curves.

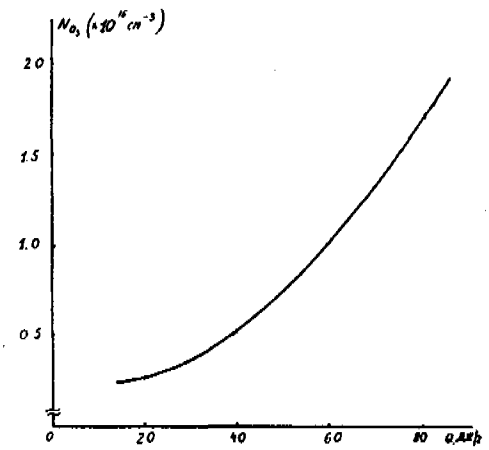

Fig.4. Ozone concentration vs energy deposition. P = 1.3 atm. V=200 m/s.

DEVELOPMENT OF OZONE PLANTS IN RUSSIA

Budarin M.V, Litvinov V.V., Prigozhin V.I.

Design Chemical Automatics Bureau (CADB) in Voronezh - one from the leading enterprises in Russian space industry; with the beginning of conversion has began to develop on ozone producing equipment and technological processes of application of an ozone in various branches of a national economy.

In CADB since a 1988, the complex of the activities which have allowed to develop serviceable, effective and reliable ozone installation owing productivity from 15 gram/hours up to 5 kg/hours was conducted.

These activities includes development of a design of the base generator of an ozone with metal enameled high voltage electrodes;

Choice of materials for dielectric coating of high-voltage electrodes;

Creation of own production line of the enameled electrodes;

Development of reliable power supplies with increased operational frequency for ozone of installations of various productivity;

Creation of experimental facilities for improvement sources of the ozone equipment and technological processes of use of an ozone.

The ozone installation of CADB have wide range productivity and usage. As example, units ДС-1, ДС-2К with productivity 70 g/h were developed for poultry - farm and were intended for disinfection of reusable package blocks and production eggs, and besides the sterilization, sanction poultry used instruments, and also for grain processing a grain have found a use for disinfection and cleaning of industrial premises. Units ДС-1, ДС-2К are used introduced in 25 poultry production facilities Russian Federation.

For water in swimming pools processing; the installation ОС-25М is used, with an ozone productivity 250 g/h. It is the complete package down to the block of contact chambers and has the Hygienic certificate of Russian Federation. Such installations are delivered and work in 15 cities of Russia, providing in pools quality of a waters which are conforming the requirements ГОСТа 2874-8.... "A Water potable".

Ozone plants "Yamal" for disinfection of a potable water with productivity 1 - 5 m^3/h are intended for private use and for the small communities. They are produced as the monoblock, i.e. all aggregates are placed on one platform.

- Now main industrial application of ozone technologies, in which it is possible to receive significant economic and ecological effects, are the neutralization of industrial gas iets;
- Bleaching of cellulose;
- Processing of a potable water and neutralization drainage waters.

For such technologies are intended ozone of installation ОУ-2 and ОУ-5 with productivity on an ozone accordingly 2 and 5 kg/h. Now they are delivered:

- For processing drainage waters - on Ivashkov alcohol factory by Kharkov and in NIIMASH Salda, Sverdlovsk area,
- For processing a potable water - in Hubkin, Belgorod area and in Nizhnekamsk, republic Tatarstan;
- For neutralization of gas lets from styrol components in "Voronezhsintezcauchuk";
- For bleaching cellulose - on Kondokonpaper factory.

CADB developed ozone plants, due to application cooled enameled electrodes and also power supply with operational frequency of 2000-2400 Hz are superior in a number of parameters of the best foreign ones under the characteristics. So, for example, specific energy expenditures on electrosynthesis of an ozone on air make 11 - 12 KWh/kg, while at foreign this parameter makes 13-15 KWh/kg.

Ours plants surpass in specific ozone productivity surface of electrode (qоз = 16,5 gh/decimeter^3) foreign analogues in 10 times. Due to the high specific characteristics, and also vertical arrangement in ozone module of ozone generators, in the block weight and dimensions of installation decreases, the required flow space for accommodation of the equipment are reduced.

Number of the schematic and design solutions in ozone plants are protected by the patents of Russian Federation and pattern certificates.

Delivery of the installation to the customers by CADB at their request.

CADB production possibilities allow to produce up to 50 ОУ-5 plants annually will be accompany with any kind of service.

OZONE DECOMPOSITION ON SOLID SURFACES

Demidyuk V. I., Tkachenko S. N., Yegorova G. V., Popovich M. P., Lunin V. V.
Moscow State University, Moscow, Russia

Research work was carried out to look into the activity of a number of natural and industrial "inert" materials and ozone decomposition catalysts. Ozone-air mixture temperature, ozone concentration and sometimes humidity in ozone--air mixtures were varied in the experiments. These experiments were carried out in static conditions and in flow. We used spectral, chemical, calorimetric and chemiluminescent analysis methods.

To characterise the surface activity ozone conversion factor (g) is used, which is the ratio of active collision of ozone molecules with a surface resulting in ozone decomposition to the total number of collision.

It was determined that the activity (g) of "inert" materials such as glass, quartz, aluminium oxide etc. is 10^{-7}--10^{-8} and for catalysts it is about 10^{-4} [1,2]. It was established in the experiments that the activity of the "inert" materials depends on ozone concentration. When the ozone concentration is increased by a factor of 10^4 the activity of Al_2O_3 surface decreases by a factor of 10^2. On the other hand the activity of catalysts does not depend on ozone concentration. The chemical model of this phenomenon has been found. The active centers of the "inert" materials which decompose ozone gets occupied by ozone molecules or by the decomposed products (oxygen molecules), and as a result, the activity of the "inert" materials decrease. In the case of catalysts the active centers are liberated rapidly from the adsorbed molecules, and therefore the catalyst activity is stable. The calculations match well with the experimental data.

It has been determined that the best catalysts for ozone decomposition are oxides of metal on a porous carrier. Oxides of copper, manganese, nicel, cobalt and theirs compositions have been investigated. We used silica, aluminosilicates, cements and bentonite clay as carriers [2-4].

Metal oxides-cement catalysts showed the best activity in humid areas [5-7].

The ozone decomposition mechanism, which includes ozone adsorption, its decomposition and desorption of the oxygen formed has been discussed in the work. The lifetime of ozone on the surface of the catalyst was found to be 4-8 seconds [8].

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OZONATION AND ADSORPTION IN WATER TREATMENT TECHNOLOGY IN RUSSIA

Draginsky, V.L., Alekseeva L.P.
Municipal Water Supply and Treatment Research Institute

In recent years in Russia ozonation in water treatment technology has been used on a widening scale.

In 1996 in the city of Kurgan they commissioned the first water treatment plant in Russia, using only native ozonation equipment of 120 kg per day total capacity, manufactured by the "Kurgankhimmash" Joint Stock Company. The equipment of similar capacity has been also produced for a water treatment plant in the city of Tumen.

Preliminary work for production of ozonation equipment with high technological parameters is under way at a number of foreign firms cooperating with Russian manufacturers. At a water treatment plant in Nijny Novgorod equipment made by the "Ozonia" Co is being installed. Preparations for design work and implementation of ozonators in the cities of Samara, Perm, Kemerovo and others have also begun.

Technological effectiveness of using ozone has been determined on the basis of many investigations carried out when treating raw water of such rivers as Volga, Oka, Kama, Don, Tom, Ural and many others. The following has been established:

1. Ozonation of water allows to decrease concentration of chlorinated organic compounds, produced by preliminary chlorination or completly solve the problem of their formation while lowering or completely eliminaring primary chlorination of water, ensures removal of phenols. oil products, amines, pesticides and other chemical substances.

2. Combined use of ozone and activated carbon is the most effective treatment method, enabling to ensure effective purification of water containing organic compounds and sometimes achieve their total removal.

3. In most cases ozonation of water improves the process of coagulation, reduces coagulant dose by approximately 20 to 30 per cent, while the value of basic parameters: turbidity, colour and permanganate oxidation is somewhat lowered.

4. However, desogite general high effectiveness of ozonation, there are cases when specific character of ozone takes place resulting in deterioration of floc formation process and in hindrance of coagulation and subsequent settling of water.

Formation of oxidation by-products when using ozone is a serious problem. These by-products include phenols, formaldehyde, acetaldehyde and others.

5. The facts mentioned above require a more careful approuch to water ozonation. In every case it must be reasonably chosen on the basis of carrying out technological investigations and studying interaction of ozone with other water treatment methods.

It is only on the basis of such investigations that ozonation and adsorption effectiveness can be established and technological parameters as well as those for treatment plant units determined.

6. Ozone can be used not only for removal of anthropogenic pollutants from water , but also for treatment of coloured and highly coloured waters, for removal of iron and marganese compounds from ground water, as well as for water purification in swimming pools, in package treatment plants and in other cases.

USING OF OZONE FOR TREATMENT OF DRINKING WATER IN THE REGIONS OF PROBLEMATIC WATER DELIVERY WHERE ARE NO ALTERNATIVE SOURCES

Florovskiy K.L., Domninskiy O.A., Panchenko R.K.
Khrunichev State Research and Production Space Center, Moscow, Russia
Smirnov A.D.
Russian State Research Center "NIIVODGEO", Moscow, Russia

The problem how to provide civil population with drinking water is very typical for the vast areas in the desert and steppe climatic zones. In this regions the sources of the water are located very far from the hamlets, villages or towns. The quality of the water delivered to them does not comply the standards. That is why water purification before its consumption arises to be an important problem. Khrunichev State Research and Production Space Center has developed, produced and installed two types of systems designed for purification and decontamination of strongly contaminated, dirty and salty waters.

Equipment for water purification using ozone sorption to be installed in the buildings provided by the operator.

Complete set of the equipment for ozonizing and purification of the water including pumps, pipe-lines, valves, tanks for 1-day store of the water etc. is delivered to the place of operation and located inside the building of 200...400 m^2 area which can be quickly assembled using light metallic elements with thermal protection (including ventilation chamber, chamber for control units, sanitary rooms). The water purification station is operated automatically from the central control unit. The set of control and monitoring equipment consists of the devices to measure ozone concentrations (in the working gas mixture, in the air at the outlet, and in the water).

These systems provide an efficiency of 300...1000 m^3/day with respect to purified water.

Container-type systems for water purification using ozone sorption.

For these systems the complete set of the apparatus for ozonizing and purification of the water is placed inside the standard size containers together with all the necessary service equipment (ventilation, heating, illumination, air-conditioning, etc.). This equipment is installed and tested at the factory and it is delivered quite ready for the operation. Installation of these systems at site can be accomplished within the period of 5...7 days, building and/or construction works being not necessary. These systems function independently without constant presence of the personnel involved.

These systems may be used to provide a high quality drinking water for the population of isolated groups of cottages and villas, city districts, temporal villages for the workers of industrial enterprises, isolated distant objects, hospitals, children summer camps, etc. Besides they can be used anywhere in the case of natural or technological catastrophes leading to the failure of water delivery system, epidemics, etc.

Container-type systems provide the efficiencies of 60, 100 and 200 m^3/day with respect to purified water.

Taking into account the possibilities of the supplied equipment both types of the systems can be used for purification of the waters from strongly contaminated sources with the wide range of organic, inorganic and bacterial contaminants, including those formed as chlorination by-products. They can be easily adapted to different water sources, therefore their application is not limited by the troublesome regions mentioned above. Water treatment technology and process parameters were optimized for the water in which the quality standards before purification were exceeded: for different bacterial contaminants - 57-370 times; for chlorides and sulphates - 5 times; for metals classified according to toxicological harm - up to 5; for boron and bromine - up to 3 times; for organic and chlorine-contained organic compounds - up to 5 times; etc.

During purification process the water is treated by ozone, subjected to mechanical and sorption filtration, to nano-filtration as well, in order to remove salt excesses, and finally is brought to the level of quality corresponding to the standard EC SMA Decree 80/778. The latter result has been confirmed in the leading certified laboratories of Russia, the water before and after purification process having been tested for 68 parameters.

The basic part of the water purification systems are the ozonizers designed and produced by the Rocket Plant which are highly efficient and reliable. The electrodes of ozone generators are produced of the calibrated tubes of stainless steel which are covered by the special dielectric by means of specially developed technique. Water treatment technology, parameters of the water-purification equipment, sorts of sorbents to filter reaction products of contaminants ozonation were chosen and optimized at one of the real separated distant objects in a desert region.

HOMOGENEOUS AND HETEROGENEOUS DESTRUCTION OF 1.1-DI-METHYLHYDRAZINE AND ITS OXIDATION BY-PRODUCTS BY MEANS OF OZONE

Gorlenko L.E., Emel'janova G.I., Lunin V.V.
M.V.Lomonosov Moscow State University, Moscow, Russia

In water and wastewater treatment process, ozone is widely used for decreased the amount of organic materials and as disinfecting step, which can be used at different steps of biological treatment.

The systematic study of the ozonizing process of the liquid rocket fuel – 1,1-di-methylhydrazine and its oxidation by-products, namely, N-nitrozo-dimethylamine, tetra-methyl-tetrazene, dimethylamine, dimethylformamide, etc. has been carried out and the results are presented in this report.

Rocket fuel was investigated as pure liquid, gas phases, water solution and also being adsorbed on the surface of some materials including catalysts.

Kinetics and mechanism of the oxidation processes at temperatures 288-353K and ozone concentration 1-5% vol. have been carried out.

It was showed that at the oxygen or ozone oxidation a great amount of harmful by-products has been found in the case of liquid, gas and water solution of the 1,1-dimethylhydrazine. However, using catalysts-adsorbents the absolutely harmless products (N2, CO2 and H2O) have been found.

High rate of heterogeneous oxidation process was observed in the later case.

SMALL-SCALE PLANTS FOR OZONE TREATMENT OF DRINKING WATER AND WATER FOR SWIMMING POOLS

Isakov V.D.
Ecological Friendly Facilities, R&DIME, , Sverdlovsk region, Nizhnyaya Salda, Russia

At the dawn of civilization a man took water for drinking from springs and open water reservoirs. And in this case the purification of water was due to natural way: through natural filtering materials; the sun by its radiation destroyed bacteria in water; and at last, during thunderstorm the lightnings produced ozone in air and water, and this ozone disinfected the latter.

However, the human civilization made water its hostage. And the humanity had to search for ways of purification and disinfection of water.

One of the methods for disinfection of drinking water from surface reservoirs was a treatment by ozone. As it is noted in the conclusion of leading institutes of Russia - R&D Institute of Water Geology and R&D Institute of Public Water Supply Service and Water Purification - in the most cases it doesn't turn out well to produce water corresponding to the requirements of GOST 2874-82 "Drinking water" without application of ozone and coal. Particularly the sanitary conditions are not safe in Volga's basin, water reservoirs including the latters of Ural and Western Siberia.

In 1989 at R&D Institute of Mechanical Engineering the plant for ozone treatment of industrial discharges with high toxic wastes of propellants was put into operation. The realized technology was developed by the specialists of Institute and patented, and was awarded a gold medal at the World Show of inventions, Scientific Researches and Industrial Innovations "Brussels-Eureka-96". Its efficiency exceeded more than 100 times traditional industrial methods. It prompted the specialists to spread the current technology to the treatment of water for drinking purpose and swimming pools.

The introduction of presented technology combined with the adsorption filtering ensured the correspondence of organoleptic properties of water to the requirements of GOST 2874-82.

In consequence of use of the given invention the made plants of various types for water purification possess the following advantages in comparison with analogs, produced in our country and abroad:

- the modularity, allowing to manufacture, assemble and adjust the facilities at works conditions with the subsequent mounting at a site of operational use;
- the small-scaling and space-saving: the areas occupied by ozonizer, contact chamber and residual ozone neutralizer in plants of maximum output (10,000 m^3/day) do not exceed 25 m^2;
- the possibility of use of already available buildings and constructions with ceiling standard height for placement of new plants due to a horizontal design facilities (the usually applied contact chambers have a height up to 5 m);
- the absence of residual ozone in the treated water;
- the decrease of ozone consumption 20-100 times depending on nature of contaminations due to the intensification of water treatment process; also the reduction of required purification time is ensured.

Taking into account that all the open reservoirs are polluted to one or another extent the introduction of new technology for water purification must be a primary task.

ELECTRO AND PHOTOSYNTHESIS OF OZONE BY USING THE MATRIX OF MICRODISCHARGES

Ivanov V.V., Rakhimov A.T., Rakhimova T.V., Rulev G.B., Saenko V.B.
Nuclear Physics Institute, Moscow State University, Moscow, Russia

There are many important technological processes and installations in chemistry and medicine needed in effective, compact and inexpensive ozone sources. We are offer the original outline of organization of the distributed cross discarge for excitation of dense gas mixes for electro and photosynthesis of ozone. The theoretical and experimental researches of this discharge are carried out. The experimental devices for a photo and electosynthesis of ozone are created.

The structure of electrodes provided an excitation of a matrix of the microdiscarges with density of 1-10 cm^{-2} on the area of 100 cm^2. The slot-hole discharge gap had the optimum size of about 1 mm.

The low inductive curcuite with high speed of energy input in the pulse discharge is realized in this outline of cross discharge organization. This has the basic significance for initiation the vacuum ultraviolet radiation of the excimer gas mixes and for ozone synthesis.

The same outline of discharge organization has allowed to receive a high degree of dissociation in oxygen gas mixes and was used for direct electrosynthesis of ozone with oxygen or air used as the working gas. The pulse discharge was supported at atmospheric pressure or above. The plasma parameters could vary in wide range with the purpose of optimization of processes of a photo and electrosynthesis of ozone.

Ozone photosynthesis. It is known, that the relatively narrow-band (130 - 170 nm) ultraviolet radiation sources are necessary for effective ozone photosynthesis. We has managed to create an ultraviolet lamp used the excimer radiation on the basis of the offered outline of the discharge[1]. The radiation of these lamp used Kr^*_2 excimer molecules is concentrated in a spectral band 140-160 нм which is optimal for ozone photosynthesis.(Fig.1) The intensity of these source was about 6 cd/cm^2.

Electrosynthesis of ozone. The atmospheric air or oxygen was used as a working gas in a mode of ozone electrosynthesis. The ozonator characteristics were investigated at an oxygen flow 0,5 - 200 l/hour through a slot-hole discharge gap with 5 cm^3 volume and containing up to 500 microdischarges. The ozonator productivity was 1,4 g/hour at a flow of an oxygen 100 l/hour. The maximum concentration of ozone was 2 %. It was observed at a flow of 5 l/hour. The ozone productivity was constant during several hour of working with natural cooling.

This work is supported by RFBR (grant No.96-02-18770).

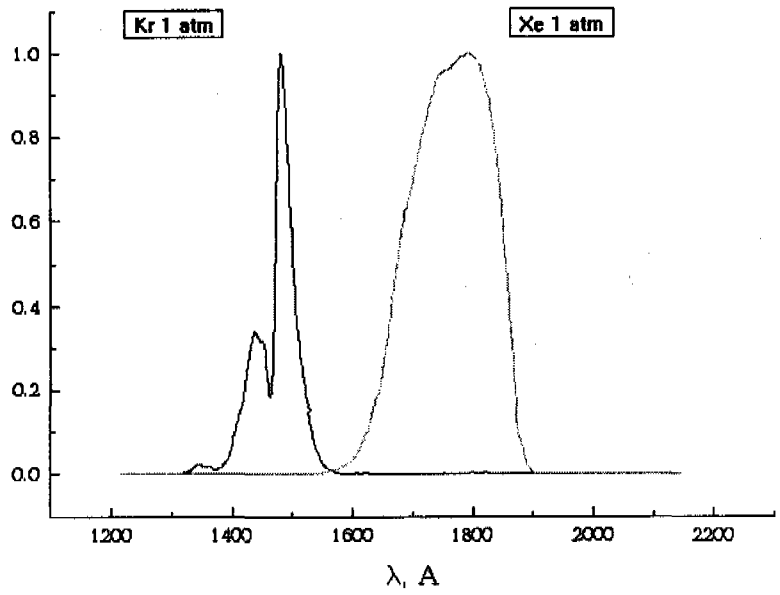

Fig.1. The spectra of VUV irradiation of excimer molecules Kr_2^*, Xe_2^*.

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ENERGY SAVING OZONE GENERATORS BASED ON PULSED CORONA DISCHARGE

Korobtsev S., Medvedev D., Shiryaevsky V.
ECOS Ltd., RRC "Kurchatov Institute", Moscow, Russia

In this work the specific features of the processes of the ozone synthesis and its destruction in the pulsed corona discharge (without dielectric in the discharge gap) are described, besides the working characteristics of the pilot industrial ozone generators based on electrical discharge of the such type are presented.

When air or oxygen passed through the pulsed corona discharge (as well as through any type of electric discharge) ozone molecules are generated in their discharge zone. However, as experiments shown, 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 mechanisms of ozone synthesis, its interaction with wall surfaces as well as processes of feed gas heating, gas - wall heat exchange. In particular, convective flows make a major

contribution to the heat transfer process in corona discharge unlike the barrier discharge. The measurements shown that the gas heat conductivity factors in pulse corona discharge of the negative polarity and in continuous corona discharge are close to each other and are almost four times higher than in pulse corona discharge of the positive polarity. In its turn the heat conductivity factor in pulse corona discharge of the positive polarity is practically equal to the usual heat conductivity factor (due to convection).

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, that is shown on Fig.1. 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). At the same time, when low and middle concentration ozone from dry air or oxygen is generated extremely low energy expenditures of ozone synthesis are achieved in pulse corona discharge at room (not cryogenic) temperatures, which makes this discharge very promising for industrial applications.

The pilot industrial ozone generators based on pulse corona discharge with productivity from 50 to 500 g/h have been manufactured and supplied to customers by our enterprise (at this principle the ozone generators with productivity some kilograms per hour can be built).

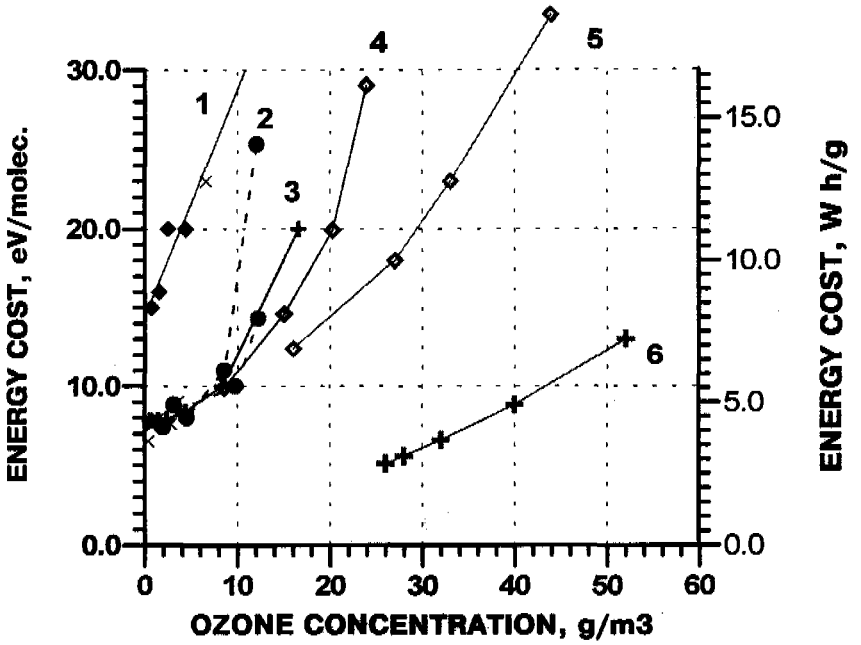

Fig.1. Dependencies of energy expenditures to produce ozone in pulse corona discharge on the ozone concentration for different discharge power:
1 - 40 W/l "negative" corona; 2 - 8 W/l; 3 - 20 W/l; 4 - 45 W/l; 5 - 70 W/l; 6 - 50 W/l, oxygen.

Ozone generators based on pulsed corona discharge have the following advantages:

- low energy cost of ozone production;
- absence of dielectric materials in the discharge gap;
- simplicity in construction;
- low investment costs;
- small pressure loss;
- wide range of the working pressure.

Some working characteristics of the pilot ozone generator "Model 050" based on pulsed corona discharge are presented, as an example, in the Table below:

Table

Ozone productivity	70 g/h
Ozone concentration	up to 25 g/m^3
Power consumption	up to 800 W
Feed gas	dry air
- dew point	not less -50 ^{o}C
- working pressure	up to 2.5 atm
- flow rate	up to 6 m^3/h
Cooling method	water cooled

BIOLOGICALLY TREATED WASTEWATER DISINFECTION AND TERTIARY TREATMENT WITH THE AID OF OZOFLOTATION

Kozlov M.N.

The tests were carried out in a batch reactor of displacement type using biologically treated wastewater. During the ozonation process with ozone dosages of more than 3 mg/l some foam occurred on the reactor surface as a result of the oxidation of the activated sludge particles contained in the water after secondary clarifiers. The foam produced was removed from the reactor by means of a special device. The ozone amount absorbed by Da solution was taken as the process basic parameter.

The tests results revealed the fact that the total coliform content during ozoflotation was characterized by the following equation:

$$lg(КИ) = lg(КИ_0) - 0.823 \cdot Da + 0.083 \cdot pH \cdot Da,$$

where КИ and $КИ_0$ = the total coliform content in disinfected and biologically treated wastewater correspondingly.

The main chemical pollutants concentration in the process of ozoflotation depends on Da in the following way:

$$B = B_0 - pH \cdot Da / (\beta_1 + \beta_2 \cdot pH),$$

where β_1; β_2 = empirical coefficients. For COD: $\beta_1 = 1.09$; $\beta_2 = 0.225$; for suspension: $\beta_1 = 3.99$; $\beta_2 = 0.915$; for BOD: $\beta_1 = -7.023$; $\beta_2 = 4.145$. The comparison with the ozonation process reveals the fact that flotation facilitates the process of pollutants removal. Thus at pH = 7 the ozoflotation removes 2.6 mg of COD per 1 mg of the ozone absorbed against 1 mg of COD which is oxidized by ozone, 0.67 mg of suspended solids and 0.27 mg of BOD compared to 0.12 and 0.07 correspondingly. It would be only natural to assume that ozoflotation is the sum of the two processes: the oxidation by ozone and the removal (as a result of flotation) of the substances which are flocculated under the influence of ozone. As distinct from ozonation, the pH value reduction influence the ozoflotation negatively. The COD removal efficiency in case of ozoflotation in acid environment is diminishing and at pH<5 it, in fact, does not differ from ozonation. The suspended solids and BOD removal at pH<4 also takes place due to oxidation exclusively. The petroleum products of mazout type (C_{22} - C_{34}) detected in the wastewater were removed during the ozoflotation process in proportion to Da:

$$P_p = 0.07 - 4.76 \cdot 10^{-3} \cdot Da,$$ where P_p = petroleum product.

The synthetic surface active substances concentration was decreased by 40 % during ozoflotation. The heavy metals content was not practically changed in this case. The foam removed into the foam separation unit was practically instantaneously compressed producing the flotocondensate which was an opalescencing liquid of muddy gray colour. The flotocondensate volume was equal to 1 - 3.0 % of the volume of the water being treated. The flotocondensate quality was characterized by high suspended solids content (150.6 $\pm$ 32.9 mg/l), COD (232 $\pm$ 59.1 mg/l) and UV (0.213 $\pm$ 0.021). The inorganic carbon concentration did not exceed the value of 5.67 mg/l, BOD_5 - 200 mg/l.

The treated water contained small amounts of residual ozone which depended on pH value:

$$C_{ж} = C_{max} \cdot Da / (D_{non} + Da) = (36.56 / pH^{1.905}) \cdot Da / [(1.38 + 0.296 \cdot pH) + Da],$$

where C_{max} = *the maximum ozone concentration in the* solution, and D_{non} = the semisaturation constant. The pH value increase is accompanied by the semisaturation constant increase and C_{max} decrease. It would be only natural to assume that this was the result of the decomposition rate increase due to OH^- ions concentration increase.

MOBIL DRINKING WATER DEVICE

Kurnikov A.S., Vantsev V.V.

The human's production activity accompanied by week ecological thought have caused the total reduction of quality of water in underground and surface nature sources.

As the result the water supply of people living in small settlements became a problem.

This can be solved by making a compact and mobile device which could prepare the natural water for drinking. It could be mostly useful for remote working and military villages and also in case of accident of industrial drop down of dangerous substances.

We offer the device which consists of the water Ozonization station (certificate РФ №89 of 01.09.97), Power Supplier, Capacity for chemical reactive, laboratory for chemical and bacteriological analysis. Productivity of the device is 10-25 m3/h depending on source water quality (underground or surface). through whole device take it's place in a standard 20-foot cold-proof container. Such measures of the station era due to an original design of sand filter and ozonator. The air, for example, is pumped through the drying and ozoning elements by a jet instrument, and the filter element and the contact area are combined in one case.

The station works in the following way: The source water is pumped by a station's pump and gets to the jet instrument, where it is mixed with ozone, which is produced from atmosphere in the ozonator. Then this gas-water mix comes to the first tank. The laboratory tests the quality of the water and if it does not correspond to the standard ГОСТ2874-82 of drinking water on some parameters it comes back to the

ozone station. Some chemical substances can be added to the water if necessary. This can be repeated until the good water quality.

The ready ozoned water comes to the second tank, and after it through the coal filter to a consumer.

So the small and fully autonomous station is able to provide 1000 - 2500 consumers with drinking water of high quality, by the norm 240 liters a day.

EFFECT OF TORCH DISCHARGE ON WATER

Lelevkin V.M, Tokarev A.V, Yudanov V.A, Tkachenko V.S.
Kyrgyz-Russian Slavic University, Bishkek, Kyrgyzstan
Kim K. S.
Kimsung Environment College, Na-Ju, Republic of Korea

Introduction

The effect of positive corona discharge on water with the purpose of its disinfection is researched. In the experiments an anomalous type of positive corona - "torch discharge" [1] - is used, according to the following circuit - disks parallel to water surface are the electrodes displaying corona discharge and water is the second graund electrode. Criterion of bactericidal properties of water is that quantity of oxidizers (ozone, hydrogen peroxide which) entered the water after the corona influence.

Experimental lay-out

A high-voltage value from the adjustable power supply is applied to the corona discharge reactor. The corona discharge reactor is a bath with water on which organic glass panel with approximately 40 stainless disks of 100 mcm thickness and 6 mm diameter fixed at the distance of 2.5 sm from each other is placed. All disks are connected with positive pole of the power supply. The bath is connected with the ground wire. Discharge parameters are adjusted in the following ranges: voltage 15 ÷20 kV, power 50 ÷110 W, volume of processable water 650 ÷1250 ml, distance between electrodes 16 ÷24 mm, processing time 2 ÷ 20 minutes. The design of the scheme permits to conduct water processing by three modes:

1. Discharge burns in the free air
2. Air circulates through the zone of discharge in the closed circle
3. Air ejection to the atmosphere followed by single pass of air through the discharge zone.

The experiments were conducted with running pipe water. Previously contents of chlorine it was determined, which subtracted from the total quantity of oxidizers in water after positive corona effect.

Results

Dependences of summary specific power expenditures for ozone and hydrogen peroxide synthesis on action time of the corona discharge on water were obtained. For all three modes we can obsene the decrease of specific power expenditures during the first 5-6 minutes since the discharge. This is probably connectod with the heating of the air and water surface to the temperature under whih in the zone oof descharge the most optimum correlation of plasma with the water vapour is established. Under these conditions maximum out put of oxidizers (hydrogen peroxide and ozone) at minimum power expenditures occur. The experiments reveal that specific expenditures are 3-4 times higher than maximum level of industry-profitable parameters of oxidizers synthesis (25-35 (kW*hour)/kg [2]) for water disinfection. Oxidizers concentration in water after 6 minutes processing is 50 g/m^3. It exceeds five times as much as maximum needed quantity of reagent (chlorine, ozone or hydrogen peroxide) for water disinfection. Besides, it is necessary to take into account such factors as ultraviolet radiation appearind in discharge zone, atomic oxygen and hydrogen and active OH radicals entering water, interacting with the microorganisms and leading them to ruin. With the further increase of deschade time in water we notice the rise of specific power expenditures. This, apparently, is caused by the disintegration of ozone and hydrogen peroxide molecules after the air temperature near the water surface increases. Increase of discharge distance leads to the reduction of specific power expenditures: for 16 mm distance it is 530 kW*kg and for 24 mm it is reduced to 370 kW*kg. Increase of distance up to 24 mm leads to the increase of discharge burning voltage and the speed of electrical wind (up to 2 m/s), the improvement of mass-exchange between gas and water, increase of oxidizers in water.

Thus, water processing by torch discharge can find technological application for disinfection of drinking water and sewage. The given way is distinguished by its simplicity of realization, reliability in operation and by reception of oxidizing reagents directly in water in discharge zone unlike chlorine or ozone technologies.

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THE ELECTRON DISSOCIATIVE ATTACHMENT COEFFICIENT AND THE RATE CONSTANT FOR VIBRATIONAL EXCITATION OF OZONE MOLECULES

Lopaev D.V., Klopovskiy K.S., Popov N.A., Proshina O.V., Rakhimov A.T., Rakhimova T.V.
Nuclear Physics Institute, Moscow State University, Moscow, Russia

The work presented the cross section set of electron scattering on O3-molecules, as well as the results of calculation of the electron dissociative attachment coefficient (/[O3] in pure ozone and the electron drift velocity Vd, The cross section set is normalized with respect to the experimental dissociative attachment coefficient [1], which has been measured in the reduced electric field range E/N = 1-20 Td. The discussion of the presented cross section set and the references on experimental and theoretical data are in [2]. The set allows one to calculate the EEDF for low E/N values.

On Fig.1. are shown the following cross section: (1,2)- the electron transport cross section on O3-molecules (Qtr) and the ozone rotational excitation by electron impact (Qrot); (3) - the cross section of vibration excitation with the narrow threshold resonance, (4) - the cross section of the dissotiative electron attachment to O3 molecules; (5),(6),(7) - the ionization cross sections of O3 molecules under electron impact with 3+,-2+,+ ions appearance in output channels.

The normalization of the crossection set for low E/N values was done on results of measurements of the attachment coefficient (/ [O 3] in pure ozone and CO2 : O3 mixture. The normalization was carried out as follows: the drift velocity Vdr, the rate constant Ka and the attachment coefficient (/[O3] = Ka/ Vdr as a function of E/N were calculated, and this was followed by comparison with the experimental data. It was shown that in pure ozone, electron detachment process strongly affects the relationship between the measured and real rate constants of electron attachment. A comparison of the measured and calculated attachment rate constants in pure ozone showed that the previously unknown process of the resonant vibrational excitation should be taken into consideration.

Shows the experimental values (/[O3] (+) as a function of E/N, as well as two variants of calculation of this coefficient: with (solid line) and without (dashed line) accounting for the near-threshold vibrational resonance. By varying the half-width of this resonance excitation in O3, position of the maximum and its amplitude, we have managed to obtain a good accordance between the results of calculation and the experimental attachment coefficient in pure ozone in the range of E/N discussed. Shows the calculated values of the drift velocity. It follows from the dependencies of these parameters on E/N that taking into account the resonance cross section leads to the decrease of the electron temperature and to the increase of the electron drift velocity in the range of E/N studied. This follows from the fact that the existence of a new inelastic process with a low energy threshold leads to a significant decrease of the EEDF in the energy range 0.2-0.6 eV. As the transport cross section is constant in the energy range studied, the decrease of the transport frequency leads to the increase of the drift velocity. Using the normalized cross section set, we have calculated the rate constants of O3 vibrational excitation and of dissociative attachment in pure ozone.

The work is supported by the Russian Foundation for Basic Research (grant No 96-02-18747).

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THE APPLICATION OF OZONATION FOR THE IMPROVEMENT OF THE EFFICIENCY OF THE TREATMENT OF WATER FROM THE MOSKVA RIVER WATER SUPPLY SOURCE

Mirkis V. I., Smirnov A. D.
MOSVODOKANALNIIPROJECT Moscow Institute for Water & Wastewater Research & Design, Moscow, Russia

Traditional potable water treatment methods and facilities are designed to remove coarse dispersed and readily oxidizable admixtures from water; up to recently they served as an efficient barrier providing the protection of human health from the negative consequences of water consumption. Nevertheless the development of industry results in occurrence of the increasing number of new synthetic materials and by-products including some highly toxic ones. Conventional clarification and disinfection treatment systems are not effective against them.

The deterioration of water quality in water sources is accompanied by the tightening up of the potable water quality requirements. At present there have been established the new Sanitary Norms and Regulations for Surface Water Protection Against Pollution (SaNPin [1] 4630-88) as well as the Sanitary Requirements for Potable Water Quality (SaNPin [1] 2.1.4.559-96) which are brought in conformity with the WHO Recommendations and the EEC Standards.

Unlike the standards in force, these Standards include the indices which determine the degree of parasitological and virus water contamination; the list of the indices controlled is considerably enlarged and the MPC levels for a number of toxic organic compounds are lowered.

The world practice of water conditioning reveals the fact that large water treatment plants create the most favorable conditions for the combination of traditional water treatment methods (coagulation and clarification) with ozonation and granular activated carbon sorption.

The research work which has conducted during the last three years by MOSVODOKANAL MSE and MOSVODOKANALNIIPROJECT Institute with the participation of NIIKVOV named after K.D. Pamfilov, GNC NIIVODGEO and other specialized organizations proved the efficiency and the reliability of this technology application for the plant that treats the water from the Moskva River water source.

The experiments were carried out with the usage of a continuously operated flow-through installation both under ordinary conditions and under the emergency situation imitating conditions. To evaluate the role of ozonation, several treatment variants were tested; the common feature of these variants was the successive incorporation of the methods into the process flow chart.

The tests proved the necessity of ozonation application for the conversion of readily oxidizable substances into the insoluble ones, for example, iron and manganese compounds, even extremely small concentrations of which influence activated carbon negatively. The ozonation has also provided the bio-resistant organic compounds partial destruction to more readily oxidizable forms which facilitate the development of biological treatment process in the sorbent layer increasing thus both the total effect of pollutants removal and the carbon service life. In particular, the inter-regeneration period of activated carbon usage was increased by 40 - 60 % minimum.

It was also stated that during the spring, summer and autumn periods the application of ozonation and flotation combination (ozonoflotation) is highly effective at the preliminary stage of water treatment. Ozonoflotation considerably lowered the color, the permanganate value and the suspended solids level (by 80%, 40% and 70% correspondingly); the coagulation of water was also improved.

THE TALLINN OZONE PROJECT – FROM LABORATORY STUDIES TO INDUSTRIAL APPLICATION

Munter R., Loorits H., Kamenev S.
Tallinn Technical University, Estonia

An overview on the drinking water production problems in Tallinn is given. 85% from Tallinn drinking water consumption comprises surface water (Lake Ulemiste water, about 140,000 m^3/d) and 15% groundwater. The Tallinn Water Treatment Plant was built in 1927 and it processed 24,000 m^3/d of the Lake Ulemiste water at that time. The possibility of ozone introduction for water disinfection was first time discussed, but due to the availability of relatively cheap chlorine this intention was given up.

During Soviet period in 60-80s several problems in drinking water production from lake water in connection with continuous worsening of raw water quality arose (industrial and agricultural pollution). Department of Chemical Engineering of Tallinn Technical University started with the first laboratory tests of Lake Ulemiste water preozonation in 1960. The kinetics of ozonation as well as ozone mass transfer from the gaseous phase to the liquid one were studied. Impact of ozone on lake water quality was mainly characterized through changes in color, turbidity and pH. It was established that in the color reduction the main role plays not the contact time, but the hydrodynamic conditions in the contact apparatus. The kinetics of ozone decomposition reaction in lake and distilled water at pH=4.6, 7.1 and 8.4 and at the temperatures 5, 10, 15 and 25°C was studied and established that ozone decomposition follows the 3/2 order with respect to dissolved ozone concentration quite well in the range of pH 6.8-7.5. Using the mathematical model of the semicontinuous bubble column and the values of ozone decomposition rate constants, the expected values of ozone true reaction rate constants with humic and fulvic acids in lake water were calculated.

Different contact equipment (cocurrent downflow bubble reactor with ejector, cocurrent downflow bubble reactor, sectionalized countercurrent bubble reactor and mechanically agitated vessel) were studied and tested in pilot plant conditions. To compare the effectiveness of different kinds of contact equipment, a new specific parameter - energy consumption for color reduction by 1° (degree) per 1 m^3 of water was chosen. The cocurrent downflow bubble reactor proved to be the most effective one. A mathematical model of this column was composed and verified using decoloration reaction rate constants. A five-stage absorber of that type (D=0.3 m, H=0.6 m, Q=600 m^3/h) has been tested successfully on an industrial scale for preozonation of raw lake Ulemiste water. The procedure of scaling for downflow bubble reactor was elaborated.

The whole lake water improved treatment process (preozonation+coagulation & flocculation + clarification + filtration) was tested in pilot plant conditions at the Tallinn Water Treatment Plant in 1990-1992. Ozone was generated in a tube generator with water cooling, operating at low frequency current (50 Hz), and composed of 19 dielectric tubes. Ozone concentration in the gas was in the range of 8.0-23.0 g/m^3, air flow rate varied from 0.85 to 1.9 m^3/h and ozone generator's capacity from 7.2 to 24 gO_3/h. Due to the significant algae content of raw water in summer the ozoflotation chamber (V=I.2 m^3) was chosen as a contact device instead of cocurrent downflow bubble reactor. Porous plate for industrial bubble columns (D=230 mm, diameter of pores 20 μm) was used as a gas diffuser. The surface of the plate was swept by the inlet raw water stream thus simulating the ozoflotation process (French patent, Bourbigot, Faivre, 1986). The residence time of water in the ozoflotation chamber ranged from 20 to 35 min. For clarification of flocculated water the sludge blanket clarifier (D=0.84 m, H=6.0 m) was used. Clarified water was filtrated through two-layer (GAC + sand) filter (D=0.2 m, H=6.0 m). The pilot plant tests were performed using Lake Ulemiste raw water after microscreening with the flow rate 0.9-3.0 m^3/h. The coagulant (aluminum sulfate) dose was in the range of 5-23 g/m* Al203, and the flocculant (polyacrylamide) dose was 7.3-36 g/m*. After reaching the steady-state conditions samples

were taken from 5 different points: I - initial water; 2 - the outlet of ozonation chamber, 3 - coagulated and flocculated water; 4 - clarified water; 5 - filtrated water. In the collected samples the color, turbidity, biomass content and different algae species were measured. Some pilot plant tests were carried out to compare the efficiency of prechlorination and preozonation stages. The main results of pilot plant tests are summarized as follows: 1) from the point of view of color, turbidity and biomass reduction preozonation is about 1.5 times more effective than the prechlorination of raw lake water; 2) among of the different algae species the highest degree of reduction (71-84%) was achieved for blue-green algae;

3) the COUmn can be suggested as a summarized quality parameter of water. On its basis the optimum dose ofpreozone should be in the range of 4-10 g/m* depending on the season; 4) preozonation is especially effective treatment method for clear cold water where coagulation is not satisfactory, i.e. under winter conditions; 5) usage of the GAC filtration at the end of the scheme can reduce the color below 5° and is a guarantee of production of drinking water of a very good quality according to the Estonian and EEC Standards: color of treated water 0-5°, turbidity 0-0.24 mg/l; CODmn I mg/l. no TOM.

On the basis of the results of the pilot plant tests the full-scale OZONE PROJECT was developed and successfully implemented in 1997. The contract for purchasing of 2 medium frequency ozone generators (each with maximum capacity of53 kgOg/h) was signed with the French company TRAILIGAZ. The technology of ozonation and building for ozonation station was projected by the Estonian-Finnish company PIC- EST. For ozone-water contacting 4 usual bubble columns (without sweeping system) were projected: 2 basins for preozonation and 2 basins for possible intermediate ozonation (before filtration). The dimensions of one basin are: 24 x 10 x 2.75 m (height of the water layer) and height of the air space above the water surface 2.35 m. Maximum water flow rate for one basin is 1.1 m*/s = 3960 m*/h = 95 040 rn*/d. The water residence time in the basin is about 10 min. Two preozonation basins can guarantee the drinking water production 190 080 m*/d which totally satisfies the nowadys need of the city. The basins are operated at the approximate gas/water ratio G/L= 0.5 m*/m* with the maximum dose of introduced ozone 10 g/m* of water. Needed ozone production for the two basins is then 80 kg/h, it means that 2 generators are in operation in summer and I in wintertime. Concentration of the dissolved ozone at the outlet of the basin is automatically kept

0.3-0.4 mg/l. Ozone utilization degree has been in the range of85-90%, it means that 10% of the introduced ozone (8 kg/h) leaves the basin with ozone-air mixture and, needs in destruction. To save energy the tentative electrical destruction units were replaced by the injectors + chimneys system for used ozone-air mixture dilution and

emission to the atmosphere, however some problems with achievement of the MPC of ozone have arisen and using of catalytical destruction system has been under consideration.

Economical calculations have indicated that in the year 2005 the working cost of I m* ofpreozonized drinking water will be 1.82 EEK and the working cost of I m* of prechlorinated drinking water 2.20 EEK. The quality of water is, of course, incomparable.

USTNG REDOKS-SYSTEMS WTTH OZONE IN PROCESSES OF REGENERATTONS OF SEWAGES TN THE TEXTTEE PRODUCTTON

Murakow A.P., Grebenchikow E.N.
Engineering ecological agency "Redolks- systems", Tvanovo

Essential reserve in rational watersuppy and shortenning a consumption of water in processes of decorating fabric are a local waterpurifiy to stations,which capable to ensure a necessary quality of water for recurrent use in technologikhrocess. Main problem at regenerations of sewages in dyetrimming a production is high color and color sewages by diffe-rent hemical join (aplicable for fastening the dye staffs on weaving*.

EEA «REDOKS- SYSTEMS» has developped a new technology ofdestrukcion oxidation and discoloration polluted earned one's living sewers by processing water redoks-systems with ozone. Given technology ensures a production in factory conditions different oxidation: atomami and singltni oxygen, ozone, products of electtricchimist decomposition of water (gipohlorit, hydrogen peroxide and av.), which capable to forming the radical components in processes ozomrowamj.

Using redoks-systems with ozone allows repeatedly to intensily and accelerate processes ofdestructuir oxidation and discoloration such complex enwironment,as polifenolin.dye staffs, SPAW,oilprodukt and other difficult cleaning biodestrukeshen enwironment earned one's living sewers. Discriminating particularity of process and its value is an absence of contact pillars (for ozonirowanij water) and nousense to muddi water.

Technologically way of getting redoks-systems with ozone is executed in the manner of systems presseozonirprocess with using a principle an turbulisirung and manykomponentnis do mel- ange an oxidacion (fluid and gaseous) in the cascade of devices an ejector-turbine a pump- ejector. Using redoks-systems with ozone allows to obtain a necessary quality a peelings of water with specific energy expenseses 0,6-2,5 kWt.h/m* water that greatly below when is used only one ozonirowanie and requiring specific expenses 4-6 kWt.h/m* sewages. Herewithc hemical consumption of oxygen (UFO) falls on 60-70 %, when using one ozonirowanie ewers this value only on 6-10 % only.

On the base oftinning results on inventories ofsystems watersupply and possibility of using one or another method a peelings of local flows of sewages is offered technology an

enwiron- ment water facilities dye-trimming textile factory production, including following main processes, division of specific and association of sister flows for he reason greatly efficient their peelings and rational using cleaning water again, processing the individual flows of sewages on local puri- fu erecting a shop, recurrent using the cleaning sewages in technologies of trimming production, salvaging caught from sewages polluting ingradient and heat. Proposed by us technology allows to bring back into the production and again use before 50-80 % cleaned water and shorten a consumption of heat energy before 50-70 %. Installation «KATOZO'N», realizing tehprocess peelings of sewages, executed in the manner of the universal blonder ensuring multiloop circulation okisgen water solucition enterring from devices of different purpose and power, generator of ozone, installing a direct electrolysis of flow of water, elektrolisen of installing a getting gipohloridum, installing an ultroviolet irradiating water and getting a hydrogen peroxide.

Time of the full discoloration an solucion direct and active dye staffs forms 1-12 minutes undersourceconcentrationsofdye staffs accordingly lOand45mgs/l.discoloration ofacid dye staffs occurs for 4-6 minutes under same concentrations. The most difficult oxidized are considered sulphurous dye staffs and even after 12 minutes ozonirowanie has an observable colouration. Using redoks-systems with ozone allows greatly to reduce a consumption of ozone, which depends on the type, concentrations of dye staffs and HPO dissolve. At the average this value forms 8-15mr/l.

However, if regeneration to lead with partial diluting washing water by clean water in volumes I :2, the concentration an oksigen decreases in 2-10 times. Such a effect is observed at ultrovio- let processing a flow of water at doses of irradiating 30-40 m*g/sm*, or under the direct electrolysis of flow of water (working density of current 50-100 A/sin*) or accompaniment gipohlorita in concentrations 1-7 mgs/l. Use any oksigen combination with ozone greatly raises a synergism processes an *estrukschen, but requires special studies. Given technology is tested on piloten testing the sewages containing different dye staffs (with limits of diluting on color 1:500-1 :2500).

Three application redoks-systems is considered In the report with ozone: clear of greater volumes ofmunicipal and industrialen sewages, detoksikacion powerfully polluted and painted sewers and bleaching a linen filament with the full absence of chlorine.

BLEACHED PULP PRODUCTION WITH OZONE FOR BLEACHING AND PROCESS WATER TREATMENT

Musinsky S.V., Rytova E.Yu., Zvezdina L.K., Shpakov F.V., Krjazhev A.M.
AO VNIIB, St. Petersburg, Russia

With the chlorine-based bleaching systems currently in use , there are not the special strict standards for process water needed to perform bleaching successfully.

In modern bleaching various non-chlorine bleaching chemicals such as oxygen, hydrogen peroxide and ozone are used . It is well known that iron, manganese and other transition metals catalize ozone and peroxide degradation as well as oxidative destruction of cellulose. Therefore, modern bleaching requires the lower contens of iron, manganese and copper ions in process water than conventional bleaching.

Removing of iron and manganese ions in process water may be realised through water ozonization and filtration.

The results of some authors and our experiments demonstrated that under the Baikal pulp and paper mill conditions the ozone consumption should be 30 g/ m^3 of water to attain Fe^{2+} content 0.5 mg/l. Our bleaching technology requires no less than 5 m^3 of process water/t pulp or 60 m^3/h, consequently, economically sound ozone consumption for the iron removal was be 1.8 kg O_3/h.

We have developed two TCF bleaching sequences for the papers O-Q-O-Q-Z-P and O-Q-P-Q-Z-P for the dissolving pulps. In ECF bleaching chlorine dioxide is used, so the effluents comprise chloride ions and a local treatment of these effluents needs some special expensive methods, while in TCF bleaching ozone delignification allows to organize a closed effluent free mill operation.

Our experiments on TCF pulp production with ozone stage for the papers and dissolving pulps show that effective ozone delignification takes place at 40% pulp consistency. In this case ozone consumption is 1.5-2 kg/t pulp or 18-24 kg/h and it let us produce the bleached pulps with the standard strength characteristics.

Thus, it is worth using ozone for pulp bleaching as well as in water treatment. Chlorine dioxide substitution for ozone allows to close the effluents and realise the ecologically benigh technologies on industrial scale without waste water treatment at the outside water treatment facilities.

PRIMARY OZONIZATION OF DRINKING WATER AT WATER TREATMENT PLANTS

Naidenko V.V., Vasilyev L.A.
State Architectural and Building University,NizhnyNovgorod,Russia

The Volga basin annual drinking water requirement is 75.5 cu.k m, 86% of it being covered by surface water supplies. For namy decades there has been an intensive urban development in the basin of the Volga. The real possibilities of ecosystems in the region in adapting to enormous anthropogenic load has been ignored. The territory of the basin , which accounts for 8% of the total area of Russia, has accumulated 45% of industrial enterprises and nearly 5% of

farming facilities of the country.There are 444 cities here (42% of the Russia's total) with 57 mln population.

The concentration of industrial production in the region with no allowance made for environmental safety has lead to heavy pollution of water , atmosphere and soil..

The effluents discharged into streams in the area annually carry nearly 350 thou.tons of organic pollutants, 18 thou. tons phenols, 6 thou. tons synthetic detergents, 100 thou t. ammonia nitrogen , 90 thou tons phenols and other pollutants harmful to ecosystems.

To obtain drinking water surface water supplies are usually subjected to primary chlorination , chemical treatment, sedimentation or floc blanket clarification, sand filtration and secondary chlorination. These technologies were developed in 1930s-1940s and were not designed for treatment of water supplies carrying pollutants of anthropogenic and technogenic origin. Most water treatment plants fail to fulfil their main function, i.e. barrier intended to control pollutants of both natural and anthropogenic nature. Beside this, trihalomethanes ($CHCl_3$, CH Br Cl_2, $CHBr_2Cl$, CH Br_3,) are produced in water in the process of water chlorination, their concentrations in water being much higher than that of any other organic pollutants. Presence of organochlorine compounds in drinking water is of great danger for public health.

As removal of VHC is a difficult task, it is expedient to change the existing process of water treatment to avoid production of organochlorine compounds in the course of water treatment. The analysis of world experience and our own research have prompted us to prefer a most promissing technique of preliminary chlorination. Deep understanding by specialists of high efficiency of ozone treatment; increasing anthropogenic load imposed on water bodies and streams; impossibility , in most cases, of using chlorine as primary chemical agent from the sanitary point of view - all this proves the multi-purpose action, ecological safety and necessity of ozone application in drinking water treatment.

Taking into account heavy pollution of water supplies , and therefore, large ozone dosage required for destruction of pollutants we have suggested introduction of preliminaty water treatment by biosorption units intergrated in water treatment processes.

Thus, before primary ozonizaton water passes through preliminary treatment to remove organic compounds, bionths, SS, microorganisms. The section with natural biocenosis installed in the input channel of the microfilter is made of racks spaced 0.2-0.4 m . River water is passed through the natural biocenosis at the rate of 0.2-0.6 m/sec where the cells of phyto- and zooplankton settle down. Their mass grows providing preliminary treatment of water. As the saturated particles of mature biocenosis grow they are carried with water to the microfilter, where they are mechanically detained and removed.

The water is further treated with ozone, and undergoes coagulation, clarification, filtration and disinfection . The main condition of successful realization of the process is microfiltration immediately following the biocenosis treatment stage located nearby to prevent destruction of biocenosis flocs while passing water to the microfilter.

Considering the fact that ozone is an easily degradable substance and that its action is of a short-time nature, we have suggested a technique for stabilization of ozone in water with a derivative of S-heptasin having general formula $C_6N_7R_3$, where R is NH_2 or OH, used as a heterocyclic compound. The derivative of S-heptasin is a 13-member heterocyclic compound with a stable nucleous and substitutes Rx not included in the general formula $C_6N_7R_{3x}$.

Beginning from early 1990s , in view of a dire need in water treatment and ozonizing equipment of small capacity , the N.Novgorod State Architectural and Building University together with a number of industrial enterprises of N.Novgorod have organized manufacture of ozone treatment modules with capacities of up to 1,000 gram of ozone per hour, contacting equipment (bubbling, pressure, static mixers for water pipes), various filtering equipment. This equipment is used in water treatment plants of small communities.

Though quality characteristics of water may differ in turbidity, colour these water supplies have much in comon: presence of organic pollutants, specific organics, hydrobionths, which allows application of preliminary treatment of water with useing natural biocenosis, microfiltration, primary ozonation and making it a multi-purpose technology.

COMPACT OZONE GENERATION PLANT

Panteleev V.I., Panteleeva A.K.
Vyatka State Technical University, Kirov, Russia

In recent years ozone is finding rapidly increasing broad indastrial application.

The advance ozone technology is economically and environmentally beneficia especially for treatment of municipaland industrial effluents and disinfection of potable and swimming-pool water.

Conventional disinfection of water with chlorin results in formation of toxic chloro-organic derivatives. Besides that, some bacterias have adapted to chlorine and it practically have no impact on viruses (herpes, hepatit etc.). Nowaday requirements to the quality of potable and swimming-pool water condition the necessity of including ozonation in water treatment process.Being a stronger and enviromentally safer oxidating agent than chlorine, ozone oxidizes a broader diversty of contaminations, inactivates viruses and improves the organoleptic properties of water. The rise of the new byproduct of civilization - patogenic chlorine-resistant viruses - enhances the role of ozone. The great advantage of ozone is that the ozone production doesn't depend on the delivery of raw material. Ozone can be produced from air or oxygen immediately at treatment site.

Ozone water treatment requires the use of rather complicated equipment comprising ozone generation unit and contact chamber , where ozone-air mixture is mixed with

water. Despite high efficiency and economic advantages of ozone technology the practical application of ozone is restricted because of deficiency of reliable equipment satisfying the modern requirements. The ever increasing load on the environment calls for the rapid rise of demands in ozone generators for drinking and swimming-pool water treatment.

The ozone generator comprises multi-cell tube ozonator and high-voltage power supply (RF Pat.No 1370072). Ozone generator consists of 150 ozone discharge elements connected in parallel and placed in one body. The body is made of plastic tube (diameter = 160 mm,length = 300 mm). The openings at both ends of this plastic tube are closed by covers made of some isolation material. In each cover there are 150 holes (diameter 5,6 mm) drilled at equal distances. Through these holes the quartz tubes (wall thickness = 0,8 mm, length = 350 mm) are inserted inside the plastic tube (Fig.1, Fig.2). To make the inside of the body water-proof, the space between the outer surfaces of quartz tubes and the cover is filled with hermetic. There is an inlet and an outlet for cooling water,wtich functions as the grounded electrode.

High-voltage electrodes are made in the shape of a spiral from stainless wire with the diameter 0,25 mm. The discharge occurs in the gap between a high-voltage electrode and the inner surface of a quartz tube. The air gap beyween a high voltage electrode and the inner surface of a quartz tube is 0,5 mm.

The caps made of some isolation material are hermetically fixed to the covers. Oxygen or dry air is fed into one of the caps,then it passes through discharge gaps, wtere ozone is generated by electric discharge, and is let out through the second cap.

Ozone generator data:

Diameter, mm 170

Length, mm 400

Discharge area,cm3 174

Discharge gap, mm 0,5

The cooled area of the discharge surface 5 560

The new design of ozone generator resulted in a compact ozone plant for swimming-pool water treatment:

Ozone yield,g O3/h 100

Massa, kg 75

Dimensions, mm 890x470x280

The cooling efficiency of the nwe ozone generator is not worser than that of conventional ozone generator with the cooling of tow electrodes,but its disign is simpler and technologically better. Due to the spiral configuration of the high-voltage electodes the electric field created in the discharge gap has extremely non-uniform distribution of field intensity, it helps to reduce of the operating voltage and makes the demands to centering of electrodes not so strict.

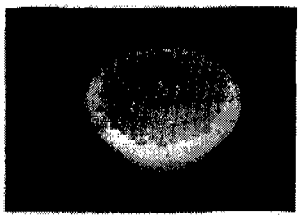

Fig.1

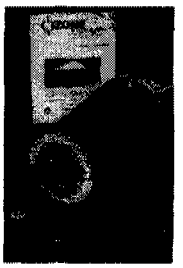

Fig. 2

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CALCULATION OF THE THERMAL BALANCE FOR BARRIER OZONIZERS

Peiguo Li, Vereshchagin I. P., Sokolova M.V.
Moscow Power Engineering Institute (TU), Moscow, Russia

To draw up the thermal balance in an ozonizer the processes that take place in it must be considered using a system of differential equations with corresponding boundary conditions: equations of continuity; equations of movement and equations of energy conservation [1]. A computer program was written for calculating of the thermal balance in barrier ozonizer on the basis of the numerical solution of these differential equations. For this purpose the tubular ozonizer should be presented as a system of coaxial cylinders, and following assumptions should be made. (a) Only the thermally stabilized regime is taken into account. (b) The flow of gas has dynamically developed character and the velocity profile of the flow does not vary along the length. (c) Discharge does not influence the character of the gas flow (laminar or turbulent). (d) All energy is distributed in gas; (e) The end borders of electrodes are thermally isolated.

An example of such calculation is presented below. The length of the ozonizer is accepted to be equal to 60 mm. Diameter of the internal electrode with an enamel cover is equal to 42 mm. The enamel thickness is 1 mm. Width of the discharge gap equals to 1.5 mm. Both electrodes are cooled by water, which flows in the direction opposite to the gas flow. The temperature of the water at the inlet is 13 °C. Because of the short length of the ozonizer, it is possible to assume, that the heat distribution along the length of the discharge zone is uniform. The heat distribution along the width of discharge gap is not clear till now [2]. In this work the following five variants are assumed for calculation. (I)

Uniform. (II) Non-uniform, but symmetric (heat is distributed within the limits of 50 % of width of discharge gap adjoining each electrode) [2, p.96]. (III) Strongly non-uniform, but symmetric (heat is distributed within the limits of 5 % of width of discharge gap near each electrode). (IV) Asymmetric, heat being distributed within the limits of 5 % of discharge gap near the surface of internal electrode, and (V) the same but near the outside (metal) electrode.

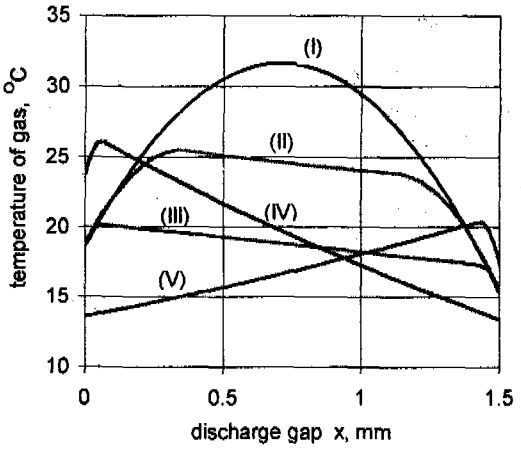

Fig. 1 The distribution of temperature of gas along the width of the discharge gap.

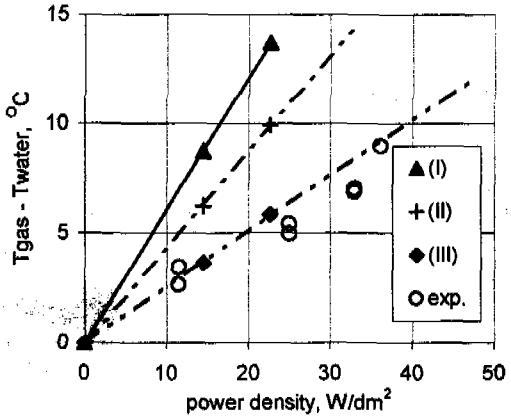

Fig. 2 The increase of temperature of gas from temperature of water at the exit end of the discharge zone as a function of the specific power.

Distributions of the gas temperature along the discharge gap width at the exit end of the discharge zone are shown in fig.1. The calculation was carried out for specific power density of 23 W/dm^2 and the gas flow rate V_{gas}= 3 l/min for different assumed heat distributions. (In Fig.1 abscissa x=0 corresponds to the surface of the dielectric electrode; x=1.5 mm – to the surface of the metal electrode).

Table 1

Heat distribution	(I)	(II)	(III)	(IV)	(V)
$Q_{intern.}$, %	45	47	47	88	5
$Q_{extern.}$, %	51	50	52	10	94
Q_{gas}, %	4	3	1	2	1

The portions of heat, removed by gas and by water, which cools the external and internal electrodes, are shown in table 1. It is to be reminded, that the parameter Q_{extern}/P, which was obtained in experiments [3], lies within 50±5%. It well coincides with the calculated results for all variants of heat distribution except for asymmetric ones (variants IV and V). Therefore it is possible to consider the heat distribution along the width of the discharge gap as practically a symmetric one. From other point of view, the energy removed by the flow of gas is practically insignificant. It is associated with small thermal capacity and low gas flow rate (3 l/min).

The average (over the cross-section of the discharge gap) temperature at the exit of gas for various accepted heat distributions is shown in Fig.2. In this figure points obtained in experiments [3] are also shown. It can be seen, that the calculated temperature coincides with the measured one in the case of strongly non-uniform heat distribution. Using the uniform distribution results in an increased value of temperature. Therefore, it is possible to say, that the heat distribution in barrier ozonizer is strongly non-uniform. The energy is released practically symmetrically and only near the surface of the electrodes.

The gas flow rate is changed from 1 up to 10 l/min. It does not result in appreciable change of temperature distribution at the exit end of the ozonizer. As in ozonizer the gas flow speed is not high, the flow has a laminar character, so

the influence of the gas flow rate on the temperature distribution should not be great. This fact was also observed in experiments [3].

The temperature of gas reaches a stable value at a distance ~10 mm from the inlet for gas flow rate 3 l/min. Such a small initial length is associated, first of all, with small thermal inertia of the gas. And it, certainly, depends on the gas flow rate.

Thus, for an ozonizer with two-side cooling it is possible to make following conclusions. (a) The heat from the discharge zone is carried out by water. The amount of heat through each electrode is about 50%, and the heat removed by the gas flow is insignificant. (b) The distribution of the heat release is non-uniform, the most quantity of the heat being released near the electrodes. (c) The heat release is practically equal near each electrode.

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EXPERIMENTAL INVESTIGATION OF THE THERMAL CHARACTERISTICS OF A BARRIER OZONIZER

Peiguo L.I.. Sokolova M. V., Vereshchagin I. P.
Moscow Power Engineering Institute (TU)

Ozone is a thermally unstable substance, therefore we always pay attention to the thermal characteristics of an ozonizer. A brief message on an attempt to measure the heat flows in a barrier ozonizer and the temperature of gas in it is submitted here.

The experimental object is a sectioned tubular barrier ozonizer with cooling of two electrodes. It is a system of coaxial electrodes, in which the external electrode is divided into 4 sections along its length. Sections are isolated from each other by plastic ring gaskets and have their own cooling systems. The internal electrode is covered by a layer of enamel (type ЭСГ-21) 1 mm thick. The width of the discharge gap is 1.5 mm. Six thermal flow gauges are uniformly placed on the outer surface of external electrode of one section. The output voltage of gauges, which are connected in series, linearly depends on a thermal flow, that passes through the electrode. Such a dependence was obtained for different water flow rates. To measure the temperature of the gas the thermal resistors are located in isolation gaskets. The heads of the thermal resistors are 2.5 mm away from the surface of internal electrode. So there is no discharge between the heads of thermal resistors and the internal electrode. Such construction permits to investigate the change of the characteristics of the ozonizer along its length (for example, the active power of the discharge, the temperature of the gas, etc.).

Preliminary experiment on a plane model ozonizer was made, in which the thermal flows through both electrodes were measured by thermal flow gauges stuck to both electrodes. It has been proved, that, firstly, the active power measured by Volt-Coulomb Characteristics (VCC) and the sum of heat flow through two electrodes coincide with each other (divergence not more than 10%); secondly, in the case of cooling of both electrodes the heat flows through each electrode are practically equal.

In tubular ozonizer thermal flow gauges were located only on the external electrode. The ratio of the thermal flow, removed by external cooling, to the active power, measured by VCC is shown in Fig.1. In all experiments both electrodes were cooled by water, which flows in the direction opposite to the gas flow. The water temperature at its inlet into the ozonizer was 13°C. The water flow rate was 0.2-0.6 l/min. The flow rate of dried-up air was 1-3 l/min. The applied voltage had an amplitude 4.5 - 6.0 kV, its frequency being 250-1000 Hz.

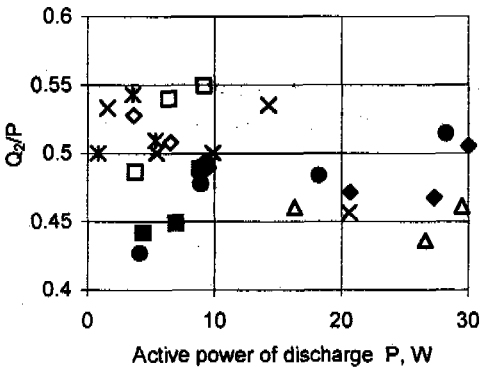

Fig. 3 A portion of energy, removed by external cooling for different conditions (voltages, frequencies, gas flow rate, etc.)

An experiment was carried out with only one-side (external) cooling. Thus the energy, which passes through the external electrode, should be approximately equal to whole energy of the discharge, as the energy of the ozone formation and of the gas heating is small. Two points obtained in this experiment are 1.01 and 1.02, that approved this statement (measurement error ≤10%). For all cases of cooling of both electrodes the parameter Q_2/P, as shown in fig.1, is within the limits of 40 – 60%, and majority of points does not come out of the band 50±5 %, as it was obtained in the experiment with plane ozonizer.

It is found in the experiments, that the specific active power of discharge decreases along the course of gas flow (Fig.2 (a)). This non-uniformity is associated, probably, with the change of ozone concentration in the flow of mixed gas. It is known, that an addition of ozone to air results in an increase of the initial voltage of discharge and, as a result, in a decrease of the discharge intensity at a given voltage. Therefore at the lowest voltage used in experiment (Uo=4.5 kV) there was observed even an absence of discharge in the last section. But the increase of the initial voltage because of ozone is limited. It does not exceed about 10-20% depending on the geometry of ozonizer, type of the gas, ozone concentration, etc. Therefore the non-uniformity of distribution of active power decreases at higher voltages.

The temperature of gas was measured in the experiments. As was said above, the thermal resistors are not located in the discharge zone but after it. A calibration was made, in which the gas was heated up by a spiral resistor located in the gas gap. Temperature of the gas at the outlet of the discharge zone was measured by a second thermal resistor. The relationship between two values of temperature is thus obtained. The distribution of gas temperature along the ozonizer is shown in Fig.2 (b), the calibration being taken into account. The temperature measured in these experiments is an average one over the cross-section of the gas gap. Abscissa 0 in Fig. 2 (b) corresponds to the initial part of ozonizer without discharge. Accordingly, the initial temperature of gas is practically equal to the temperature of the cooling water. The following experimental point (as follows from the characteristics of experimental curves) already corresponds to the thermally developed part. Thus, the undeveloped regime of heating of gas takes only a small part of the ozonizer length.

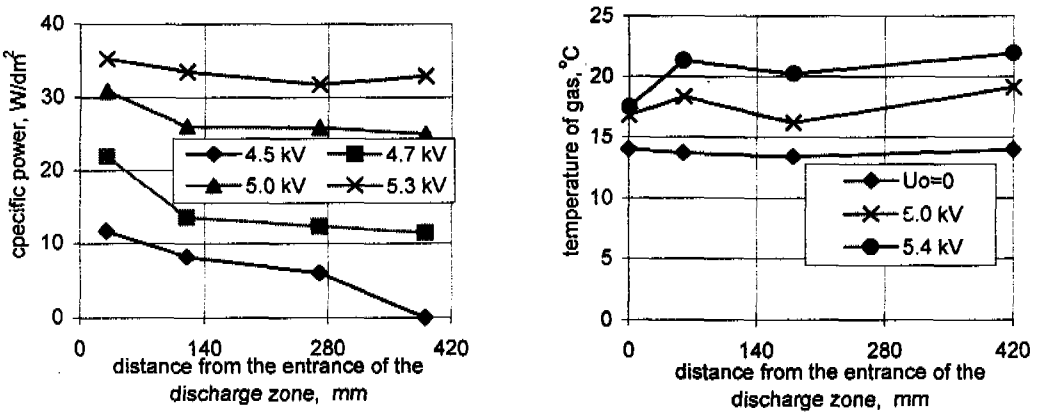

Fig. 4 The distributions of the specific (over the area of electrode) power (a) and the average (over the cross-section of the gas gap) temperature of the gas in the discharge zone (b) along the ozonizer. (f=1000 Hz, V_{gas}=1 l/min, $V_{water1}=V_{water2}$=0.5 l/min, $T_{water,input}$=13±1 °C. The water flows opposite to the gas flow.)

From all said above it is possible to make following conclusions. (a) In case of symmetric cooling the heat removed through two electrodes is practically equal. (b) The active power of the discharge is distributed non-uniformly along the length of ozonizer. The lower the overvoltage is, the higher is the non-uniformity. (c) For considered conditions the temperature of the gas is established in the initial part less than 60 mm from the inlet.

CORONA DISCHARGE OZONIZERS IN MEDICINE, FOOD-PROCESSING INDUSTRIES AND AGRICULTURE. EXPERIENCE OF DEVELOPMENT AND APPLICATION

Pershin A.F.
The research-and-production enterprise "Antares", Moscow, Russia
Fedorov A.V.
People's Friendship University of Russian, Moscow, Russia

The basic way of ozon generation is the electrosynthesis by barrier ozonizers (using silent discharge in a gas gap interrupted by an insulating layer inserted in it), shows the special requirements to drying and purifying of feed air.

Corona discharge ozonizers allow to use ambient air as raw material,because the discharge is much less sensitive to the gas humidity and purity. The corona discharge synthesis can get the ozone yield level of barrier one.It occurs in a

sharply non-uniform electrical field by positive potential on the corona electrode /2/.As a result of experiments it has been possible to receive a steady corona at a voltage 15 ... 25 kV, capable actively synthesis ozone concentrations up to 5,2 G/Nm.

Extensive researches have been undertaken to determine electrical, gas-dynamic and constraction factors influencing the ozone yield. The main problem to be solved to develope corona ozonizer was an increase of the energy dissipated in the discharge gap without sparking.

The decisions have been determined,on the one hand,at an optimization of parameters of an applied voltage,and on the other hand,at an organization of an effective cooling of electrosynthesis zones.

The power supply scheme have been developed, in which a current stabilizer is established on an entrance of a source of a high voltage, and on an exit - a RCL- filter, set - up on the appropriate frequency, that has allowed almost completely to remove a spark discharge and receive optimum energy dissipation for the given electrodes system.The special mode sectioning electrode,in the longitudinal and in the cross direction, has enabled to interleave active ozone synthesis zones to zones of cooling /2,8/. Thus an"electrical wind" of corona evacuates ozone from zones of ozone formation, preventing its thermal decomposition.

The revealed mode of corona discharge does not interfere with overlapping of ozone electrosynthesis process with ozonizing process, that has allowed to influence object of processing not only ozone, but also strong electrical field,electron-ion beaming and UV- radiation.

We suggest, that corona ozonizer application is very prospective for medicine,food-processing industry, agriculture technologies /1,5/. That application has enabled to develop high-effective technology of sanation,deodorazation and disinfection of air,water and various objects;air cleaning and detoxication;disinsection and deratization /5,7,9/. We have designed ozonizing devices - household, portable, automobile and stationary- for these technologies. The number of the new technical decisions has ensured simplicity of a design and operation, low energy consumption and compact size /2,3,4,6,8/.

Technical data of devices:

- ozone generation rate05...25 /h
- ozone yeld 10...18 Wh/kg
- air productivityup to 80 3/h
- electrodes life time less than 8000 hour

The cost of devices is 2... 5 times less, than domestic and foreign items. Some of them have not a lot of analogues, for example, device for processing of grain,sewage and etc., or an air detoxication device supplied by ozone decomposition catalyzer on an air output. The devices have been certified and are serially let out.

More than 7 years experience of these devices application allows to speak about their high economic efficiency and reliability.

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THE CATALYTIC OXIDATION OF TOLUENE BY OZONE IN THE ACETIC ACID

Pluzhnik I.M., Galstyan G.A.

The Rubezhnoe Branch of the East-Ukrainian State University. Ukraine. The ozone chemistry

The kinetics of oxidation of toluene by ozone content gases in presence of metalcatalysts with the changing valency has been worked out. The mechanism of catalysis has been observed, it was shown that in catalytic conditions the ozonolysis of the aroma-tic ring is greatly prevented, the selective oxidation of 7a 0-C-H-bond of the methyl group becomes noticeable. Thus, for example, while oxidation the toluene in the presence of the cobalt acetate at 90 C the main products of oxidation are benzoic acid (43,0%) and the peroxides that are the products of destructive oxidation of the benzole ring. The concentration of benzaldehyde in the oxydate passes through the maximum and is no more than 1,0-1,5%. The benzyle alcohol is detected as the traces.

For reaction worked out the initial rate of oxidation is not depended on the concentration of the toluene and is complexly de-pended on ozone and catalyst concentration:W=K 4ef 0[Co 52+ 0] 51.5 0[Oз] 50.5 0.

The equation obtained for the rate of reaction is in compli-ance with the following simplified scheme of toluene oxidation:

O 43 726 0 ArCH 42 0 + O 42 0 + OH

ArCH 43 7 2\\\\2

72 26 0 destructive products

72 0Co 53+ 0 .

72\\\\ 0> ArCH 42 0 + 4 0Co 52+ 0 + 5 0H 5+ 0(1)

Co 52+ 0 + O 43 7 6 5 0 Co 53+ 0+ 5 0O 43 0 5 0 4 0(2)

. 7 0 .

ArCH 42 0 + O 42 0 76 0 ArCH 42 0O 42 0(3)

. H 5+

ArCH 42 0O 42 0 + Co 52+ 0 7\\\\ 0> ArCH 42 0O 42 0H + Co 53+ 0(4)

ArCH 42 0O 42 0H + Co 52+ 7 6 0 ArCH 42 0O + Co 53+ 0 + HO 5- 4 0(5)

ArCH 42 0O 42 0 + ArCH 43 0 76 0 ArCH 42 0O 42 0H + ArCH 42 0(6)

2ArCH 42 0O 42 0 76 0 products (7)

The reaction (1) in the cycle of the valent transformations of catalyst is the limitative stage, and Co 52+ 0is readily oxidated by ozone mainly on reactions (2) (K 42 0=9,3 77 010 52 1 0l/mole 77 0sec). The difference in the rates of reactions (1) and (2) (W 42 0/W 41 7~ 05 77 010 52 0),is so great that Co 52+ 0is transformed into Co 53+ 0as fast as in a 10 min in 1 0 an 1 0 experimental conditions and the concentration of Co 52+ untill the oxidation is 1 0 over 1 0 is 1 0 practically unchanged. The deceleration of reaction 1 0 is 1 0 not observed. The transition moment of Co 53+ 0is equal in time to approaching the maximum rate of formation the benzoic acid. The oxidation begins with the maximum rate provided the toluene 1 0 is introduced 1 0 into the system after complete transition of the double-valent cobalt into the three-vallent state.

THE COMPLETE SET OF THE OZONE ANALYZERS IN AIR (OXYGEN) AND WATER

Podgorny Y.V., Voronov Y.N., Voropaev V.I.
Open Joint-stock Company "Angarsk Experimental Design Bureau of Automation", Angarsk, Russia

At last years our Open Joint-stock Company have developed production of the set of unified ultraviolet high-precision driftless analyzers for monitoring ozone concentrations at all stages of its production and utilization.

The list of the O_3 Analyzers, their purposes and basic technical data (metrological properties) are located in table 1. The all ozone measuring devices operate according the same proven Ultra-Violet Absorption Technique and these instruments are dual cell U V photometers. The each instrument is cyclic. In the beginning of the cycle, sample enters one cell and reference mixture (without ozone) enters the second cell. Reference mixture is prepared from the analysing air (oxygen) or water sample by or termocatalytically conversion ozone to oxygen in the gasanalyzers (***Ozone 5, Ozone 5–1*** and ***Ozone MPC***) or blowing air through water sample in the ***Ozone W.***

Detectors then measure the light intensity transmitted trough each cell. The UV-radiation source is a low-pressure mercury electrodeless lamp VRM-1 (BPM-1) with intensive spectra line at 253,7 *nm*. During the second half of the cycle, the roles of the cells are interchanged by appropriate switching of solenoid valves. The instrument then determines the ozone concentration by computing the attenuation ratio of light, due to ozone absorption from two half cycles, accordingly to Lambert-Beer low.

The describing O_3 Analyzers differ one from the other by length of cells. And so as device for working place monitoring (lower toxic limit value) in the surrounding ozone plants ***ozone MPC*** has the most long sample cells, currents of the photocells, what was caused by ultraviolet radiation, are integrated to the moment, when the certain charge (voltage) will be accumulated, and spaces of the integration time are measured and then used for calculations of the ozone concentration ***c***:

$$c = \frac{1}{K \cdot (L_1 + L_2)} \cdot \ln\left(\frac{T_2'}{T_1'} \cdot \frac{T_1''}{T_2''}\right),$$

where T_1' and T_1'' – the spaces of the integration time of the first photocell current accordingly during the first and the second halves of the cycle (Obviously that these spaces of the integration time are inversely proportional with respect to the being integrated currents);

T_2' and T_2'' – the spaces of the integration time of the second photocell current accordingly during the first and the second halves of the cycle;

L_1 and L_2 – lengths of the sample cells, $L_1 = L_2 = 320\ mm$;

K – extinction coefficient,

$$K = 1{,}727 \cdot 10^{-2}\ \frac{m^3}{g} \cdot mm^{-1}.$$

In the other O_3 Analyzers the currents of photocells are measured directly, and their sample cells length variations from two to thirty millimeters.

The above equation shows clearly that ozone concentration can be calculated directly from the relation light intensity with and without ozone. This means that this measuring principle is basically independent from other calibration procedures.

Cross flow modulation in the described O_3 Analyzers, with their balanced optical systems, offers increased specificity through the real time cancellation of interference species, and fast response time. Their other merits are simple to operate, maintenance free, span and zero drifts are absent, insensitive to flow variations.

Table 1. Device table Ozone Concentration Measuring Devices.

	Gas phase			Liquid Phase
Model	Ozone 5	Ozone 5–1	Ozone MPC	Ozone W
Application Fields	Monitoring of Ozone Generators	Technological Monitoring	Working Place Monitoring	Device for Ozone in water
Measuring Range, gO_3/m^3	0...200	0...1	$0...5 \cdot 10^{-4}$	0...5
Accuracy, gO_3/m^3	$\pm(0,25+0,02 \cdot c)$*	±0,05	$\pm0,025 \cdot 10^{-4}$	±0,25
Display	Digital with LED-element, height of digits - 7 *mm*, numbers of digits - 4			
Zero Point Drift	Driftless			
Analog Signal Output	0 ... 5 *mA*, switched to one from three optional subranges		0 ... 5 *mA*	
Alarm Output	Pre- and Main Alarm Potential-free Contact		Potential-free Contact	Pre- and Main Alarm Potential-free Contact
Flow rate, *l/min*	< 3		1,5	<3
Dimensions, (w×h×d) *mm*	315×145×320		485×208×370	233×140×315 280×410×222
Weight, *kg*	12		15	3,8 11
Continuous measurement time without adjustment, *day*	90			
Mains Supply	220 *V*, 50 *Hz*			

*c– measuring concentrations of ozone.

OZONE SYNTHESIS FROM OXYGEN IN BARRIER DISCHARGE AND UNDER THE INFLUENCE OF ULTRAVIOLET RADIATION

Popovich M.P., Lunin V.V.
Department of Chemistry, Moscow State University, Moscow, Russia

Discharge in the ozonizer (barrier discharge) consists of separate microdischarges, which occasionally appear and disappear in the area of discharge interval [1,2]/ The interval of the current impulse of microdischarge is equal to the (10-30) ns, the transferred charge - (0,1-0,5) nK, radius of the canal - (0,1-0,5) mm, the average energy of the electrons (3-5) eV.

The temperature of the gaze in the canal is still unknown. In the early studies, when it was measured with the spectral method, the temperature was ~ 600-100 K. After that, in the investigation [3] is given value 340-350 K. This corresponds to the average temperature in the discharge interval [4]. The model of the low-temperature microdischarge better conform with the value of the transferred charge and with the energy coming into the canal. We suppose, that the gaze in the microdischarge heat only on the several degrees, in the comparison with the average temperature in the discharge interval.

In the low-temperature model the basic chemical reactions occur in the canal of microdischarge in two stages:

1) Fast dissociation of the molecular oxygen and ozone

$$O_2 + e \xrightarrow{k_1} O + O + e \qquad (1)$$

$$O_3 + e \xrightarrow{k_2} O + O_2 + e \qquad (2)$$

2) Relatively slow reactions of the formation and decomposition of the ozone.

$$O + O_2 + M \xrightarrow{k_3} O_3 + M \qquad (3)$$

$$O + O_3 \xrightarrow{k_4} O_2 + O_2 \qquad (4)$$

Some authors draw the conclusion, that for the stationare level from $d[O_3]/dt=0$ follows:

$$\frac{[O_3]}{[O_2]} = \frac{k_3 M}{k_4};$$

When the temperature is 340-350 K, this results in the unjustified high concentrations of O_3. In order to combine the experiment with the calculation, the additional sources of decomposition are introduced: the chain decomposition [5], the increase of the velocity of reaction at the expense of vibrational excitement [6], and others.

In the report is shown, that the including of the dissociation of ozone and solution of the equation, resulted from mechanism (1-4), leads to the satisfactory conformity of the calculation and experiment without additional propositions.

Movement of the system O_2-O_3 to the stationare level is calculated. The equation, which combine the stationare concentration with the constants of the reactions (1-4) is obtained:

$$\frac{k_3 M}{k_4} = \frac{[O_3]_{st}}{[O_2]_{st}}\left(1 + \frac{k_2}{k_1}\frac{[O_3]_{st}}{[O_2]_{st}}\right) \qquad (5)$$

Using the values of the constants k_3 and k_4, when T=340 K and $k_2/k_1=10$, we obtain the stationare concentration of ozone 15%.

In the limited temperature interval dependence of stationare concentration from temperature can be extrapolated to the Arrenius' coordinates as a straight line. The effective energy of activation is equal to ~3 kcal/mol. The experimental measurements [4] give the value, equal to 2,3 kcal/mol.

The synthesis of the ozone from oxygen using the photochemical method needs more energy, than in the electrical discharge. However with the help of radiation 150-170 nm one can obtain high concentrations of ozone [7]. In study the calculation method for the stationare concentrations was suggested and some experimental investigations were done with the radiation of mercury lamp. The references of experimental studies devoted to the ozone synthesis using vacuum ultraviolet. The results were compared with the calculation.

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THE STUDY OF REACTION 0_2OF THE OXIDATION OF NITROTOLUENES BY OZONE IN THE PRESENCE OF CATALYSTS

Potapenko E.V., Galstyan A.G., Galstyan G.A., Shpak L.P.

The Rubezhnoye Branch of the East-Ukrainian State University, Ukraine

In ozone-nitrotoluene-organic solvent system the competitive reactions of ozone with the aromatic ring and the methyl group follow.First of all the composition of oxidation products is of great dependence on the structure of nitrotoluenes and conditions in wich the reaction flows.While ozonation of nitrotoluenes in acetic acid the main oxidation products are ozonides.The summary yield of the oxidation products on a benzyle state is no more than 14,8 (2-nitrotoluene) я7_я0 24,0 (3-nitro and 4-nitrotoluene)%. Among the products of oxidation on a benzyle state the corresponding nitrobenzyle alcohols are identified together with the nitrobenzaldehydes and nitrobenzoic acids.The low selectivity of oxidation on a benzyle state when 2-nitrotoluene is connected with some steric difficulties caused by the presence of the nitrogroup in state 2 correspondingly to the methyl group.

The destructive oxidation of the aromatic ring is greatly prevented by introduction the metals with the changing valency into the system.In catalytic conditions the main products of oxidation are the corresponding nitrobenzoic acids. The selectivity of oxidation at the first approach depends on the quantity of the oxidatively reducing potential of the pair Meя5n+1я7/я0Meя5n+я0is maximal in the presence of cobalt salts (96,6%) and lower in the line of Coя52+я0> Mnя52+я0(43,5%) > Pdя52+я0(37,4%)>Grя52+я0(30,3%) (for 4-nitrotoluene).

The nitrobenzyle alcohols and aldehydes while oxidation of nitrotoluenes are the intermediate products and concentration passes through the maximum and is no more that 1-3%. However, in some conditions the catalytic oxidation of the nitrotoluenes may be stopped at the stage of forming the following aldehydes.

This may be carried out while oxidation the nitrotoluenes in acetic anhydride in the presence of catalytic additions of the sulphuric acid. In this conditions the aldehydes forming are interacting with acetic anhydride forming the benzylydendyacetates stable to the action of ozone:

ArCHO + (CHя43я0CO)я42я0O + Hя5+я7 6я0 ArCH(OCOCHя43я0)я42 The marganese bromide catalyst shows its hight catalytic activity and yield of 4-

nitrobenzylydendyacetate reaches 67,3%.Except the dyacetate the 4-nitrobenzyle alcohol (0,1%), 4-nitrobenzylacetate (0,3%),4-nitrobenzaldehyde (1%) and 4-nitrobenzylbromide (3%) are formed.

Generally,the transformation of nitrotoluenes while catalytic oxidation in acetic anhydride may be explained by following scheme.

OZONIZING SYSTEM ENGINEERING FOR POLY-PARAMETER NEUTRALIZE TECHNOLOGY PROCESS CONSIDERING DISTURBING INFLUENCE (ON THE TECHNOLOGY PROCESS MODEL IN POULTRY BREEDING)

Pugin A.M., Golovanov
Ufa State Aviation Technical University, Ufa, Russia

In many branches of human activities (e.g. industry, agriculture, public health service, public service) it is often necessary to neutralize different materials (e.g. microbiological disinfecting, detoxification, deodoration etc.). In poultry breeding the problem of neutralizing efficiency is the most vital. High density of settlement changes for the worse physical & chemical and microbiological parameters of lodgment microclimate - they are much influenced biotically, the very bio-system of feeding and maintenance becomes unstable and any disturbing influence can overbalance it - morbidity and mortality jump, weight increase and nurture reduces. The widespread neutralizing technologies compensating the biotic influence have some essential deficiencies: negative incidental effects, narrow field of application, liability to different disturbance influence and at last they can not strictly observe the optimal treatment conditions. The ozonizing technology is less liable to the above disadvantages. The main reason of the narrow field of their application (water-purification) lies the absence of theoretical basis of ozonizing system (OS) projecting for poly-parameter neutralize technology processes considering disturbing influence, the following included:

- their application conception for the neutralize technology process (TP) in poultry breeding, in particular;
- their projecting technology, including the safety exploitation principles;
- ozonizing process mathematical models as the control object, considering disturbing influence on these processes and also the peculiarities connected with simultaneous realization of several technological parameters;
- ozonizing process control algorithms and the work of multiply connected TP poly-parameter control systems;
- theoretical result approbation on the full scale industrial plants.

The basic conception of ozonizing technology application is feasibility of statements about the efficiency of combined influence of ozonizing on neutralization and on increasing of biologic activity of the object to be cultivated by creating controlling influence on it in the form of optimal technological regimes with optimal ozonizing dosage and exposition. In the common case these optimal values depend on disturbing influence including some technological parameters such as some other output coordinates of the biological system as whole. For such poly-parametrical processes as, for example, optimal climate promotion in an incubator or mixed fodder preparation, the effective neutralization may be done with the help of specialized equipment united into a multiply connected ozonizing system which allows to take into account the inter-influence of all control processes (temperature, humidity, ion and chemical atmosphere composition).

Such system design methodology is based on the methods of system analysis, in particular of systems engineering and also on the methods of automatic control theory. As one of the basic problem is ozonizing system exploitation is the ozone leakage into working zone then its design must be based on some principles of their safety exploitation ensuring. The principles realized by a set of typical design techniques embrace all main causes of ozone leakage.

The mathematical model for describing the ozonizing process, in general, composed on the basis of linear differential equations is written down in signatures. The coefficients of the equations are received by expansion of the differential equation non-linear terms of the active kinetic masses or the ozonizing reaction in Tailor series using the method of "frozen coefficients". The process transfer functions are received from which it is evident that when the reagent concentrations have little deviations from the initial equilibrium values, the above processes can be simulated by inertial links of the first order. The mathematical model of transfer processes in general is described in matrix form and it allows to describe the ozonizing dynamic regimes.

Application or the received structure schemes of the ozonizing system and of the mathematical models made it possible to design some process control algorithms and on their basis - the optimal technological regimes. The control is realized by microprocessor sub-system of technological regime and parameter automatic set taking into account their mutual effect and their value stabilization in the process in TP. For incubation TP the sub-system also performs the functions of gathering, delivering and processing of the information about micro-climate parameters, the function of archive storing, visual TP controlling on monitor screens, regime signaling.

The received results are used in design and industrial promotion of the mixed fodder neutralizing system on the basis of fodder mixer with one-time loading up to 4 tons at the Turbasly poultry farm. Experimental tests of the system on practice have confirmed the theoretical results. The systems of controlling microclimate parameters in incubators are now elaborated.

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SIMULATION OF THE KINETICS OF ELECTROCHEMICAL OZONE- PEROXIDE OXIDATION OF ECOTOXICANTS

Putilov A.V., Klochikhin V.L., Makhnach O.V., Potapova G.F.
State centre of science of Russian Federation L.Ya. Karpov Research Institute of Physical Chemistry, Moscow, Russia

The neutralization of ecotoxicants in water is one of main problems of ecological safety in industry. In most cases technical solutions of these problems are power-extensive and can cause derivation of secondary pollution. Ozone and hydrogen peroxide oxidize ecotoxicants up to harmless products, turning in ecologically harmless oxygen and water. The effect from their common action during clearing is much stronger, than sequential effect of each of these oxidizers separately. In connection with appearance of new electrochemical technologies of water clearing and, in particular, possibility of producing in the same electrochemical process both ozone and hydrogen peroxide [1], the problem of development of appropriate kinetic models of share oxidation of ecotoxicants by ozone and hydrogen peroxide becomes urgent. In further it could be helpful for optimization of the process of clearing.

This kinetic model is presented as a computer program solving the direct problem of chemical kinetics of oxidation, which is facilitated by the fact that the reaction kinetic scheme for calculation of kinetics of ozonizing at the presence of UV-radiation and hydrogen peroxide is already developed. Numerical values of main rate constants are also known [2]. The kinetic model for the case of stationary concentration of ozone, hydrogen peroxide and fixed pH is considered. It takes into account stages of initiation of the chain process with formation active intermediate particles, responsible for chain prolongation, and finally, their interaction with molecules of pollutants and free radicals recombination (termination of a chain reaction). The last type of reactions is especially important to be taken into account in a case of heavily oxidized ecotoxicants (for example, dyoxines), which concentration also can be rather small. In this case the termination of chain can limit all the oxidation process.

This model was used for calculation of a kinetics of ozone - peroxide clearing of water systems from di-benzo-para-dioxine. The results are represented in Fig.1. The points on graphics represent experimental data, the curve is a result of calculation of reaction kinetics.

In conclusion it is necessary to mention, that not only bacteria are destroyed during ozonizing, but viruses too, that makes additional adventages to ozone-peroxide method of disinfection. Further the method of simulation has good perspectives in estimation of harmful effect of secondary products of primary pollution oxidation. The result of the present paper also is the utilization of the kinetic model in soft/hardware computational complex for simulation and optimization of technological stages of water clearing and water preparing.

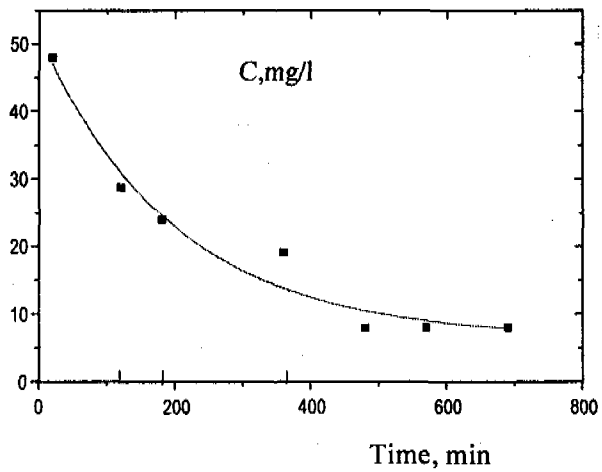

Fig. 1. The kinetics of ozone - peroxide oxidation of di-benzo-para-dioxine.
Points - experimental, curve - result of calculation of the described kinetic model.

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MEDIA INFLUENCE ON MECHANISMS AND KINETICS OF OZONE - ORGANIC COMPOUNDS REACTIONS IN WATER SOLUTIONS

Razumovskii S.D.
Institute biochemical physics Russian Academy of Sciences, Moscow, Russia

Most parts of research of ozone reactions in ecologies and medical areas were conducted and probably will be conduct in water solutions. Therefore some peculiarities of influence water as reaction medium are important to allow for and to know how to use it. Different examples of water ifluence on ozonization reactions one can find in literature, but some generalizations was'nt made yet. Analysis of published materials show that roles of water media are important and various enough.

1) Water can take an active part in intermediate stages of ozone reactions with members of many classes of organic and elementoorganic compounds. In first turn it concerns unsaturated compounds. In nonactive solvents (hexane) ozonides are formed. In the water solutions intermediate carbonyloxide mostly reacts with water molecules forming unstable hydroperoxides and than aldehydes and acids.

2) Water do'nt part directly in reactions, but can hydrolyze final product. It typical for a many elementoorganic compounds, amines, aromatic hydrocarbons.

3) Water reacts with initial substrates forming a new compound what can react with ozone by a new route and more fast in comparison with initial product. As an example it is possible to mention phenol. It can react in water as in molecular so in phenollyat-ion forms.

4) Products of water dissosiation (hydroxylion) sometimes react with ozone faster than studying compounds. In such case one can to observe a formal sign of reactions (ozone absorbance, product formations), but the real mechanism can be significally different from that we supposed. As rule, rate of reaction become faster too.

5) Water solutions allow as to change the acidity function of solution in wide limits simple enough. It gives to us an extra possibilities to operate by reaction mechanisms. It are used wide in research practice if somebody wish to protect one functional group and to involve in reaction another. As an example it is possible to mention ozonation of alkylpyridines. In neutral media ozone attack nitrogen atom, in acidalkyl groups

Mentioned above was related basically with the composition of final products and reaction mechanisms. The kinetic effects of water as a reaction media are'nt less significant.

a) Solubility of ozone in water 3-4 times less than in another solvents. In comparative conditions it leads to perceptible reducing of the reaction rate and the level of ozone consumption (*due to ozone loses with bubbling gases*).

b) Heat of ozone solution in water is high enough and commensurable with activation energies of many ozone reactions. Due to it ozone reaction rates in water as rule show a weak dependence from temperature changing.

c) during results evaluation one has to consider heterogeneity of the systems organic compound - water. There ozone solubility in micelles of organic substrate is high, in water phase - low. Therefore to determine the final results will be the reaction not in water, but in inside volume of micelles. Considered peculiarities water as media for ozone reactions with organic substrates are important both in scientific research and at its realization in technology. In the report will be given an examples of intuitive and conscious operations by ozone reactions in research practice and in industrial processes.

ABOUT SOME REGULARITIES OF REACTION OF OZONE WITH ALKYLBENZENES AND THEIR SUBSTITUTIONS

Romanenko A.G., Galstyan G.A., Galstyan T.M.
The Rubezhnoye Branch of the East-Ukrainian State Uni-versity. Ukraine. Ozone Chemistry

Ozone reacts with methylbenzenes in acetic acid mostly on the double bonds of the aromatic ring. The main products of reaction are the polymeric ozonides. The part of the oxidation products on a benzyle state is no more than 17%. The following regularities may be observed.

The rate of oxidation in homologenous line of toluene is aproximatelly doubled with every introduction of the methyl group.

Increasing the number of methyl groups the part of the products with the aromatic nature is decreased. Three- and polymethylbenzenes are ozonized only into the nucleus.

The selectivity of oxidation on a benzyle state is increased with introduction into the p- and m-state of the ring of electroacceptoric substitutions -NOя42я0, -Cl, -Br, -SO§H, -SOя42я0Cl.

Among the products of aromatic nature the aromatic aldehydes are prevailed provided the small oxidation depths exist. When the exhaused я4 я0oxidationя4 я0 the carbon

acids are prevailed. The aromatic alcohols may be recognized only in the very first moment and only partly.

Ortho-substitutions of tolyene because of the steryc effects of the substitution, which block their mating with the electronic system of molecule, are interacting with ozone more slowly and mostly on the aromatic ring.

The effects of the substitution numbers brought out are connected with enforcing of the electrofilic ozone attact to the aromatic nucleus. The influence of the number of substitutions on activity of C-H-bond of benzyle state is shown very slightly.

The substitution of methyle group for more complex alkyle radicals permits to bring out the following facts.

The constant of velocity increases proportionally to decreasing the strenth я7ая0-C-H-bond in the line CHя43я0- < CHя43я0-CHя42я0- < <(CHя43я0)я42я0CH- and increasing the effect я7ся0,я7р я0- mating in a molecule (я7ся4t-Bия0= -0,197; я7ся4-CH§я0= -0,17). The first reason is the main.

In a tret-butylbenzene the regularities observed are broken.

The constant of velocity of its oxidation comparing with the toluene decreases more than two times. It is connected with the fact, that, firstly, tret-butyl group was not week C-H-bonds and, secondly, is characterized by the steric influence that blocks the interaction of ozone on the aromatic ring in the ortho-state.

The increasing of the constant of velocity of absorbtion of ozone while increasing the selectivity of oxidation on я7ая0-C-H-bond of benzyle state is observed with the subtitution the atoms of hydrogen in it for some benzyle remainders. While oxidation dy-and three-fenylmethans the yield of the products of oxidation in the methyl group is equal to 63,8 and 78,9% correspondingly [1].

The high reactive ability of benzyle state in dy- and 2 - three-fenylmethyle radicals that flow from the high grade of delocalization of non-double electron. The stability of dy- and three-fenylmethyle radicals is not shown fully because the fenyl ring occupies the «propeller» state with the angle of turning of 40-55 [2]. The stability desired of the dyfenyl radical may be reached with the hand of additional bridges that favour the transition of the space structure to the plane one. This may be observed on example of 9,10-dyhydroantrathene and 9,9'-dymethyl-9,10-dyhydroantrathene. Having the plane structure these compositions are highly reactive in reaction with ozone, mostly reacting on the C-H-bond in states 9 and 10 [1].

The influence of the nature and the number of the substitutions on reactive ability of hydrocarbons in the line of ethyle- and izopropylebenzenes analogically observed in the line of methylbenzenes. However, when pentha- and hexasubstituted because of the steric effects the rate of oxidation is greatly decreased.

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EFFECTIVENESS OF WATER DISINFECTION BY OZONE

Rusanova N.A., Semenova M.A.
Municipal Water Supply and Treatment Research Institute
Novosiltsev G.I.
E.I.Martsinovski Institute of Medical Parazitology and Tropical Medicine

At present the possibility for drinking water to spread hepatitis A virus, enteric pathogenic protozoa cysts and helmint eggs has been established. Beacause of this, experiments on water disinfection by ozone were performed with water, having more resistant model organisms, than those which had been used before.

Coliphage MS_2, which according to many authors is a good model of enteric viral pathogens, including hepatits A virus, for water disinfection studies, as well as Giardia cysts, Ascaris eggs, Taeniidae oncospheres were used. While following a regime of ozone disinfection with its residual concentration in water of 0,2-0,3 mg/l and 12 min contact time, 100% inacfivation (0 PFU/10 l) of coliphage MS_2 was achieved, if its initial concentration had been lower, than 10^2PFU/l; concentration of viable Giardia cysts was reduced by 60-70%, Taeniidae oncospheres - by 5-7%, Ascaris eggs - by 1-5%. It was possible to inactivate Coliphage Ms_2 with initial concentration of 10^3 and 10^4 PFU/l, if the level of residual ozone reached 0,5 and 0,8 mg/l respectively. The concentration of viable Giardia cysts was reduced by 97%., Taeniidae oncospheres - by 13%, Ascaris eggs - by 8%, if residual concentration of ozone in water was maintained at 0,8 mg/l during contact time of 12 min. The effectiveness of disinfection was lower, if the contact time was 7 min. When pH of water was changed within 6.5 to 8.5 and its temperature varied from 25 to 4°C, there was no substancial influence on disinfection effectiveness at the stated regimes.

In parallel examinations effective regimes of chlorination were established. Combined chlorine was considerably less effective, than the free one. UV-irradiation decreased concentration of viable Giardia cysts only by 21%, Taeniidae oncospheres - by 11%, Ascaris eggs - by 7%, when the effective power of the UK-irradiation unit was 10 times greater, than that necessary to inactivate B.Coli by at least 10^4 times.

For those water treatment plants where raw water contains high concentrations of ammonia, the use of ozone instead of chlorine may turn more feasible for disinfection of water, containing resistant organisms.

Experimental results were taken into account while working out technological regimes of purification and disinfection for enhancing epidemiological security of drinking water.

HIGH FREQUENCY RESONANCE OZONATORS AS THE MORE ECNOMICAL METHOD TO RECEIVE AN OZONE

Shapiro S.V.
Ufa technological Institute of service, Ufa, Russia

In the science - research labotary of department of physic of Ufa technological Institute of service there were worked out original [1] high frequency resonance ozonators for the different ecological technologies included the cleaning drinking and sewage water.

The peculiarity of these ozonators is the creation the running barrier discharge by the freguence of the supplied tension is 5 ÷ 10 kHz.

The running on cylindrical surface front of discharge forms because the supplied tension has a configuration like a trapeziform and because the high voltage electrod was worked as a system of threadform conductors.

Application the running barrier discharge permits the most effectively preference high frequence ozonator: decrease the expense of active materials.

This can establish by the formula of the power used by the ozonator:

$$p = f\, c_e\, [V_m^2\, K_c - \frac{V_g^2}{K_c}]$$

where $K_c = C_e / (C_g + C_e)$, C_e and C_g - capasitios of the dielectical barrier and the gaz space, f - the frequence of the supply tension, V_m - his amplituda, V_g - the strugle tension.

The working methodic of the analitical design of ozonators prevented us to establish the gamut industial makes with the next indices (to gether with the semi - conductor inverter): the mass materials of the ozonator with productivity 1 kg/h ozone - 200 kg, the gabarit volume - 1 m^3, the power - 10 kWt.

The working ozonators have parametrical stabilization tensions on elements of the network if the input tension varies on ± 10%.

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PRODUCTION OF OZONE IN A SUPERSONIC AERODYNAMIC NOZZLES

Shatalov O.P
Institute of mechanics, Moscow State University, Moscow

The possibility of ozone production during the supersonic cooling of partially dissociated oxygen was pointed out in [1]. However, the optimization of the nozzle shape and of gas parameters ahead inlet of the nozzle carried out in [2] didn't allow to receive a reasonable ozone output. This optimization was made for equilibrium-heated (and partially dissociated) oxygen in front of the nozzle.

As it was shown in [3,4], the production of superequilibrum concentration of oxygen atoms in a nozzle supersonic part gives rise the ozone concentration (~1 %) and production rate. On this basis the nozzle parameter optimization was made and electrical discharge characteristics in its supersonic part was calculated in [5]. It was supposed that oxygen temperature in front of the nozzle was the room one and the pressure was equal to 1-10 atm. The oxygen flow was interacted with the electrical discharge to produce the oxygen atoms in some section of the nozzle.

The calculations were carried out using the chemical reactions set (oxygen and ozone dissociation-recombination and exchange reactions) and reactions involving electrons and ions. The results of calculations are rather optimistic: concentration of ozone formed inside of the nozzle was more than 3 %. These results served as the basis for experiment performing and creation of a gasdynamic ozonizer scale model.

A flat wedge-shaped nozzle with the critical section height of 0,4 mm and the full expansion angle of 10 degrees was taken to modeling a gasdynamic ozonizer. The pressure of oxygen at the inlet of the nozzle was 1-10 atm. In a supersonic section of the nozzle a stationary direct current discharge was mounted. The voltage between the electrodes was 0,8-1 kV, the discharge current was 24-150 mA. The ozone concentration at the output of the nozzle measured by the iodometry method had been attained 0,3%. When gas flow speed between the electrodes was near 500 m/s, the achieved ozone concentration was of 6,4 g/m3 and the capacity of ozonizer was 257 g/hour.

The advantages of gasdynamic ozonizer described here are its small dimensions (length and width of the nozzle were 100 and 15 mm respectively), absence of force-cooling (gas flow is cooled during its expansion in the nozzle) and high productivity, connected with high speed of gas flow.

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PARTICULARITIES OF NATURAL WATER DECONTAMINATION AND OXIDATION \WITH OZONE

Shcherbina G.P., Kozhushko S.G., Rudenko G.G.
Research and Development Institute for Municipal Facilities and Services

Ozone is and excellent oxidizing and decontaminating agent, acting by double threshold method. In consequence deactive, smacks and odors disappear, phenyl acids are extracted, detergents are decayed. Water has got blue tint and improved qualities.

However, in order to prevent repeated contamination in the water supply network, the secondary water chlorization should be performed. The ozone influence as regards certain carbons, pesticides, ammonia compounds remains limited.

Water supply department of NIKTIGH which is the main Ukrainian organization in the development of progressive water treatment technologies, carries out the researches of natural and waste waters ozonization during over 30 years. They include the development of the ozone treatment technologies of such rivers as the Dnieper, the Desna, the Uzh, the Zherev, the Irsha, the Dniester, the Southern Boog, the Ros, etc. It gives recommendations on water treatment optimization which includes ozonozation at a number of Ukrainian's water supply systems. The technico-economic basis of energetical and material costs are also taken into account.

Taken into consideration the results of researches which had place during many years at pilot ozonization plants, as well as the process flow diagrams, the preliminary, middle and after ozonization process and NIKTIGH's recommendations, the ozonization plant is constructed and operate during almost 25 years at the Dnieper water supply system. The "Trailygas" equipment is used there. Its ozone capacity is 1,6 t/day. The ozonization plant is operated according to the water conditioning scheme. The organoleptical indexes of potable water quality are improving crominance lowering an 6-10 degrees, smacks and odors disappear. The ozone dose varies from 1 to 2 g/m^3. Electrical energy consumption is nearly 25 kW per hour on 1 kg of ozone.

Meanwhile this scheme isn't efficient enough in the conditioning of manganese presence increase in initial water. In order to ensure deep discoloring, the primary water chlorization with great doses should be excluded. It means that the ozonization plant should also be used for preliminary and middle water ozonization. Our earlier researches proved the principal possibility of ozone-air mix transmission to long distances by pipelines constructed from certain materials. In this case the ozone is exposed to minimum dissociation and it gives a great economic effect.

Primary and middle ozonization should be used in the case of initial water quality deterioration in order to prevent the formation of chlororganic compounds, especially in summer and in the conditions of the considerable chlorabsorbility. However, some scientists suppose that the wide introduction of ozonization is restrained because of by-product formation. French specialists consider this point of view exaggerated. Certainly, in order to retain organic impurities the preliminary water treatment should be applied at water treatment plants. It becomes more actual in a view of more strict requirements introduced as regards potable water quality.

It is known that he big ozonization plants are also operated in Moscow, Nizhny Novgorod, Minsk with application of "Trailygas" equipment.

In accordance with NIKTIGH recommendations in 1979 the ozonization plant has been constructed in Irshansk (Zhytomir region). The ozone generators, type ОП-121, manufactured by the Kurgan plant (Russia) are used at this place. The similar ozonization plant is being constructed in Bar (Vinnitsa region).

At present NIKTIGH is entitled to be the client of home-made ozonators (capacity - 1,4-5-30 O_3 kg per hour). The air preparation line and the generator (30 O_3 kg per hour) have been constructed in Kiev (their installation is complicated in a view of economic reasons).

According to NIKTIGH technical specifications of ozone application and natural waters treatment, the Institute and Kharkovvodocanalproekt elaborated to accelerate the ozonization introduction at water supply systems of Ukraine.

REALISATION OF ADVANCED OXIDATION TECHNOLOGIES IN DRINKING WATER TREATMENT DEVICES "QUANT-OZONE"

Sotnichenko S.A., Bravyi B.G., Gur'ev V.I.
Institute of Chemical Physics RAS, Chernogolovka, Moscow region, Russia
Tyichinin V.N.
Federal center of medico-biolog. problems of Minzdrav, Russian Federation, Moscow, Russia

In recent years steady attention of the scientists and the ecologists were drawn to the new methods of drinking water treatment, which use the co-operative action of so ecologically safe oxidisers as hydrogen peroxide, ozone etc. and UV-radiation . They have got the generalised name the Advanced Oxidation Processes (AOP). The effectiveness of these methods are conditioned by the sufficient increase of the disinfecting and purifying quality because of the mutual amplification of particular agents action (so called synergetic effect). The gain factor in several cases can reach the value

of 107 for micro-organisms and 104 for organic impurities and the effective disintegration for organic can go up to the complete mineralization or, at least, up to the forms easily subjected to bio-degradation.

In this report we show the full process scheme of the compact drinking water treatment devices "Quant-Ozone". Quality of purifying complies with the World Health Organisation requirements. Purifying includes four steps: prefiltration, UV + ozone action, UV- action and post filtration. The using of new AOP technology (realization of synergism) and technical decisions, combining compact dimensions and little power demand resulted high effectivity and ecological safety. Last requirement is very important for water ozone-treating systems. Absence of ozone odor near working system and in outlet water is one of the main conditions of ecological safety because human smell can to detect very small concentration of ozone (about 0,001 LSC). Two our systems satisfy this requirement unlike other known commercial ozone systems ("Ross", "Ozonid" and etc.). Besides that using of ozone/UV technology in water treatment don't the restrictions for water containing abundance of chlorine unlike water treatment with only ozone. It's probability that if the chlorophenols will be in the water containing abundance of chlorine and this water treat only ozone, it can to produce chloro-oxide forms as dioxins, well known as supertoxicants, whereas ozone/UV treating produce OH-radicals, which will lead to untoxic products.

We are the authors of the Russian patent RU 2057548 24.12.1994 г.

Table.

Model	M60	M300
Productivity, L of water/hr	60	300
Dimentions, mm	260x180x450	450x500x1800
Mass, Kg	8	78
Power requirements, V/Hz	220/50	220/50
Power consumption, W	70	250
Ozone content of water at the main vessel inlet, mg/L	0.5	5-15
Ozone content of water at the unit outlet, mg/L	< 0.01	< 0.001

The sertificational tests have shown, that water treatment devices "Quant-Ozone" are characterized by a high degree of reliability, large resource and comprehensive treatment, wich enables to make 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.

LOW-TEMPERATURE INTERACTION OF OZONE WITH HCl-H_2O SYSTEM

Yagodovskaya T.V., Zosimov A.V., Lunin V.V.
Moscow M.V.Lomonosov State University, Moscow, Russia

The depletion of the ozone layer of the Earth atmosphere is one of the most important problems of the present. Many authors connect the decrease in ozone concentration in the ozone layer with the presence of active chlorine in the atmosphere. Active chlorine is produced in the circulation vortex over the Antarctic as a result of interaction between atmosphere masses of ice, super-cooled water, molecules of HCl and $ClONO_2$ [1,5]. However, there is no direct evidence yet of formation of the ozone hole as a result of these processes, and the search for unknown sources of active chlorine remains the actual problem. In spite of all this the possibility of formation of chlorine oxides under oxidation of HCl with ozone is not investigated.

The purpose of the paper is the experimental study of interaction of ice and HCl-H_2O system with ozone under conditions close to stratospheric. The experiments were conducted in vacuum set-up at temperature 77-273 K and pressure 10^{-4} - 4-7 Torr.

The qualitative experiments have shown that ozone from the gas phase is fully condensed on the solid surface of ice and HCl-H_2O system at 77 K, forming the blue film. As temperature rises, the liquid ozone film diffuses in the volume of samples and remains up to 193 K.

As the temperature of ice-ozone system rises, ozone passes to the gas phase without decomposition, because the pressure over the sample has reached its initial value. The repeated decrease in temperature to 77 K resulted in full condensation of ozone on the surface of ice.

The noticeable change in the colour of HCl-H_2O system and disappearance of the blue ozone film at 193 K indicates that their interaction takes place, the pressure of the system being constant (10^{-4} Torr). The coloured stains (yellow and yellow-brown) appeared on the white colour background of the sample. Then at temperatures higher 223 K the red-brown ring formed around the thick colourless liquid on the bottom of the low-temperature trap; the pressure started to grow slowly and reached 4-7 Torr at 273 K. The repeated lowering of temperature caused full condensation of the gas phase and formation of white residue, which contained mainly green-yellow stains. The phenomena observed can be explained by interaction of ozone with HCl-H_2O system and formation of chlorine oxides of various composition [4].

These qualitative results are confirmed by the analysis of IR absorption spectra of systems investigated:

1. The contact of ice with ozone has not changed the absorption spectra of ice.

2. The IR absorption spectrum of the initial system HCl-H_2O showed only insubstantial absorption bands in the region of deformation and vibration oscillations of OH-group (1650 cm^{-1} and 800-700 cm^{-1}). The sharp change of IR-spectrum on contact of HCl-H_2O system with ozone at broad temperature range and appearance of the whole series of new absorption bands (1450, 1280, 1260, 1170, 1155, 1120, 1110, 1060-850, 780, 710, 695 cm^{-1}) indicates the formation of new compounds with the bond Cl-O [3,4]. Some changes in the spectra were observed during interchangeable increase and decrease in temperature of the sample. It has been found that ozone reacts with the HCl-H_2O system at 77 K already. As temperature rises up to 193 K, the rate of formation of various chlorine oxides increased, and interaction between them took place. From primary chlorine oxides, the structures Cl_2O_6, $ClOClO_3$, $H_3O^+ClO_4^-$ is likely to form. It can be supposed that ionised complex of ice and hydrated molecule of HCl, which have high oxidising capability [2,6], participate in the reaction with ozone. As temperature rises to 223 K, the chlorine compounds started to pass to the gas phase.

Thus, it has been shown that, as a result of interaction of ozone with solid hydrates of hydrogen chloride, the formation of chlorine oxides and their accumulation on the particles of atmospheric ice during winter is possible. As temperature rise in spring, these oxides may pass to the gas phase and become the additional source of active chlorine, which was not taken into account at simulation of heterogeneous processes occurring on the particles of ice in stratospheric clouds, in papers [6,7], where the reaction of water cluster with molecules of HCl and $ClONO_2$ was used.

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NUCLEAR SCIENCE AND TECHNOLOGY IN WATER RESOURCES SECTOR AND OVERVIEW OF THE IAEA'S ACTIVITIES

Yurtsever Y.

International Atomic Energy Agency (IAEA), Department of Research and Isotopes

Methodologies based on the use of isotopes in a wide spectrum of hydrological problems encountered in water resources assessment, development and management activities are already an established scientific discipline recognized as "Isotope Hydrology", and proven methods are presently employed as an integral part of water resources investigations and environmental studies. Together with techniques based on the employment of radioactive isotopes for water tracing purposes and use of sealed radioactive sources for in-situ measurements related to water movement, they comprise the overall field of "Nuclear Techniques in Hydrology".

During the last four decades, the International Atomic Energy Agency (IAEA) has been directly involved in efforts towards research and development of nuclear techniques in water sciences, and their actual field applications, and has acted as an international-scale focal point for dissemination of information and promoting their wider-scale use, within the framework of its activities related to peaceful nuclear applications.

The potential role and contributions of isotope methods in the water resources sector can be grouped into the following general categories:

- Determination of physical parameters related to flow, its dynamics and structure of the hydrological system,
- Process Tracing - delineation of processes involved in circulation of water and mass transport of dissolved constituents,
- Identification of origin (genesis) of water,
- Component Tracing - determination of pathways and mixing ratios of component flows,
- Study of "Time-scale" of hydrological events.

"Isotope Hydrology" deals with various methodologies essentially based on the general concept of "Tracing", in which either naturally occurring isotopic species (environmental isotopes) or intentionally introduced isotopes (stable or radioactive) are employed. The use of naturally occurring isotopes, often referred to as "Environmental Isotope Methodologies", has the distinct advantage of facilitating the study of water movement and hydrological/climatological processes on much larger temporal/spatial scales than possible with intentionally injected tracers, which are often used for site-specific, local-scale engineering problems.

The paper provides an overview on the type of hydrological information that can be obtained from applications of nuclear science and technology in water resources assessment/management and related environmental studies. Summary information on the activities of the International Atomic Energy Agency and programme components in this field is given.

EXPERIMENTAL COMPARISON OF METHODS FOR MEASUREMENT OF OZONIZER POWER LOSS

Zheleznov A.I., Panjushkin V.V., Zhukov V.A., Chistjakov M.N., Shchigel G.V.
Moscow power engineering institute (technical university), Moscow, Russia

One of major ozonizer characteristics, enabling to judge efficiency of its work, is a power of the electrical discharge. It is necessary to use a method for determination of electrical discharge capacity with a small error and to make measurements not only in laboratory, but also under production conditions. For determination of merits and demerits of available methods for measurement of active power of the discharge and also with the purpose of their comparison an experimental research was lead. Thus there was considered a voltage-charge method, a modified method of three voltmeters and a method of three ammeters (fig. 1, 2, 3). The experiments were carried out on conventional-type and surface discharge ozonizers.

Fig. 1. Voltage-charge method

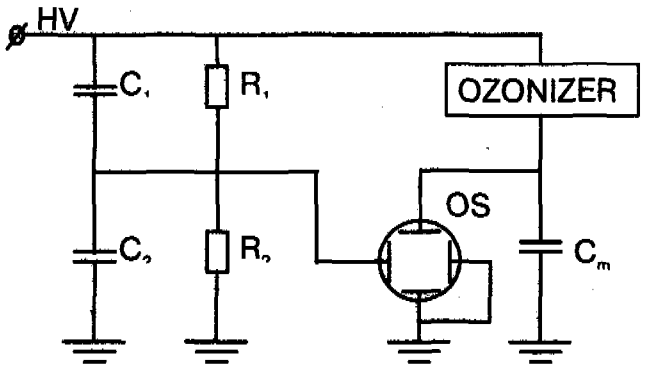
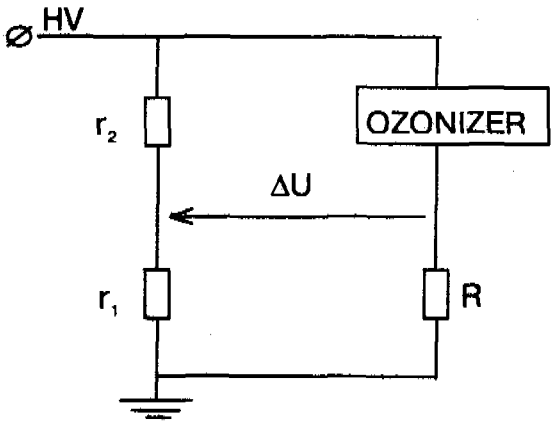


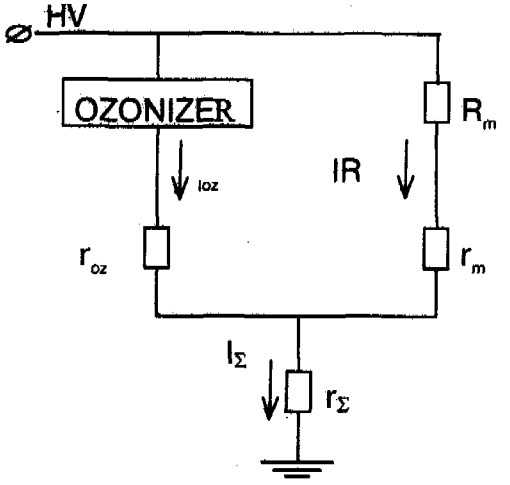
Fig. 2. Modified method of three voltmeters



r_1, r_2 - voltage divider
R - resistance
V - voltmeter
HV - high voltage

$$P = \frac{U_{r1}^2 + U_R^2 - \Delta U^2}{2R\,\dfrac{r_1}{r_1 + r_2}}$$

Fig. 3. Method of three ammeters.



r_m, r_{oz}, r_Σ - voltage divider
R_m - limited resistance
HV - high voltage

$P = (I_\Sigma^2 - I_{oz}^2 - I_R^2)R_m/2$

The analysis of the experiments results has shown, that all researched methods for measurement of active power have sufficient precision for both type of ozonizers. The results, received by various methods, differed not more than 16 %.

The modified method of three voltmeters is preferable to the method of three ammeters, as it requires smaller amount of measuring elements (resistors), therefore power consumed by a measuring circuit is reduced. It is especially important in ozonizer feeding from a source which has limited energy. The amount of connecting circuits in the case of the modified method of three voltmeters is less then in the method of three ammeters. Thereof the error brought by electomagnetic noises decreases.

Measuring of power loss by the modified method of three voltmeters and the method of three ammeters the larger accuracy, than in measurement by the voltage-charge method, is reached if the electomagnetic noises are less then three percents.

Direct calclulation of active power loss by the modified method of three voltmeters and the method of three ammeters is easier, than the voltage-charge method as in the last method it is necessary to calculate the parallelogram area.

Comparative analysis has shown, that in the case of large energy source an optimum method is the modified method of three voltmeters. It allows also to expect complete power of ozonizer, that is the advantage too.

Using the modified method of three voltmeters and the method of three ammeters it is necessary to pay attention to the following:

- For decrease of errors, connected with electomagnetic noises in connecting circuits, it is necessary to reduce their length;
- As electomagnetic noises in measuring circuits, in small meanings of measuring resistance can be comparable to useful signal, to decrease this error one should increase meanings of measuring resistance;
- For reduction of energy by the consumed circuit of measurement it is necessary to increase the meaning of measuring resistance Rm.

OZONIZER OF SURFACE DISCHARGE: INFLUENCE OF DESIGN AND FEED PARAMETERS ON WORKING CHARACTERISTICS

Zheleznov A.I.; Panjushkin V.V., Zhukov V.A.; Chistjakov M.N.; Shchigel G.V.
Moscow power engineering institute (technical university), Moscow, Russia

Some technologies of drinking and waste waters treatment requires ozone application. For these purposes ozonizers of high-freguency surface discharge have been used lately. The present report is devoted to experimental researches of influence of a design and feed parameters of the surface discharge ozonizer on its working characteristics - the ozone ganaration rate [g O_3/h], the ozone concentration [g O_3/m^3], the energy yield of ozone generation [g O_3/kW h] and the efficiency. The efficiency is understood as the relation of a real energy yield of ozone generation to maximum theoretical, received on basis enthalpy of ozone generation and equal 1220 [g O_3/kW h]. The parameters of feed are varied in following limits: amplitude of sine-wave voltage - from 3 up to 6 kV, frequency - from 1 up to 4 kHz, gas (oxygen) flow rate - from 0,5 up to 4 l/min., pressure from 0 up to 1,5 kg/cm^2.

The ozonizer was a plasma chemical reactor with a ceramic plate located inside. The plate thickness was 1 mm. A number of parallel strips - like discharge electrodes and a single film - like induction electrode were located on opposite surfaces of the plate. The choice of the material of the plate is caused by the next. First, the ceramic has high themal conductivity, that permits effectively to cool surface of the plate. Secondly, rather high meaning dielectric permeability of the ceramic increase dielectric capacity and as a results increase voltage on the gas gap and, hence, faster achieve of a discharge voltage. The synthesis ozone occurs in plasma of the electrical discharge, extending on the surface plate when applayed voltage is over discharge value. The area of the surface discharge was 23,5. 10^{-4} м^2.The size of the gas gap above surface of a discharge plate varied in limits from 6 up to 30 mm. The reactor was cooled by water.

There is the increase of energy invested in the discharge with the increase of amplitude and frequency of voltage. At the beginning it causes growth of ozone concentration, and then recession owing to overheating of the discharge gap and ozone destruction. The electrical power of the discharge in ozonizer has square-law dependence on amplitude of voltage and linear dependence from frequency. Special influence of frequency and amplitude of voltage on the yield of ozone at constancy of power of the discharge is not observed. However for achievement of large concentration the increase of frequency in comparison with increase of voltage is more preferable, as are thus reduced the size of the ozonizer. There is the sharp increase efficiency of ozonizer with increase of power of the discharge. A maximum makes 15 -20 % at power 2,5 - 5 W. Then recession the efficiency and output on fixed meaning in 6 - 8 % is observed at power 15 - 20 W.

There is decrease of ozone concentration and increase of ozone generation rate and efficiency ozonizer with the growth of the gas flow rate, as well as in case of conventional-type ozonizer.

As followes from fig.1 the fast growth of ozone concentration occur with increase of pressure of gas up to 0,5 kg/sm^2 at constant meaning of discharge energy. But then stabilization and recession come. The growth of pressure results in deterioration of conditions of starting and propagation of the gas discharge and, as a consequence, to increase of discharge voltage and decrease of discharge power at same meanings of voltage and frequency. That is

for reception of equal meanings of concentration at large pressure are required large specific power input.

The analysis of dependence of an ozone yield from size of the gas gap above surface of discharge electrode (fig. 2) shows, that the maximum ozone yield is reached at gap, equal 10 mm. At a smaller gas gap ozone concentration falls as a result of thermal destruction ozone by radiation overheating of a plate limiting the gas gap. At a large gas gap a smaller amount of gas passes through zone with the silent discharge, where ozone is synthesis. From here ozone concentration decreases on ozonizer output.

Carrying out researches show directions of optimization of desing and feed parameters on working characteristics of ozonizer of surface discharge .

FIGURE.1. Ozone concentration versus specific energy (V_g = 2 l/min)

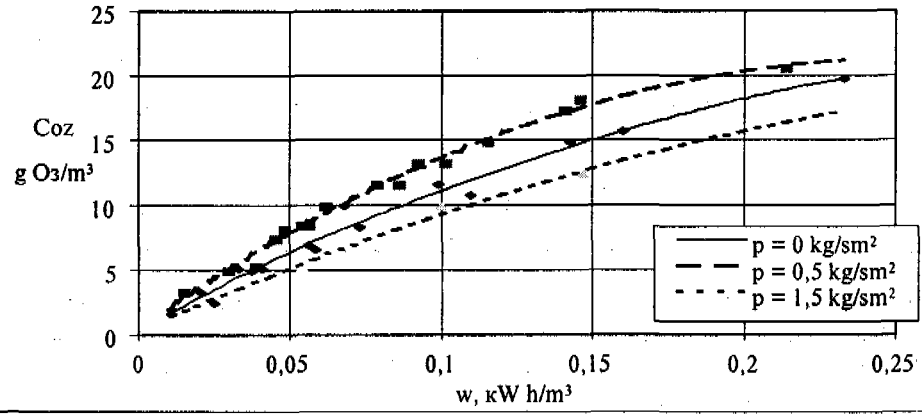
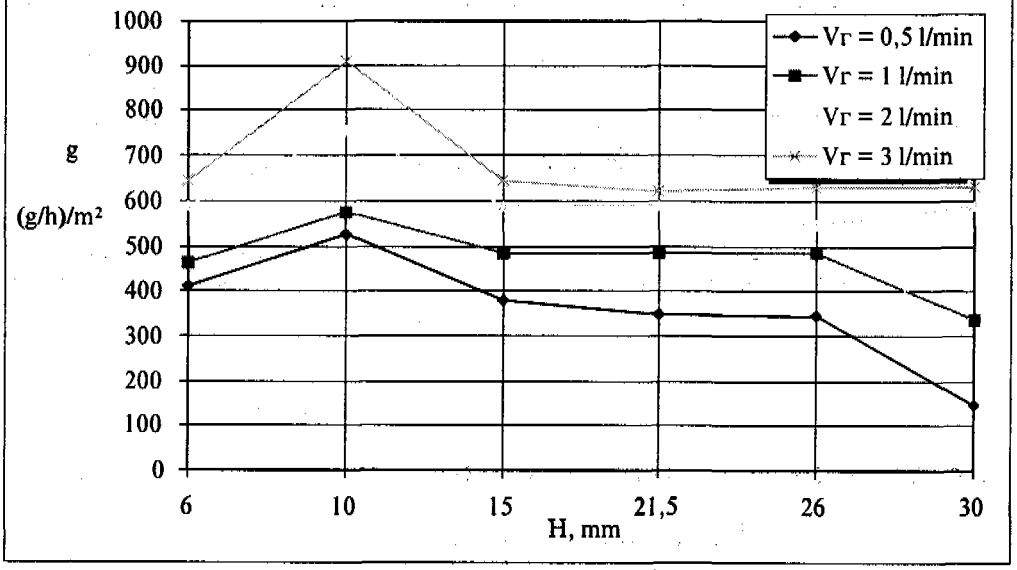


FIGURE.2. Specific ozone ganaration rate versus size of the gas gap above surface of discharge electrode

(U = 5 κV, f = 4 κHz, p = 0 kg/cm²)



KINETIC LAWS OF OXIDATION OF POLYATOMIC. SPIRITS BY OZONE IN AQUEOUS SOLUTIONS

Zimin Y.S., Truchanova N.V., Komissarov V.D.
Bash University, Ufa, Russia

The kinetics of oxidation of polyatomic spirits by ozone in aqueous solutions have practical meaning when we speak about the purification of the industrial waste-waters and potable water treatment. The data concerning the above-mentioned oxidation are few [1-3], the constants of action are obtained at a small number of temperature poits [1, 2]; theare no activation parameters.

This research is dedicated to the kinetics of oxidation of trimethylene glycol, tetramethylene glycol, pentamethylene glycol, diethylene glycol and neopentyl glycol by ozone in aqueous solutions.

The kinetics of the reaction was investigated in static conditions of the ozone consumption in a liquid phase by spectrophotometrical method.

It was ascertained, that the ozone consumption in its reaction with polyatomic spirits is conveyed by the following kinetic equation:

$-d[O_3]/dt = k[ROH][O_3]$.

For all the spirits taken into the investigation the temperature dependence of the second-order rate constant k was researched (table 1) and activation parameters were determined (table 2).

Table 1. The dependence of the rate constant k (l/mole·sec) on the spirits structures and temperature

Spirit	T, K				
	277	283	290	297	304
$HO(CH_2)_3OH$	0.12±0.01	0.19±0.01	0.49±0.01	0.69±0.09	1.54±0.41
$HO(CH_2)_4OH$	–	0.29±0.01	0.59±0.02	1.31±0.04	2.48±0.10
$HO(CH_2)_5OH$	0.28±0.01	0.46±0.01	0.95±0.04	1.29±0.03	2.79±0.19
$HO(CH_2)_2O(CH_2)_2OH$	0.07±0.01	0.10±0.01	0.24±0.01	0.41±0.06	1.19±0.11
$(CH_3)_2C(CH_2OH)_2$	0.17±0.01	0.29±0.01	0.71±0.06	1.24±0.07	2.87±0.22

According to the data, given in table 1, we may observe the following order of ROH reacting ability in attitude to ozone (290 K): pentamethylene glycol > neopentyl glycol > tetramethylen glycol > trimethylene glycol > diethylene glycol.

As the result of the analysis of the data given in table 2 it was found that lgA is growing linearly with the increase of E (the compensative effect); it shows that there may be a common mechanism of ozone interaction with the investigated spirits.

Table2. Activation parameters of ozone-polyatomic spirits reaction

Spirit	lgA (l/mole·sec)	E, kkal/mole
$HO(CH_2)_3OH$	11.7 ± 2.3	16.1 ± 3.0
$HO(CH_2)_4OH$	13.1 ± 1.5	17.7 ± 2.0
$HO(CH_2)_5OH$	10.6 ± 1.9	14.1 ± 2.6
$HO(CH_2)_2O(CH_2)_2OH$	10.8 ± 2.7	15.2 ± 3.6
$(CH_3)_2C(CH_2OH)_2$	13.1 ± 1.4	17.6 ± 1.9

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APPLICATION OF OZONIZATION FOR INDIVIDUAL CONTAMINATORS OXIDIZATION

Zinberg M.B., Mezhebovskaya G.P., Shamsutdinova M.V.
Firm "Ecobios", Orenburg, Russia

Nowadays under growing anthropogenic influence on surface natural water sources the classic technologies for drinking water preparation, used at the water treating facilities, are turning out not to be enough efficient.

Especially notable reduction of these facilities barrier role in relation to organic contaminators, getting into waters sources during emergency discharges or different other emergencies.

All that drove to introduction of new methods of water treatment into water preparation technologies. One of the most universal and effective methods among them is ozonization; the application of that method gives an opportunity to rise barrier role of waterdraft treating facilities and to rise a degree of different water contaminators recovery. For determination of effeciency of the ozonizaton process considering different contaminators of natural and anthropogenic origin, containing in water of the Ural river and establishing of optimal process parameters in actual conditions of the opened waterdraft of Orenburg an experimental unit has been assemlied and pilot tests have been performed.

Ozone dosage and contact time have been determined during the tests; effeciency of treatment and disinfection of the Ural river water and model solutions with different dubstances (the most often occured in surface watersupply sources, were studied).

In the course of investigations the influence of ozonization on oxidization efficiency of such individual organic com-

pounds as surfactants, oil products, pesticides, chloroform were studied.

Studies were performed on solutions with different contaminators concentrations from 1 up to 10 maximum allowable concetrations at ozone dose of 3,5-5 mg/l and contact time of 10 minutes. Studies results are given in the table.

Table. Contaminators concentration changes under water ozonization (contact time with ozone - 10 minutes, ozone dose - 3,5-5 mg/l)

Contaminators, introduced in river water	Contcentration of contaminators, mg/l		Treating efficiency, %
	primary water	after ozonization	
Oil products	1,7-2,2	0,14-0,3	92-86
Surfactants	1,27-3,7	0,13-0,31	89-91
Pesticides	1,1-2,6	traces	100
Chloroform	0,94-2,1	0,025-0,03	97-98,6

The presented results show that such spread contaminators as oil products, surfactants, pesticides, chloroform are well oxidized by ozone. Treatment effeciency is: from oil products 86-92%; from surfactants 89-91%; from pesticides 100%; from chloroform 97-98,6%.

The achieved values of all mentioned substances satisfy the requirment of the National Standard (GOST) "Drinking water" at ozone dose 3,5-5 mg/l and contact time of 10 minutes.

The obtained results game been used in the development of the technological regulations for treating facilities reconstruction of the Orenburg opened waterdraft with introduction of ozonization and adsorption on coal filters methods.

WORKSHOP: "GEOINFORMATIONAL SYSTEMS IN APPLICATION TO THE WATER SECTOR"

ECWATECH

GEOINFORMATION TECHNOLOGIES IN THE SOLVING OF THE TASKS OF MANAGEMENT OF THE SUE "VODOKANAL OF SAINT PETERSBURG"

Barkovsky V.N, Vasiljev A.I., Gumen S.G., Trukhin J.A.
SUE "Vodokanal of Saint Petersburg", Saint-Petersburg, Russia

It is noted the importance of the timelines of the adoption of management decisions, as well as their bringing the to the notice of direct executors and the further control of their execution. The adoption of decisions is to be based on real information. It is considered that wrong information can lead to much more serious errors than its absence.

The accumulation of information, its fast search, analysis and operative adoption of decisions are the components of management.

At the present time the understanding of the importance of the use of geoinformation systems technologies when solving of management tasks by such enterprises as Vodokanal comes.

The SUE "Vodokanal of Saint Petersburg" has some experience of the creation of geoinformation systems. Together with the city enterprises: i.e. the Trust of Geodesic Works and Engineering Investigations, Computer Center for Collective Use of housing services, the committee of power-engineering and engineering provision, covered the path of the creation of geoinformation systems beginning from the putting of task and up to applied systems.

The questions of the realization of geoinformation systems for control management and also for regional operational organizations are considered in the report.

On the first stage the basic electronic map of the whole city on the scale 1:10000 is developed, main nets and equipment are put. In future it is supposed to expand the objet composition, increase the scale, expand the functional composition of the system.

STRUCTURE AND COMPOSITION OF UNIFIED GEO-INFROMATION SYSTEM OF THE VOLGA BASIN (GIS-VOLGA)

Naidenko V.V.
NGASU
Dynkin A.M., Petukhov M.I.
Solomatin M.E.
CPG"Terra-Space"
Nikolsky Ye.K.
NGASU

The unified geo-information system of the Volga basin (GIS-Volga) is an inter-regional, inter-branch, multifunctional information system which contains regularly arranged set of documents including information on condition of nature and resources, socio-economical potential and ecological situation in the Volga basin. It must combine five basin centres connected by telecommunications and located on the territory of the Volga basin.

The GIS-Volga, basin information and analysis centres and typical information and analysis complex are being designed and developed on the basis of the latest programme and technical, and technological solutions by the Intergraph Corp.The application of the solutions offered by the Intergraph Corp. will allow us to simplify the structure of the system, facilitate solution of an entire complex of technological problems connected with forming data bases and their analysis, and speed up putting the system in full-scale production operation.

The Volga River basin is a vast territorial, nature and economic complex occupying the area of 1,380,000 sq.km. Managing the complex to implement the measures envisaged by the Target Federal Programme "Revival of the Volga" must be based on a well-developed theory and powerful information and analysis basis, on the latest achievements in the area of geography, geodesy, mapping, ecology, informatics, technical cybernatics and economics.

Being both an information system and juridically arranged organizational and legal structure, the GIS-Volga must accumulate information from the existing branch sources including operating cadastre services (land cadastre, cadastre of forest resources, cadastre of mineral resources, water cadastre, real estate register, etc.) and regional and branch data bases and data banks in particular.

One of the main objectives of the unified GIS in getting documented information intended for forming information resources in the data bases is coordination of activities of the administrative and departmental infromation services providing information on socio-economic and property complexes and ecological situation on the territory of the Volga basin, particularly in working out criteria for combining heterogenous data obtained from various sources, standardising exchange formats, selecting optimal data structures, etc. Coordination of the work must be based on legal acts concerning cooperation with separation of responsibilities, rights and duties.

The structure and composition of the data bases are determined by territorially distributed information coming from administrative and departmental sources. The GIS-Volga must receive integrated (generalized) information. In case of urgent necessity, the GIS Volga must be entitled to ask and get primary data as well.

The GIS-Volga data bases must be formed on a unified topographical and geodetic (mapping) basis using unified

classification and information coding systems, approved formats and data structures through their respective processing and targeted complexing. The information must follow the results of regular and continuous observation of the Volga basin territory.

To establish the GIS-Volga it is necessary to develop technologies for using the GIS-Volga product in solving the problems of management aimed at rehabilitation of ecological situation in the area of the Volga river and its tributaries, restoration and preventing degradation of natural complexes in the Volga basin.

Among potential users of the information to be provided by the GIS-Volga are governmental bodies at the federal, regional (subjects of the RF), municipal and local levels; structural divisions of the State Committee for Ecology and Ministry of Natural Resources exercising control and management in nature use; organizations in branch ministries and departments responsible for providing relevant information for the data bases of the GIS-Volga and involved in inventory registering, analysis and assessment of condition of natural resources and ecological situation; enterprises, organizations and establishments, juridical and natural persons operating on the territory of the Volga basin.

GEOINFORMATION TECHNOLOGIES IN MAINTENANCE OF CITY WATER SUPPLY AND SEWAGE SYSTEMS

Vaisfeld V.A., Yeksayev A.R.
EIC "Potok" ,Moscow, Russia

Introduction

City systems of water supply and sewage (WS&S) are large information entities. Updated information about the WS&S system units cannot be provided without modern computer geoinformation technologies. The report is based on a wide practical experience of applying information systems (IS) both to water supply and sewage systems and to systems of heat and gas supply. IS's based on the technologies described in the report are being operated in water supply and sewage facilities of Moscow, St.Petersburg, Kiev, Vilnius, Izhevsk, Sochi, Cheboksari and Cherkassi.

Ws&s system diagram

A WS&S systems diagram is the main document for operating WS&S networks. The diagram has to be based on standard city maps of 1:500 or 1:2000 scale (the latter scale being more preferable for large cities). The available geoinformation technologies enable entering WS&S network diagram into a computer making it thereby possible to display any fragment of network on the monitor screen or any printer. A computer WS&S network diagram has to meet the following requirements:

1) In the long run, the diagram has to be stored in a vector (rather then a raster) pattern;

2) The absolute majority of the units on the diagram have to be identified, i.e. the graphical representation of a unit has to be linked to its technological description;

3) Graphical attributes of units (colors, types of lines, types of filling) have to be functions of the technological attributes of the units;

4) All explanatory captions should be based on the technological attributes of the units.

A unified system to classify and code ws&s network units is a prerequisite to create a data base of a plant

From the mathematical point of view, water supply or sewage network is a graph consisting of nodes and sections connecting adjacent nodes. A classification of the types of the nodes has to be performed both for water supply and sewage networks to unambiguously define both the principles of their representation and technological characteristics.

Each node of the network has to have a unique user's name (code) which is used by all services. When the names of the nodes are available, the names of the sections are easily derived as pairs of names of the adjacent nodes. Some nodes (e.g., pumping stations, water wells, users of the central heat point, etc.) may have an intricate internal structure which is represented on various diagrams of the nodes (detailed diagrams). An information system has to be able to create computer detailed diagrams in a vector form, specifications of equipment (a list of valves, hydrants, bell mouth joints, etc.) being automatically generated. Nodes, sections and the equipment of nodes are described by scores of parameters, which have to be stored in the data base. The set of parameters which governs the scope of the network inventory is determined, on the one hand, by the practice of operating the network in each particular organization, on the other hand, this set has to be sufficient to solve the main technological tasks.

Main tasks of an information graphical system when inventoting water supply and sewage networks

A single data base enables generating various certificate, reports and special-purpose diagrams of networks. However, according to our opinion, the expenses to create a data base will not pay back unless the following technological operations are performed (a description of the operations is presented in the report):

- Correction of WS&S network diagrams on the basis of operation document.
- Plotting pressure profiles (piezometer charts) along the required route.
- Keeping records and analysis of failures in water supply networks and of clogging in sewer networks.
- Keeping dispatcher logs and records of emergency repair operations in WS&S networks.
- Giving recommendations to localize faulty sections of water supply network.
- Automatic identification of the gravity sewage system sub-graph along which the sewage can flow to the required sewage well.
- Hydraulic calculation of water supply and pressure sewage networks.

CONTENTS

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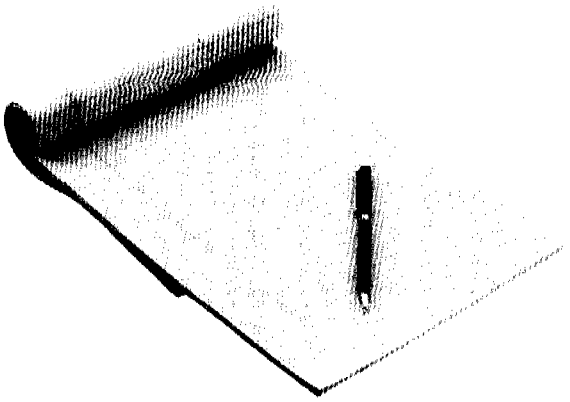

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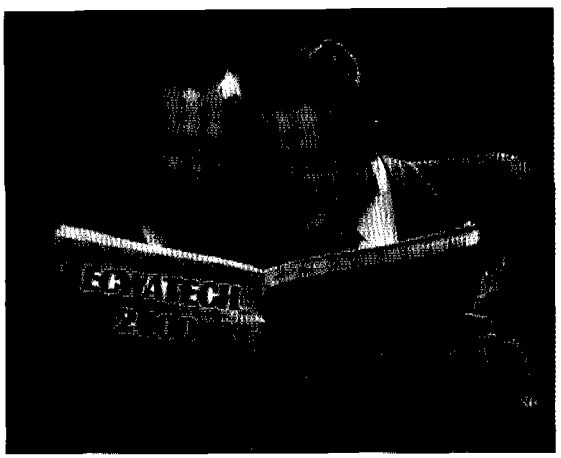

ADDRESS OF THE SECRETARIAT: P.O. Box 173, Moscow, 107078, Russia
TEL/FAX: (7-095) 975 5104, 207 6310, 975 4808
E-mail: sibico.int@g23.relcom.ru