

Center of Ecological Systems and Technologies (ECOST)
Ministry of Immigrant Absorption of Israel
Union of Immigrant Scientists of Israel

**The 4th and 5th Annual Ecological
Immigrant Scientists Conferences
from the cycle “Ecological Problems of Israel”**

URBAN ECOLOGY



TECHNOLOGIES FOR WATER TREATMENT AND DESALINATION AND FOR WATER SAVING

By financial support of
Ministry of Immigrant Absorption of Israel

PROCEEDINGS

Supported by:

- Ministry of Environment of Israel
- Municipality of Ashdod
- Municipality of Jerusalem
- Absorption Authority of Municipality of Jerusalem
- Jerusalem Immigrant Community House
- Discount Bank of Israel

Ashdod Center of Arts
21 Ha-Banim str. Ashdod
November 29, 2001

Jerusalem Culture Center
27 Hillel str. Jerusalem
December 12, 2001

Table of Contents

The 4th Annual Ecological Immigrant Scientists Conference
“URBAN ECOLOGY” 3

The 5th Annual Ecological Immigrant Scientists Conference
“TECHNOLOGIES FOR WATER TREATMENT AND DESALINATION
AND FOR WATER SAVING” 61

INFORMATION ABOUT THE AUTHORS 114

ISBN 965-90417-0-5

Editorial staff:
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Printed in Israel
“Noy” Printing House
Jerusalem
Tel. 02-6250561

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Ashdod Center of Arts
21 Ha-Banim str. Ashdod
November 29, 2001

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PROGRAM OF THE CONFERENCE
“URBAN ECOLOGY”

| | |
|---|----------------------|
| Registration of participants | 9.00 – 10.00 |
| Greeting to the participants | 10.00 – 10.30 |
| Paper and report presentation: | |
| Prof. Nonna Manusov <i>Parameters of Environment Quality Control in Cities of Israel</i> | 10.30 – 10.45 |
| Mr. Vladimir Gershov <i>Ecological Problems of Ashdod</i> | 10.45 – 11.00 |
| Dr. Anat Rozen <i>Organization of Environment Protection in Israeli Cities</i> | 11.00 – 11.15 |
| Dr. Vladimir Elper, Dr. David Kheifetz <i>Estimation and Decrease of Noise Level in Urban Conditions</i> | 11.15 – 11.30 |
| Dr. Zoya Novakovsky, Dr. Vladimir Chapsky <i>Electromagnetic Pollution of Urban Environment and Apparatus for Magnetic Fields Measurement</i> | 11.30 – 11.45 |
| Prof. Valery Alfimov <i>Pollution of Urban Air Environment by Automobile Transport</i> | 11.45 – 12.00 |
| Dr. Ilia Moskovich <i>Ecological Hygiene and Health of Urban Citizens</i> | 12.00 – 12.15 |
| Coffee break | 12.15 – 12.45 |
| Dr. Alexander Tzikerman, Dr. Julius Ilievsky, Dr. Sergey Sushon <i>Problems of Solid Waste Treatment in Cities of Israel</i> | 12.45 – 13.00 |
| M.Sc. Ilia Linger, Dr. Uriy Borbotz <i>New Projects of Urban Environment Improvement</i> | 13.00 – 13.10 |
| Prof. Vladimir Umansky <i>City Population and City Ecology</i> | 13.10 – 13.20 |
| Dr. Yakov Raikhman <i>System Analysis of Carcinogenic Situation in Cities of Israel</i> | 13.20 – 13.30 |
| Dr. Margarita Fraimovich <i>Urban Environment and Stress-Dependent Diseases</i> | 13.30 – 13.40 |
| Prof. Ilia Revelis, M.Sc. Larisa Revelis <i>Earthquakes and Problems of Urban Ecology</i> | 13.40 – 13.55 |

| | |
|---|----------------------|
| Prof. Alexander Kimberg, Dr. Evgeny Belanov, Dr. Julius Ilievsky, Prof. Naum Sosensky <i>Ecologically Clean Construction in Cities</i> | 13.55 – 14.10 |
| Dr. Michael Milov, M.Sc. Alexey Papadin, Prof. Ilia Revelis, Dr. Raisa Milov <i>Ways of Life Conditions Improvement in Cities of Israel</i> | 14.10 – 14.25 |
| Discussion | 14.25 – 15.30 |

TABLE OF CONTENTS

| | |
|---|----|
| <i>Amstislavsky Alexander</i> Green Zones as an Additional Subsystem in Urban Ecological System | 10 |
| <i>Anfimov Valery</i> The Problem of Ecology of Transportation in Urban Areas of Israel..... | 11 |
| <i>Belanov Evgeny, Ilievsky Julius, Kimberg Alexander, Sosensky Naum</i> The Variant of Ecological Construction | 13 |
| <i>Borbotz Uriy</i> Decrease In Consumption of Municipal Water In “Yehuda Pladot” Steel- Smelting Plant | 14 |
| <i>Elper Vladimir, Kheifetz David</i> Evaluation And Reduction of the Noise Level in Urban Conditions..... | 15 |
| <i>Frainovich Margarita</i> Pollution of Residential Districts of A Big Industrial City – the Risk Factor of Illness and Neuroses..... | 18 |
| <i>Ioelovich Michael</i> Biodegradable Barrier Polymer Materials as Means for Improving Ecological State of Cities | 20 |
| <i>Kagansky Julius, Blumin Alexander, Slobodov Rozalia</i> On One Method of Water Supply In Settlements With Low Construction | 22 |
| <i>Klinov Tatyana, Ilievsky Julius</i> A Method of Reducing the Volume of Rigid Waste in Urban Areas of Israel... | 23 |
| <i>Korobkin Alexander</i> Methods to Boost the Environment Ecological Level | 24 |
| <i>Krasilshchikov Leonid</i> Geo-Ecological Problems In the Ramat-Hovav Industrial Zone | 25 |
| <i>Levin Evgeny</i> Ecological Problems of Transport in Big Cities | 27 |
| <i>Manusov Efim</i> Town As an Ecological System | 29 |
| <i>Manusov Nonna, Nelin Valentina, Polonsky Vladlen</i> Indexes of Urban Life Quality in Israel | 31 |
| <i>Mikhailovich Anatoly</i> Evaluation of Environmental Changes Resulting From Constructing Or Modernizing Installations | 33 |

| | |
|---|----|
| <i>Mikhailovich Anatoly</i> Regime Methods for Lowering of Nitric Oxides Ejections by Boiler Units of Thermal Power Station..... | 34 |
| <i>Milov Raisa</i> Air Quality in Israeli City Apartments..... | 36 |
| <i>Moskovich Ilia</i> Ecological Hygiene and Health of the Population in the Urban Areas of Israel | 37 |
| <i>Natanson Mark, Natanson Leonid</i> Indexes Meaning And Alteration For Parameters of Ecological System | 39 |
| <i>Novakovsky Zoya, Chapsky Vladimir</i> Apparatus And Method For Measurement, Observation And Topography of Magnetic Fields For Robotics And Ecology..... | 40 |
| <i>Novakovsky Zoya, Farfel Leonid</i> Electromagnetic Pollution of Urban Environment | 42 |
| <i>Priyatel Anatoly</i> The Role of Urban Motorways in Environment Pollution and Creation of the Sound Field | 44 |
| <i>Raikhman Yakov</i> System Analysis of the Carcinogenic Situation in the Cities of Israel | 46 |
| <i>Raitsin Mark, Sosnovsky Yakov</i> On Energy Consumption Management at a Municipal Level | 48 |
| <i>Revelis Ilia, Milov Michael, Popadin Alexey</i> On Rainwater Usage in Ashdod..... | 50 |
| <i>Revelis Ilia, Revelis Larisa</i> Earthquakes And The Problems of Ecology | 51 |
| <i>Slavin Vladimir</i> Ecology of Cities: Electromagnetic Wave Processes In Industrial And Municipal Sewage Treatment | 53 |
| <i>Sushon Sergey</i> Methodological Issues of Determining Efficiency of Waste Utilization From Secondary Sources | 55 |
| <i>Terletsky Diana</i> Interethnocultural Community to Improve Urban Ecological Situation..... | 56 |
| <i>Tzikerman Alexander, Ilievsky Julius</i> Influence of Natural Climatic, Ecological and Ethnocultural Peculiarities of Israel on Problems of Utilization of Municipal Solid Wastes (MSW) | 57 |

| | |
|--|----|
| <i>Umansky Vladimir</i> | |
| City Population and City Ecology | 59 |
| <i>Vasjukova Elena</i> | |
| Negative Impact of Globalization on Urban Ecology of Small Countries | 60 |

**GREEN ZONES AS AN ADDITIONAL SUBSYSTEM
IN URBAN ECOLOGICAL SYSTEM
Amstislavsky Alexander**

All towns, especially those with industrial enterprises, constitute heterotrophic systems consuming energy, food, water etc. from outside resources. To improve the urban environment within the municipal borders, there are established autotrophic subsystems (or green zones – GZ) including trees, shrubbery zones, grass plots, lakes, ponds. Quite frequently GZ comprise so-called “green belts” providing improvement of the urban atmosphere and forming recreation zones for the town residents.

Unfortunately, in the Israeli towns even the natural GZ are not always preserved. Thus, in Jerusalem only one third of the GZ area – about 130 hectares – has been survived.

During the last few years, there disappeared a splendid forest near the densely populated residential area of Senhedria. It was swallowed up by the industrial zone. Similar is the situation in the Har Nof neighborhood. It must be added that the existing legislation does not prevent from construction of various communication facilities (power transmission lines, different kinds of pipelines etc.). The vast worldwide experience, as well our observations, testify that such interference in the forestry functioning usually leads to quick disintegration of the forest into separate sections, almost isolated one from another. This inevitably brings about degradation of the forestry and drastic decrease in its recreation and other important functions.

Moreover, new industrial zones ruining the existing forestry areas are being erected all the time, causing crucial distortion of the ecological balance, which is fraught with numerous negative consequences.

It is necessary to undertake a profound research related to ecological prognosis of the remote consequences of green tracts extinction for each concrete project to be erected. There is a necessity to promote legislation protecting green zones within the municipal borders of the Israeli towns and to impart them the status of areas protected by law.

**THE PROBLEM OF ECOLOGY OF TRANSPORTATION
IN URBAN AREAS OF ISRAEL
Anfimov Valery**

At present, a number of problems of utmost importance related to the population's vital activity in Israel can be distinguished. Transportation is one of such crucial problems, since the net of roads and streets in the urban areas does not meet the demands of transportation, and, besides, the transport exerts a substantial impact on the population's health and renders to be a source of the environment pollution.

Israel has above 21 large built-up urban areas with well established infrastructure nets of roads and streets, especially such as those in Jerusalem, Tel-Aviv, Haifa, Beer-Sheva. Thus, in Haifa the total extension of the roads and streets is about 480 km, and it is constantly growing in light of the further development of territories to be built up.

Intensive traffic development is connected with ever growing number of vehicles and the volume of freight and passenger transportation. This growth of transportation activities, appearance of heavily loaded multi-axial vehicles, increase in the number of vehicles with diesel engines bring about increase in exhausted volumes of pollution in the form of smokes, gases, waste products of pneumatic tyres, friction details, as well as waste products resulted by rolling surfaces (asphalt concrete pavements). Motor transport also causes considerable noise and vibration effecting the environment. This is observed especially on the central transit roads and streets passing through towns and settlements.

The ever increasing volume of waste products caused by motor transport exerts impact on the roadside space in the form of ground and soil pollution, oppression of plants (forests – trees, bushes and grass; agricultural crops in fields and orchards etc.).

The motor transport wastes, noise and vibration exert a considerable impact on man's vital activity. Thus, due to the data set forth by Dr. Geula Scharf of the Association "Man, Nature, Earth", concentration of harmful compounds in the atmosphere is increasing. Above 433 cases of air pollution excess above the admissible level have been registered in big towns, which brings about increase in the respiratory tracts diseases.

The impact of the motor transport wastes on the environment in Israel is aggravated because of climate peculiarities (high temperature, low precipitation, increased solar radiation etc.), high density of population (one of the highest throughout the world) and lack of natural "lungs" represented by forests and small woods.

The concentration of motor transport wastes is especially influenced by frequent traffic jams on the roads, which are caused by traffic accidents, road

works, as well as a result of congestions at rush-hours. In traffic jams the vehicles either stand still or move slowly, their engines causing increase in concentration of exhaust gases within short sections of roads and streets. Besides, concentration of motor transport wastes is connected with car parking grounds and the problem of car washing near dwelling houses.

It must be noted that no regular studies of the motor transport wastes impact on the environment on the road of the urban areas is implemented. This was made clear at the scientific-technological conference on ecology in Beer-Sheva in 1999.

Israel has no maps with ecological indices characterizing roads and streets of urban areas and residential grounds; no data on actual and normative volumes of motor transport wastes for roads and streets of the urban area are available, which gives no opportunity either to implement reconstruction of the net of roads and streets and, or to elaborate protective measures against the motor transport harmful impact. There are no data reflecting the scope of pollution of soils and of the flora environment, which brings down the possibilities of natural cleansing. There are neither data reflecting pollution and dust content of urban territories and their influence on the level of the disease rate and the health state of the population. There exist no elaborated local norms taking into account the climate, the relief, the density of population, the built-up territories and the traces of the actually functioning net of roads and streets.

At present, there exist various methods of measuring wastes concentration in atmosphere, in soil and in flora. For instance, in Haifa a method enabling examination of 10 thousand motor vehicles per hour has been developed ("Herald of Haifa and the North", 02.08.2001), to distinguish poisonous components in the motor vehicle engine.

Integrative use of measurement methods reflecting the situation as related to different urban areas and different year seasons will enable to obtain extremely important data for elaboration of plans aimed at improvement of the urban ecology and its protection from the motor transport wastes.

On the basis of complex study, a computerized system "town – motor transport" must be developed including the components of climate, relief, road net configuration, peculiarities of built-up grounds, flora controlling the urban ecology and decreasing the volume of the motor transport wastes.

The above integral study is presumed to bring about contributions as follows: 1) development of database reflecting the volume of pollution and the ecological burden of the motor transport; 2) maps of ecological situation in towns as caused by the motor transport wastes impact of plans for the infrastructure development; 3) concrete measures towards improvement of the ecological situations.

THE VARIANT OF ECOLOGICAL CONSTRUCTION
Belanov Evgeny, Ilievsky Julius, Kimberg Alexander, Sosensky Naum

Center “Progress in Construction” (CPC) offers a communal and dwelling complex consisting of two parts: ground and underground ones.

The ground part is a communal center and 3 apartment houses above. The roof of the communal center is a park for tenants of the apartment houses; its area is about 3 thousand sq.m., which answers the international standards for providing population with green territories. Besides this green zone protects the dwelling from harmful influence of human activity (exhaust gases, noise, etc.). The proposed mutual location of apartment houses forms an aerodynamic tube that improves ventilation of apartments of the complex as well as ventilation of area inside the complex. The roofs of apartment houses are the place for sun batteries capable to provide electricity and warm to the complex.

In the underground part, there are garages for 200-300 cars and treatment plants capable to process the products of human activity.

The framework-assembled reinforced concrete bearing construction of the complex gives the possibility to make outer and inner walls non-bearing and build them from light ecologically clean building materials. The technology offered by CPC specialists gives the possibility to create assembled constructions directly in the building area, which industrializes building, shortens the building time, and subsequently reduces harmful influence of building on environment.

The territory of the complex building-up consisting of communal center (area about 6 thousand sq.m.), three apartment houses with 200 apartments, underground garages for 200-300 cars and engineering plants providing gas, electricity and warm to the complex, is 3050 sq.m. In Israel, 40 dunams are needed to build such a complex. The liberated territory may be turned into forest park.

CPC developers hope that this proposal will be interesting to the Ministry of Building and Infrastructure as well as to city administrations of Israeli cities.

**DECREASE IN CONSUMPTION OF MUNICIPAL WATER
IN “YEHUDA PLADOT” STEEL-SMELTING PLANT**

Borbotz Uriy

To replenish recycled water supply systems, in “Yehuda Pladot” steel-smelting plant in Ashdod 0.7 m³ of water is used to produce 1 ton of cast billet.

In the system of arc-heating furnace, gas treatment, scoop furnace, and transformers TK-7, expenditure of recycled water is 950-1000 m³ per hour. Water evaporation in refrigerant tower is equilibrated by water added from municipal water supply of as much as 150-170 m³ per day. To provide the necessary saline regime for recycled water, drainage into sewerage system was 30-40 m³ per day. Refrigeration of slag poured out from furnace formerly was carried out in the area of 150-200 m² by mixing it with bulldozer together with partial refrigeration of water. Mixing and refrigeration resulted in considerable discharge of slag dust into atmosphere and into soil with cooling water, that is why in March 2000 concrete bunkers enabling showering of slag with water from municipal water supply were build, and this decreased water expenditure to 35-70 m³ per day. Later on, improvements were made to decrease the municipal water consumption.

Large atmosphere dust content near slag bunkers both led to water contamination when it was refrigerated in refrigerant tower and required increased water drainage.

We installed a sand filter “Amiad” able to automatically treat water up to 5-micron purity. Analyses on particles distribution in water before and after filter installment showed high efficiency of its work.

Filter enabled us to decrease water drainage to 25-30 m³ per day together with keeping the level of water conductivity of 3000 mS per centimeter.

Drainage water was directed to refrigerate slag in bunkers, which gave us additional decrease in municipal water consumption.

Overall economy of water is 30-40 m³ per day or more than 13 thousand m³ per year.

**EVALUATION AND REDUCTION OF THE NOISE LEVEL
IN URBAN CONDITIONS
Elper Vladimir, Kheifetz David**

In accordance with norms established in Israel, the level of noise in residential premises cannot exceed 50-55 dBA in the daytime and 40 dBA at night. The corresponding figures for "sensitive" public buildings (kindergartens, schools, hospitals etc.) are 45 and 35 dBA.

Generally speaking, two most substantial categories of noises can be distinguished: the traffic noises (motor-cars, trains and airplanes), and the noises cause by various mechanic systems (in industry, in residential areas, in public shopping centers etc.).

The motor-car transport is the most widespread source of traffic noise. Its "contribution" in Europe is estimated as 90%. Thanks to serious efforts undertaken by all motor-car producers, the noisiness of engines has been reduced in the course of the last 20-30 years for about 8 dBA in passenger cars and for 15 dBA for trucks. Still, the intensive increase in the quantity of motor vehicles brings about aggravation of the problem.

The noise level of the motor vehicle depends, first of all, on the intensity and the speed of the traffic, its structure and the movement conditions. In the immediate vicinity of the urban highway the noise level can reach 70-75 dBA. The change of the noise level from its source to the receptor is influenced by such parameters as the distance between them, the relief of the locality and the type of the territory covering, shielding by buildings and other constructions.

In Israel, an inter-departmental committee for elaboration of recommendations related to struggle with traffic noise approved criteria for forecasting and evaluation of noise from transportation lines reaching residential and public constructions. According to these criteria, the noise level 1m away from the building during the rush-hours (taking into consideration the protective properties of the construction) must not exceed 64 dBA for residential constructions and 59 dBA for educational, health and recreation institutions.

All the above mentioned factors are taken into account when forecasting the expected noise level caused by motor transport. Forecasting is implemented by means of computer models "Stamina" and the recently introduced TNM (Traffic Noise Model) system developed in the USA under the aegis of the Federal department for motor roads.

To reduce, if necessary, the noise level, various methods are used. At the early stage, planning of the constructions can be changed, so to avoid bedrooms and drawing-rooms in residential buildings, classrooms in the schools, bedrooms in the kindergartens, wards in the hospitals from facing the "noisy" side. Changes in the housing estates planning, with placing shopping center, trading enterprises and offices between the residential building and the road, can give

favorable results. The form of the construction and its orientation to the road is also important.

Outside the town, the most widespread and efficient means of protection from traffic noise are sound barriers, which are generally erected along the most problematic sections of the road. Examples are the Ayalon route in Tel Aviv, the inter-urban Begin route and the interchange in the region of ha-Giv' a ha-Tzarfatit in Jerusalem. Other projects with similar solutions have been developed.

During the last few years, in certain cases the so-called "quiet asphalt" is used for road paving, which, in addition to its other important properties, reduces substantially the noise caused by the motor-car wheels. In term of acoustic protection, this is especially efficient for cars moving with high speed. Such paving has been set, for instance, on Route No.2, covering the road section along Kfar Shemaryahu.

In cases when the above measures are ineffective or inadmissible, it is necessary to resort to use of corresponding types of windows, doors, porch barriers and fences.

The noise caused by trains or by airplanes comprises a local problem, though its solution in specific regions becomes crucially important. The level of noise caused by railway transport depends on the type of the train and of the locomotive, the type and the number of carriages, the intensity of movement and the speed of the trains, the time section of the day. In the nearest vicinity to the railway, the noise level can reach 75 dBA.

Due to the recommendations issued by the Israeli Ministry of ecology, the level of the noise caused by trains 1m away from the construction cannot exceed 65 dBA in the daytime and 55 dBA at night for residential premises, and 62 dBA in the daytime and 52 dBA at night for educational health and recreation institutions. Forecasting of noise is implemented by means of the computer model RWNM (RailWay Noise Model) developed in the North Carolina university, USA. Due to this model, there have been implemented studies related to noise forecasting and design of acoustic barriers for the new railway lines Tel-Aviv – Lod – Ramleh – Na'an and others.

The most efficient means of struggle against the noises caused by airports is zoning of land application in the neighborhood of the airport according to the noise level, taking into account the noise factor when choosing the take-off and the landing curves, limitation of flight at night. If necessary, the sound-proofing of windows and roofs of the constructions can be improved. Upon development of alternative variants of the project, the average noise index can be used, taking into consideration the qualitative (categories of land application) and the quantitative (population, number of constructions etc.) parameters of the territory in question.

The second important source of urban noises is that of mechanical equipment of ventilation and air conditioning. To provide the required volume of fresh air and secure exhaust of the processed hot air, such noisy appliances as chillers, cooling towers and air handling units are installed on open grounds, as a rule on roofs or in the yards. The noise level of these units exceeds 80-90 dBA. Upon carrying out new projects, noise-proof measures accompany all stages of implementation, based on corresponding acoustic calculations. As an instance, a number of construction projects carried out in Jerusalem may be mentioned, such as the new Central bus station, large-scale residential complexes and shopping centers up-town in Gilo, in Giv'at Shaul, down-town in Jaffa Street (Binyan Klal – Beth), and others.

To reduce the noise level, it is recommended to choose quieter equipment and appliances for air-cooling systems, to install noise suppressors in the places of air exhaust/intake, to mount acoustic jalousies, windows and doors with heightened sound-proofing in the apertures of technical facilities of the premises, acoustic shields around noisy units, etc. Reduction of noise caused by the mechanical equipment in the existing constructions is practiced with reference to the residents' appeals. The main object of complaints are restaurants, pubs, discotheques etc.

It is necessary to practice expert examination of rare projects with the municipal borders, such as the cable-way in Haifa (between the University and the Check-Post junction, expansion of the Haifa zoo).

**POLLUTION OF RESIDENTIAL DISTRICTS OF A BIG
INDUSTRIAL CITY – THE RISK FACTOR
OF ILLNESS AND NEUROSES**

Fraimovich Margarita

The living conditions of people living in big industrial cities depend on the presence of a complex of anthropogenesis factors. Some of them (low recreational loading per person, “microwave smog”, chemical substances of neurotoxic effectiveness) will follow to the change of the psychosomatal status of the city and increase so-called “Borden” nervous-psychological disorders, neurasthenia, neurosis and especially neurosis-illness, for example: hypertension, diabetes, stomach ulcer and duodenal ulcer. There are practically no facts about spreading of the illnesses-stresses connected with acoustic “pollution” of a city.

As a model of neurosis one can take stomach ulcer and duodenal ulcer. The indexes of morbidity of ulcer and duodenal ulcer among the population of the Central district were analyzed during years 1996-1999.

1655 people living in different zones with different degree of “acoustic pollution” were examined. There are 4 zones:

Zone *A* – main city road, distance to the red line is 30-50 meters; noise protected lines of green plantations are practically absent, the level of city noise is $80.3 + 5.4$ DbA; the average rate of motor transport traffic is 37.7 km per hour, the intensity of motor transport traffic is 37.7 km per hour, the intensity of two direction traffic is 1612.1;

Zone *B* – main neighborhoods roads, distance to the red line is 25-35 meters; noise protected lines of green plantations are practically absent, the level of city noise is $77.3 + 3.3$ DbA; the average rate of motor transport traffic is 35.2 km per hour, the intensity of motor transport traffic is 37.7 km per hour, the intensity of two direction traffic is 1121.5;

Zone *C* – neighborhoods roads, distance to the red line is 20-35 meters; noise protected lines are present as two or three lines of trees, their height is 6-10 meters and the distance between them is 5 meters, bushes are absent; the level of city noise is $71.2 + 5.7$ DbA, the average rate of motor transport traffic is 35.0 km per hour, the intensity of two direction traffic is 840;

Zone *D* – main neighborhoods and habitable roads, distance to the red line is 15-20 m, noise protected lines are present as two or three lines of trees, their height is 2-5 meters, between them are thin bushes, their height is 0.5-0.8 m, the level of city noise is $58.2 + 3.3$ DbA, the average rate of motor transport traffic is 33.5 km per hour, the intensity of two direction traffic is 470.

The analysis of morbidity shows that among 14177 of inhabitants of zone *A* 427 people suffer from ulcer and duodenal ulcer (3.02%). Among 17841

inhabitants of zone *B* 376 people suffer from ulcer and duodenal ulcer (2.61%). Among 10759 inhabitants of zone *C* the same morbidity have 123 people (1.14%). And in zone *D* the percent of morbidity of ulcer and duodenal ulcer is 0.72% to 9100 inhabitants. The difference in morbidity of ulcer in all four zones is true. The factor analysis was made by the following factors: “level of city noise”, “speed of motor transport”, “traffic intensity”, “distance to the red line”, “noise protected lines of green plantations”. The main true influence is made by the factors “level of city noise” ($F=5.22, P>95$), “intensity of motor transport traffic” ($F=4.28, P>95$) and “distance to the red line” ($F=3.77, P>95$).

BIODEGRADABLE BARRIER POLYMER MATERIALS AS MEANS FOR IMPROVING ECOLOGICAL STATE OF CITIES

Ioelovich Michael

Main part of world population lives or works in cities, towns and villages or in megalopolises. At present, up to 60-80 percents peoples of industrial counties are urban population. This is lead to intensive polluting of cities with a municipal and household waste and to worsen in living quality. Statistical analysis shows that solid urban waste consist of plastics, papers, cardboard, wood refuse, food garbage, building debris, glass and metal (Table 1).

Table 1. Average Composition of Solid Urban Waste

| <i>Waste Type</i> | <i>Content</i> | |
|-----------------------|-----------------|-----------------|
| | <i>Weight %</i> | <i>Volume %</i> |
| Plastics | 20 | 24 |
| Paper and Cardboard | 31 | 34 |
| Food | 28 | 13 |
| Wood | 7 | 14 |
| Total Organic Waste | 86 | 85 |
| Glass | 8 | 4 |
| Building Materials | 2 | 3 |
| Metal | 4 | 8 |
| Total Inorganic Waste | 14 | 15 |

More than half of all solid urban waste is recycled. However, the rest part is thrown out and pollutes an environment. Particular important problem represents liquidation of organic waste that gives up to 85% of all solid urban waste. It is expediency to discuss, for example, liquidation process of biodegradable organic waste such as paper, cardboard, wood, food, etc. Before throwing out, waste of this type is put into plastic trash bags. These bags are biostable and inaccessible for penetration of microorganisms, water and air. Despite the fact that the organic waste is biodegradable itself at wet state in presence of microorganisms (fungi, bacteria), conditions having into plastic bags hinder to realization of the waste biodegradation process. Moreover, biodegradation in anaerobic condition is accompanied with forming of harmful destruction products: methane, organic acids, resins, etc.

Existing biodegradable hydrophobic polymers (polycaprolactone, polylactic acid, polyhydroxyalkanoates and others) could be applicable for production of trash bags and composting of the organic waste. However, these polymers are in five up ten times more expensive than common biostable plastics (PELD, PEHD, PVC, etc.) and therefore have very low demand.

Aim of this elaboration is development novel cheap barrier and biodegradable polymer materials – layer composites, for utilization of the solid urban organic waste.

Biodegradable substrates (Kraft paper and cardboard) and ecopolymer (aliphatic polyester) emulsions were used for production of new materials. The ecopolymer was synthesized by method of emulsion polymerization in water medium. Reaction system was contained monomers, emulsifiers, stabilizers, catalysts and water. Product of the synthesis is aqueous latex of the ecopolymer. Additional modifying components can be introduced to latex: hydrophobizators, lubricants, cross-linking agents, etc.

Barrier properties of the materials are depended on composition of the protective coating. **Rademate Ltd.** developed four versions of the layer composites with various protective polymer coatings (Table 2). Type "G" is composite intended especially against grease penetration. Type "W" is intended especially against water penetration. Type "G-W" is intended against both grease and water penetration. Type "H" is high barrier composite intended against penetration of grease, water and some solvents, as well of moisture vapor and some gases.

Table 2. Barrier properties of the various types of composite materials

| Type | Kit No | Cobb ₃₀ g/m ² | WVT g/day m ² | *T(O ₂) |
|------|--------|--|-----------------------------|---------------------|
| G | 10-12 | 20-25 | 180-200 | 12 |
| W | 6-8 | 10-12 | 50-70 | 9 |
| G-W | 10-12 | 15-17 | 130-150 | 10 |
| H | 10-12 | 0.5-1 | 3-5 | 7 |

Notes: **Kit No** – grease resistance; **Cobb** – water absorption for 30 min; **WVT** – water vapor transmission; **T(O₂)** – oxygen permeation, in units of (cm² cm)/(m² day atm).

The layer composites are produced on the basis of natural raw materials. Decomposition of the material together with organic wastes in aerobic conditions leads to forming only environment friendly destruction products – water, carbon dioxide and humus, which are returned in the natural sources. Wide application of the novel materials for urban waste liquidation allows improving ecological state of cities and megalopolises.

**ON ONE METHOD OF WATER SUPPLY IN SETTLEMENTS
WITH LOW CONSTRUCTION**

Kagansky Julius, Blumin Alexander, Slobodov Rozalia

We offer to use district municipal discrete cycling system of water supply as one of methods of water saving. Municipal effluent collecting must be divided into three effluents: fluxes of fecal confluent water and dish washing water directly to city manifold, as it is done now. Bathroom water and water from washing machines must be collected by separate manifold in underground settler tank in one of the largest yards in the district. If there is such a possibility, this settler must be equipped close to the district in places where no building will be conducted. A flocculant is added to water in this settler, water is settled, and through overflow filter it goes to accumulator reservoir (AR). There, chlorination is conducted, and water is ready to arrive into system of fecal sewage discharge. Of course, possibility of fresh water feed into AR must be also provided, in case when water level in AR becomes lower than the designed one.

The system practically does not require special maintenance, but only monitoring of its condition.

Such system becomes economically expedient when two conditions are fulfilled: prices for fresh water are suddenly increased and city administrations pay progressive “rewards” for saving of consumable fresh water in comparison to calculated or average statistical demand.

Necessity for loose low construction arises because of complexity of water feed to the floor higher than the fifth floor as well as possibility of placement of the proposed system.

Use of membrane tubular filters, according to the experiments conducted by one of the authors (J. Kagansky), allows to use treated domestic effluent even for watering yard and street green plantations (grass, bushes, and trees).

**A METHOD OF REDUCING THE VOLUME OF RIGID WASTE
IN URBAN AREAS OF ISRAEL
Klinov Tatyana, Ilievsky Julius**

The distribution of rigid waste in Israel is presented in the Table 1 below:

Table 1. Volumous distribution of rigid waste in Israel.

| <i>Glass</i> | <i>Used diapers and napkins</i> | <i>Metals</i> | <i>Wood</i> | <i>Textile</i> | <i>Orga- nic waste</i> | <i>Paper</i> | <i>Plastics</i> | <i>Other</i> |
|--------------|---|---------------|-------------|----------------|--------------------------------|--------------|-----------------|--------------|
| <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> | <i>5</i> | <i>6</i> | <i>7</i> | <i>8</i> | <i>9</i> |
| <i>2.1</i> | <i>3.5</i> | <i>3.6</i> | <i>3.7</i> | <i>3.8</i> | <i>15.2</i> | <i>28.6</i> | <i>34.5</i> | <i>5.0</i> |

As shown in the Table 1 above, the groups 7 and 8 comprise above 65% of the waste volume. It is obvious that substantial reduction of the waste volume can be obtained by dealing with one of these two groups.

The largest group of rigid waste, the plastics, is difficult to be dealt with, for it seems obvious that the prevailing component of it are plastic bottles, which are provided by special collecting chests. Thus, it is reasonable to act towards reduction of paper waste.

Printing matters are dominating this group. It is hardly practicable to reduce the number and the volume of periodicals in a such a multi-ethnic and multi-party country like Israel. It is neither practicable to organize collection of printing matters in a country with such underdeveloped ecological culture.

It seems that the most efficient way to reduce the volume of paper waste and, subsequently, the overall volume of domestic rigid waste, is cutting down of illegal distribution of printed advertising matters slipped into mailboxes without V.A.T. paid.

The experience of Scandinavian countries and of Denmark can be used here, which renders to the following: each citizen who brings to the municipal authorities two-three advertising leaflets slipped by the advertiser into the mailbox, receives a promotional cheque of about 50 NIS. The municipality, in its turn, fines the advertising body by about 2000-2500 NIS. In case of recurring violation by the advertising body of regulations determining distribution of advertisements, the sum of the fine is doubled, and if violation is repeated for the third time, the advertising body is forcedly closed by the municipal authorities.

This simple and fully self-supporting method will enable to reduce the group of the paper waste for about 40-45%, bringing it down to 10-15% of the general volume of rigid waste.

**METHODS TO BOOST
THE ENVIRONMENT ECOLOGICAL LEVEL
Korobkin Alexander**

The transportation growth of different cargoes, commissioning of output capacities and construction of welfare and industrial entities entice a necessity to develop extra measures for environment protection.

At present the greatest amount of dust and gas formation is concentrated at industrial zones, which specialize in processing and transportation of such friable and dust-producing cargoes as coal, cement, mineral fertilizers etc. In this conjunction it is necessary to envisage state-of-the-art mechanization and transportation means to transport and store such cargoes. For instance, it is highly desirable to apply hydraulic transportation through pipe-lines for coal, and use pneumatic suction and pneumatic compression installations for loading dust-producing cargoes.

The city streets contamination is mainly caused by exhaust gases, produced by cargo and passenger motor vehicles. The environment ecological level in this case may be increased on the account of reduction of non-rational cargo traffic movement in major directions, construction of by-highways, substitution of passenger buses with trolley-buses.

To resolve the said measures and substantiate them scientific research is needed.

**GEO-ECOLOGICAL PROBLEMS
IN THE RAMAT-HOVAV INDUSTRIAL ZONE
Krasilshchikov Leonid**

The present paper set forth studies related to the conditions of geo-ecological processes formation in the Ramat-Hovav industrial zone near Beer-Sheva, to prevent ecological disasters in this region.

The Ramat-Hovav industrial zone is situated 10 km southward from Beer-Sheva. 20 chemical enterprises of various productive capacities are functioning here. Upon choosing location for the industrial zone, "favorable" geological conditions, in the opinion of the planners, were taken into consideration. The territory was composed of homogeneous chalk rocks, ranging from stratiform to massive structures, moderately cracked, with rigid stony layers. The bedding of the layers was practically horizontal. In the sense of tectonic and seismic properties of the territory, it was estimated as stable. The water bearing complex was situated 80-100 m beneath. The geo-technical properties were also estimated as favorable.

But what was not taken into consideration was the possibility of changes in the soil bedding in the course of specific production activities of the enterprises, which are characterized by considerable expenses of water, wide use of chemical components, formation of heavily mineralized waste water. This water is strained through the cracked chalk basic soil and spreads to the adjoining surfaces, forming layers of technogenic underground water, 0-2 to 20m deep. As a result of the aggressive impact of the industrial waste water, the chalk deposits become partially dissolved and destroyed, and a complex system of underground cavities, crevices and canals is formed in them. The strength properties of such soils become considerably weakened, and they become less reliable as basic grounds for large chemical reactors functioning at the enterprises. This can result in catastrophic breakdowns at the enterprises and distribution of their consequences to the neighboring residential areas. The boreholes drilled here by the Jerusalem and the Beer-Sheva universities in 1995-1999 outside the territory of the industrial constructions, exposed cavities and crevices down to the depth of 20m and more. Soil destruction directly under constructions of the enterprises was not studied. But here the cavities and the crevices must be even more developed, because of a more intensive straining of the industrial waste water directly under the constructions.

We elaborated a program of special studies, which are necessary for evaluation of the geological structure of the industrial zone territory.

The issue of the Ramat-Hovav soils under the industrial construction, the program special studies aimed at forecasting development of dangerous geo-ecological processes, and the issues related to prevention of breakdowns were discussed at the meeting with the Director General of the Ministry of Ecology

I. Goren and the Director of the Israeli Institute of Geology prof. Amos Bein. The program includes researches, field studies and practical recommendations. The researches contain analysis of geological and hydro-geological studies implemented on the territory of the enterprise, changes in geological and hydro-geological conditions and evaluations of the soils stability. Cracks in the chalk soils will be characterized, zones of development of crevices and possible collapses in the soil will be detected on the basis of materials related to drilling, geological and hydro-geological transverse slots will be established, their analysis enabling to evaluate the development of processes of chalk destruction. The field studies include geological and hydro-geological investigations, study of sinking and holes in the soil, a more precise description of development of crevices and cracks and changes in the soil density.

The material above will serve the basis for elaboration of recommendations related to soil strengthening.

ECOLOGICAL PROBLEMS OF TRANSPORT IN BIG CITIES

Levin Evgeny

Main type of social transport in Israel are buses with internal-combustion engines, working on a diesel fuel. Besides a considerable quantity of lorries and personal cars are moving along streets of the towns. At next time the quantity of motor-cars moving along ways of Israel reach two millions unit.

According to the information of the ecologists air pollution in Tel-Aviv every year becomes the reason of a death of three hundreds of the people.

Researches spent by the ecologists show that the pollution of surrounding environment in towns to 80% takes place because of smoky reject of internal-combustion engines of motor-cars, buses and lorries. One of ways of lowering air pollution is transfer of buses to gas fuel. It is at 40-50 % more cheap than a diesel fuel. The price of re-equipment of a bus or a car from 15 to \$ 65 thousands in depend on a number of installed gas-containers. Max. speed that a bus can move with a gas engine – 65 km/h. Max. distance of moving without adding refuelling – 130 km. In the first place such buses suppose to inculcate in Tel-Aviv. Another perspective direction of improvement ecological situation on an motor transport is using automobiles working from an batteries. Such lorries are used inside Tel-Aviv's central buses' station.

At present created by Israel's firm "Electric fuel" powerful and economical accumulators for electromobiles allow to pick up speed to 100 km/h. and a distance of moving without substitution of fuel elements – 400 km.

In central districts of a town it is expediently to apply a centralized remote control from IBM. For these aims under road's surfacing is laid highly frequency cable, connected with IBM and is installed on electromobiles radio-frequency heads, discovering magnetic field.

IBM simulates traffic of cars along roads, controls by traffic lights and magnetic needles for turn of cars from one route on another it. Haifa's technical institution fulfils researching work in this branch. The experience of USA shows that increase of quantity strips of traffic along roads and building of adding forking don't decide problems of wiping out automobil's jams. For example, in Los-Angeles building of the most wide roads and four-storeyed forkings didn't bring to wiping out large automobile's jams. The only method of deciding of this problem creates in large cities of alternative types of transport: underground or monorail transport. According to the information of Jerusalem's municipality the price for a building of the underground is near \$ 300 millions on 1 km of a road and creating 1 km of it for a building of the monorail costs near \$ 10 millions.

The monorails have some advantages in comparison with an automobiles. It decides ecological problem: decreasing air pollution, surrounding a way field don't suffer from poisoning by a lead. It takes up a few the ground that it is

important in the conditions of Israel with limited space of life. It doesn't demand of building of bridges and tunnels. Supports under rails of monorail is made from pre-fabricated ferro-concrete structures of T-form's where every cantilever is used on a railway track. Carriages can be individual or double, equipped automated reversible drive with using asynchronous linear engines. I took part in such conduct tests in Russia.

Monorail has high speed of moving to 150 km/h. and ensures punctuality of delivery of passengers to a destination and rhythm.

The trains are equipped by magnet bracket that it secures silent movement, at the same time it is lowered costs on an electricity. The stopping places follow to equip by parkings for motor-cars. For taking up a few the ground it is expediently to use automated vertical parkings which I have supposed. It is possible to have more comfortable carriages for tourists. Carriages are equipped by extensible doors, seats and air conditioners.

At nights it is possible to use a monorail for transportation industrial loads in containers. In such case it will be created special terminals for loading and unloading industrial loads.

Such monorail it is expediently to create in Jerusalem instead of buses and a underground tramway. This town is situated in a hilly country, has deep cultural layer and gas radon in a soil.

TOWN AS AN ECOLOGICAL SYSTEM
Manusov Efim

Ecological system (ES) is a generally accepted notion in ecology determining a kind of integrative structure, which is functioning on a concrete territory. Due to the systems theory, the main properties of the so-called Large Systems (LS) are inherent in any ES:

Table 1. Main Properties of Large Systems

| No. | <i>Property</i> | <i>Definition</i> |
|-----|---|--|
| 1 | Hierarchy | Availability of subsystems of various strata. |
| 2 | Diversity of elements | No system includes equal elements, the smallest extreme equaling two. |
| 3 | Emergency | Irreducibility of the system properties to the properties of its components, for example the synergetic property. |
| 4 | Recurrence | Existing of several criteria for LS evaluation. |
| 5 | Autonomy of subsystems | Relative independence of separate subsystems. |
| 6 | Incompleteness and vagueness of information | Impossibility of presenting the whole initial information in determined or probably-determined form, and impossibility of unambiguous identification of the system status (past, current and future status). |

To the artificial ES the main energy is supplied not from the Sun, but mainly through energy carriers. In some cases partial use of the natural solar energy is possible, but there are periods when supply of energy is necessary, to neutralize the harmful impact of the solar energy (artificial air cooling in urban apartments).

Let us distinguish the following peculiarities the urban ES (UES):

- UES as a heterotrophic ecosystem characterized by much more intensive community metabolism per unit of space, requiring a substantial energy supply from external sources.
- Energy consumption in UES is 10^2 - 10^3 as much as than of the natural ES (NES), and comprises 10^6 kKcal for 1 m^2 of surface.
- A need for large-scale input of substances from outside, including foodstuff from agro-eco-systems (AES), which in its turn differs from the natural auto-troph-ecosystem (NATES) in absorbing additional antropogenic energy, fertilizers, pesticides etc., and in low diversity of flora and fauna.
- Lange quantities of solid waste and considerable air pollution.

At present, the area of dry land occupied by UES without taking into account AES comprises 1.0 to 5.0%. Does increase in UES proper constitute a reason for the approaching ecological crisis? Until recently, urbanization and industrialization has been apprehended as the main disturber of stable development, since ecology has always been included in the spheres of biological and geological disciplines (see, for instance, the term “biogeocenosis”). Social ecology, which has appeared only recently, is still “in captivity” of the traditional classification.

Meanwhile, the system approach considering the object studied as a system, enables to expose the groundlessness of the accepted approach. The system analysis and the phenomenological criteria analysis provide understanding that diverse ethno-cultures and political systems render to be main reasons for local and global ecological disasters (see, for instance, Proceedings of the 3rd Jerusalem Annual Conference of Ecology, Jerusalem, Dec 2000, and the 7th International interdisciplinary Conference on the Environment, San-Francisco, July 2001). Two instances of disintegration of the natural and the artificial water ecosystems in two sub-regions, that of the Middle East and that of the Central Asia, demonstrate that political ambitions of developing countries in combination with underdeveloped democratic political structure bring about local ecological collapse and even global ecological disasters. Unfortunately, what happened on September 11 in the USA confirms our scientifically based forecast. The necessity of further globalization will inevitably result in divergencies between communities and their development. Globalization and free migrations brings about abnormally high concentration of undereducated people who cannot meet the modern requirement for highly qualified professionals, but have access (thanks to globalization!) to highly efficient achievements of the developed societies, including means of mass destruction.

Readiness of such people in certain regions of the world for suicide is not based on that or another monotheistic religion (Islam), but on defective education. Any idea can be transformed into ideology (as, for example, Marxism into Leninism) to ground any actions.

Hence, the conclusion is simple (again simple!): ignorance, lack of education, ideology, political system – all these happen to be the main reasons for ecological crisis.

INDICES OF URBAN LIFE QUALITY IN ISRAEL

Manusov Nonna, Nelin Valentina, Polonsky Vladlen

Urbo-ecology is related to artificial urban environment, and its artificial character is determined by the degree of urbanization, i.e. the actual state of the artificial environment (AE) and the natural environment (NE). The general principle of the urban life quality evaluation is obvious: the closer the life conditions in town are to those out of town, i.e. the closer the AE indices are to those of NE, the less felt is the negative anthropogenic impact.

Though, two things are to be considered: first, the components of the AE and the NE indices are different; second, even the most optimal case these indices will differ that from another.

Let us set forth the principal indices of urbo-ecology determining the urban life quality in Israel.

1. Similar to those of NE, these are the indices characterizing the urban atmosphere (the air environment content and distribution of its pollution components in the urban space and throughout the year seasons).
2. Similar to those of NE, it is the drinking water quality and its use in different sectors of the urban space and in different periods of the year seasons. The quality of water in constructions related to sanitary-hygienic constructions.
3. The acoustic field in different urban districts at different time section of the day.
4. Gathering and moving off the urban area of rigid domestic wastes.
5. Organization of public transportation currents, taking into account such competing conditions as maximum travel conveniences for residents and limited air pollution acoustic field intensity.
6. Organization of private transportation currents with the same considerations.
7. Architectural and structural solutions taking into consideration the local relief, the natural and artificial green plantations, natural and artificial water systems (ponds, lakes, fountains), as well ethno-cultural peculiarities of various groups of population.
8. Legislation basis providing legal maintenance of the principal indices of the urban life quality (ULQ).

Naturally, each one of the above indices is connected with various ecological factors. Thus, for instance, the air environment quality depends on the organization of traffic connections within the urban area, the type, the quantity and the disposition of industrial areas, architectural solutions including the

size and the disposition of recreation zones, green plantations and water reservoirs, etc.

Each one of the above indices of urban life quality must be provided with Electronic System for Quality Control (ESQC) services.

Fig.1 presents the Electronic System for Quality Control monitoring the city atmosphere, as a sample of ESQC. Similarly, functioning of ESQC for monitoring water, noise, municipal wastes etc. must be provided.

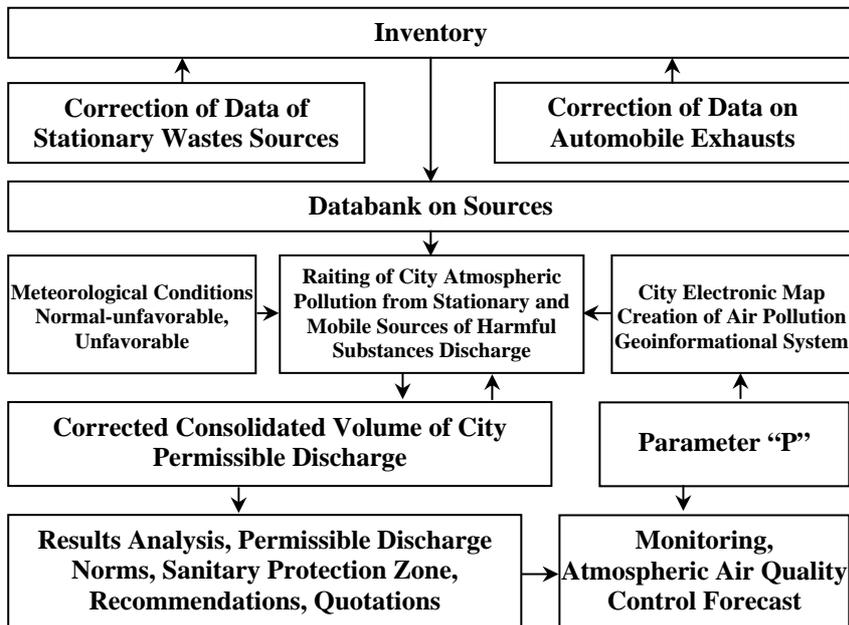


Fig. 1. Electronic System for Quality Control of City Atmosphere

All these systems must be included as autonomous sub-systems into the already functioning Environment Monitoring and Data Management System [1].

The data obtained by means of monitoring, due to the methodology proposed herein, enable to identify zones, which render to be dangerous for the urban population [2].

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EVALUATION OF ENVIRONMENTAL CHANGES RESULTING FROM CONSTRUCTING OR MODERNIZING INSTALLATIONS

Mikhailovich Anatoly

The construction, modernization and further functioning of any plant or system (an industrial or agricultural one, a public or accommodation building) result in a certain change of the environment. It is necessary to find out the nature and degree of danger of all the potential negative influence on the environment involved in such activities. The final aim is to come to optimal economic and social decisions on the advantageousness of the said construction or modernization. As a result, stabilization must be ensured with the further improvement of ecological situation in the considered region.

The work may be implemented in **two options**:

- the project (pre-project) option when the obtained results are part of the project (pre-project) records;
- the expert option when the project (pre-project) records are considered by experts from the ecological point of view or when the actual effect of an installation in the environment is evaluated.

The basis (an existing ecological situation in a region) and alternative (a situation accounting for construction or modernization prospects) are considered. The results of simulation and full-scale research, statistical and reference data, standard specifications and other information are utilized.

The evaluation of environmental changes is carried out for the main components of the ecological system, such as atmospheric air, natural and artificial water sources, aqueous flora and fauna, soils, vegetation, animal world. The consequences of these changes are tracked down with the help of a criteria system, which takes into account ecological/economic and sociological/ecological aspects. They include health of local population, preservation (change) of local flora and fauna species varieties, etc. The technique envisages comparing separate components of the environment to standard levels of their quality. Also, the values are arranged by the danger scale accounting for the interests of region inhabitants. Expert evaluation and analog methods are used.

The framework of the research is determined by natural, climatic and social/economic characteristics of a considered region, by the specific character of installations being constructed or modernized.

In addition to the said general principles, in each specific case detailed approaches are used.

**REGIME METHODS FOR LOWERING OF NITRIC OXIDES
EJECTIONS BY BOILER UNITS OF THERMAL POWER STATION
Mikhailovich Anatoly**

Often it is impossible to equip boiler units with express high-performance installations of suppression of nitric oxides (NO_x) ejections in operating thermal power stations because of lack of free areas. In such cases lowering of NO_x ejections and prevention of their formation is possible only as a result of regime-technological measures. Thus the greatest effect is reached when two and more methods are combined in one boiler unit.

For example, if burners in a boiler unit are located on side walls of a furnace directing one another in two tiers, it is possible to implement a method of two-stage fuel combustion. Besides recycling of fuel gases is often envisioned in boiler unit construction as well. Combination of these two regime methods allows to achieve lowering of NO_x ejections by approximately 30%.

However, if a thermal power station is located inside a city, it might require supplementary lowering of NO_x ejections. A favorable lay-out of burners in a furnace of a boiler unit as well as its construction allow to provide deeper suppression of NO_x ejections. Embodying of padding regime methods, indispensable for it, is not reflected in indexes of work of a boiler unit.

Lowering of NO_x ejections is most effective during three-stage fuel combustion. Thus basic gas-fuel oil burners allow to implement two-stage fuel combustion. Adding a supplementary gas burner with fuel rate component of 10-15% of total fuel rate of equivalent fuel in a boiler unit, and installing it on the bottom of a furnace, allows to implement three-stage fuel combustion.

The essence of this method is that in the first zone the combustion takes place with a lack of air ($\hat{a} = 0.6-0.8$), which creates thermodynamic conditions for suppression of form of NO_x , augments length and brightness of a jet. The heightened emissive power of a jet reduces in its prompt cooling.

The process of fuel combustion in the second zone also takes place with a lack of air. Besides there is the jet temperature lowering at the expense of a dilution by its cooled combustion gases from the first zone. To magnify the intensity of heat irradiation in the second zone provided for eventuality of the feeding in a zone of solid particles augmenting a emissive power of a jet in some times is stipulated promoting prompt lowering of temperature of gases. Such expedient of cooling of combustion zone in high-temperature area allows to diminish an NO_x yield by approximately 2 times.

Besides the burner device works in a condition as much as possible preventing formation of NO_x , still in primary furnace ($a = 0.6-0.7$, $t = 1200^\circ\text{C}$).

After primary furnace products of combustion are immixed with air and in a fire box burn down at a deficiency of air ($a = 0.95$).

The process of burning of a jet at the third stage takes place at an exuberant amount of air ($a = 1.03$), indispensable for complete fuel combustion, and under temperatures (because of a dilution by the cooled gases of the previous stage of burning). Thus the amount of air feeding in burners of the upper tier exceeds the theoretically indispensable one (and is greater than 1).

The combination of all indicated regime measures in one boiler unit allows to reduce common NO_x ejections still by approximately 30%.

At share combustion of natural gas and boiler oil it is possible also to stage three- layer fuel combustion. Thus in two lower tiers the natural gas moves, which one is burned at a coefficient of consumption of air less than 1. The burners of the upper tier burn boiler oil with a coefficient of consumption of air greater than 1. In this case, there are no thermodynamic conditions for hydrogen sulphide formation, which one calls high-thermal corrosion of heat exchange surfaces.

AIR QUALITY IN ISRAELI CITY APARTMENTS

Milov Raisa

Several factors affect air quality in Israeli city apartments. One them is, in the first place, lack of through ventilation in many apartments. This factor's influence is especially high during summer period when anticyclones prevail. Second, lack of air-ejector ventilation above gas kitchen ovens. Besides products of products of incomplete combustion enter dwelling premises. Special air-ejector ventilation or special absorbing devices with sorbent are the best way to get rid of them. Third, because of turned on air conditioning, positively charged ions are accumulated in dwelling premises. Special ionizators, for example "Chizhevsky lamp" should be used for their neutralization.

It should be mentioned that "American kitchen" (combining kitchen and living room – "salon" in Hebrew) is very often used in Israeli homes (according to an apartment project or as a result of reconstruction). This, of course, leads to decrease of concentration of products of incomplete combustion in apartments, but on the other hand, time the people spend in polluted atmosphere increases.

The aforesaid obviously means that the problem cannot be solved completely without making corresponding architectural and planning decisions. However, this task in a number of cases might not have simple solutions because of landscape peculiarities, especially in the region of Judea Mountains.

ECOLOGICAL HYGIENE AND HEALTH OF THE POPULATION IN THE URBAN AREAS OF ISRAEL

Moskovich Ilia

Ecological hygiene is a medical science with maximum possible interdisciplinary relations and with priorities for prophylaxis studying influence of dangerous and harmful factors of the environment on populated areas and developing measures for protection from their negative impact. The end objective of ecological hygiene, as set forth by one the initiators of the experimental trend in ecological hygiene E. Parks, is *to make man's development more perfect, life stronger and death more remote*. As early as in 1993, the World Health Organization, determining the principal goal of health improvement for the 21st century, recommended to establish environmental hygiene services. For the time being, the main rules of ecological hygiene can be stated as having been formulated, specifically, the rule formulated as follows: *violation of the health status of people (diseases, disturbances in the immune status and the adaptation-compensatory capabilities of the organism) caused by physical, chemical, biological, psychogenic etiological factors, can emerge only under condition of existence of three motive forces:*

- *source of damage (pollutant) or a complex of damages;*
- *mechanism of the pollutant impact or of its transmission;*
- *sensitivity of the organism to this pollutant.*

Public health is an integrative index reflecting the rate diseases with temporary loss of capacity for work, diseases requiring hospitalization, social-demographic indices (birth rate, death rate, lifetime), disablement. Indices of "health improvement" and "healthy" social policy, which have recently been introduced in some European countries, must also be added here. Different combinations of these indices showing the sickness rate or the rate of applications for medical care, analysis of the mortality reasons, provide an indication for the damaging impact of the unfavorable ecological situation, lack or absence of prophylactic medicine, and so on.

Analysis of statistical data shows that Israel is marked by a high level of cardiovascular, oncological and allergic morbidity rate, a dynamic growth of the index showing increase in chronic diseases. Compared to Asian, African and European-American countries, the index of oncological morbidity rate among men is higher than that among women. For women, this index in Israel is almost equal to that in Europe-America. It is higher than those in Asia and in Africa and, in general, than the average world one.

Infant mortality rate here is practically the same as that in many developed countries of Europe, showing an increase from 5.8 per 100 born in 1998 up to 7-8 in 2000.

In 1995-1996 an increase in the Down syndrome morbidity among Jewish children was marked. One may remark that Israel is characterized by inter-family marriages, but this remark can be turned down by the fact that this index did not show increase before.

It is necessary to pay attention to the dynamics of the tuberculosis rate growth. In 2000 the Ministry of Health provides corresponding indices only till 1996. The increase in the tuberculosis rate index is distinguished since 1994.

The data valid to the end of August 2001, the morbidity rate related to infectious diseases in 2001 is similar to that of 2000. The rate of salmonellosis (resulted by the food quality) for 8 months of the current year is almost the same as in 2000. There is an increase in the morbidity rate connected with water and food among new-born children, and in other infectious diseases. What is peculiar here is that the Ministry of Health provides statistical data related to 15 towns only. No statistical data can be available for such towns as Ashdod, Rechovot, Bat-Yam and others.

Legislation concerning public health security has been functioning in Israel since 1940. It is natural that this document has been undergone changes ever since, though not enough to apprehend the necessity of establishing prophylactic medicine. There is a need for new legislation "On sanitary-epidemiological well-being of the population in Israel", which will include establishment of a state sanitary anti-epidemic service in each town. Israel has everything need for implementation of such legislation: well trained professionals, basic structure (services of the Ministry of Health and the Ministry of Ecology), a developed computer network, software and hardware specialists etc. What is important is elaboration of legislative acts, a system of sanitary rules, norms of hygiene, standards limiting environment pollution, norms of health protection for man, fauna and flora, development of an integrative socio- hygienic and ecological monitoring "Health - Environment", establishment of an efficient state ecological and sanitary supervision with definitely determined rights and responsibilities.

**INDEXES MEANING AND ALTERATION
FOR PARAMETERS OF ECOLOGICAL SYSTEM
Natanson Mark, Natanson Leonid**

Influence of natural factors and human activity on alteration of Ecological System is characterized by parameters and relations between factors defining them. Ecological organizations usually fix and accumulate these parameters in monitoring tables. A known different version of algorithmic schemes contains influence of these factors on Ecological System. To determine levels of influence of different factors, we offer to use "Index Meaning" and "Index Alteration". These indexes enable us to compare influence of alteration parameters with influence of factors and duration of this alteration in different directions of connection. To calculate the indexes meaning of every parameter, we determine quantity of its influence on other parameters and dependence of this parameter from quantity influence of others parameters.

For Ecological System *index meaning* for every parameter of influence in the algorithmic scheme:

$$\alpha = (|\Delta Y|/Y) \tau^{-1},$$

where Y is quantity characteristic parameter; ΔY is an alteration of Y ; τ is influence time of every parameter on other parameters (x) and dependence of this parameter from others parameters (y); For this system:

$$\sum_{\kappa} \alpha \leq 1,$$

where κ is quantity influence of x or y , which corresponds to direction of connections for every parameter. On the other hand, total index meaning of every parameter is:

$$\alpha_{xy} = \sum_m \alpha x + \sum_n \alpha y ,$$

where m is quantity influence of x to y ; n is quantity influence of y to x .

For all Ecological Systems, index meaning and total influence time of all parameters is:

$$\alpha^* = \sum \alpha \text{ and } \tau^* = \sum \tau.$$

Index of Ecological System alteration is determined as:

$$I = \alpha^* / \tau^*.$$

Use of these indexes makes possible to compare various parameters and their "weight" in processes of alteration of Ecological Systems. Besides use of these indexes makes possible to determine activity influence time of various parameters in Ecological System.

**APPARATUS AND METHOD FOR MEASUREMENT,
OBSERVATION AND TOPOGRAPHY OF MAGNETIC FIELDS
FOR ROBOTICS AND ECOLOGY**

Novakovsky Zoya, Chapsky Vladimir

There are a lot of scientific, medical, ecological and technical tasks connected with measurement and visualization of magnetic fields. For example: contact less current measurement, non-destructive control of metallic pipes, control of non-homogeneous constant magnets in the process of their production and use, observation of replacements of magnets or electromagnets. Topography of earth magnetic field, magnetic fields of electrical machines and mechanisms, fields of magnetic heads, radio relays, control means on microchips, printed circuit boards, medicine apparatuses with permanent magnets, magnetic pollution of urban environment, etc.

Only recently thin film magneto-optic materials with easy axis of magnetization have been discovered and used now as magnetic fields sensors. These possess the unique magneto-optic qualities by using Bi-substituted rare earth iron garnet film formed by liquid-phase epitaxial (LPE) growth.

The high transparency of these films and the Faraday effect expressed anomalously allows to observe and to store (take photographs and enter the computer file) with highly contrasted pictures of their multiple domain structure in the transmitting or reflected polarized light. Additionally, it is possible to topography and measure magnetic fields.

In recent years Japanese, American, French and Russian firms produce these films.

The suggested device for visualization, topography and measurement of magnetic fields is based on the original magneto-optic system, which in turn, includes the Bi-substituted rare-earth garnet thin film elements and the basis magnetic fields sources, according to the topograms of which external magnetic fields measurement is proceeded.

The device is supplied with the original electromagnetic system, which increases its sensitivity to weak magnetic fields as well as the measurement accuracy. It is valid for topography and measurement of constant and variable fields, each one separately or in the aggregate all of them, depending on the level of their influence on the standard topogram. The measurement may be conducted in absolute as well as relevant units according to the standard.

Advantage of suggested devices is that they may measure not only scalar but also vector characteristics of magnetic fields on the surface under measurement.

Proposed devices can measure and topography a wide range of magnetic fields with a high degree of accuracy for robotics and ecology and may be used

either for immediate measurements or investigating initial design data of multidimensional heterogeneous magnetic fields.

The devices maybe produced in several modifications intended for the different usage areas:

a) At home and in industry for control, measurement and topography magnetic fields, modification with autonomous or circuit power supply of internal light source and light or sound signals informing the user about exceeding of permissible norms of magnetic radiation.

b) In special technique, medicine and industrial enterprises, which produce or use non-homogeneous constant magnets, or distributed in space electromagnetic devices with complicated configuration of their magnetic fields, modification with additional electromagnetic system, which produces necessary fields of displacement and swing of topogram-lines (borders) of basis magnetic field source. That modification possesses high precision and sensibility for weak magnetic field less then 10^{-6} T.

The additional advantages of the suggested devices are in their construction simplicity, low prices and wide range of measuring characteristics with high precision and sensibility, which may be necessary for robotics and ecology objects.

ELECTROMAGNETIC POLLUTION OF URBAN ENVIRONMENT

Novakovsky Zoya, Farfel Leonid

The ecological problems of big cities include many aspects. One of the less studied among them is that of electromagnetic pollution of the urban environment. Besides global sources of electromagnetic radiation, such as high-voltage electric power transmission lines, powerful relay appliances, geological breaks etc., the urban environment is polluted by a large number of local sources, which man encounters both at the industrial enterprise and in his everyday life.

The present article sets forth a principally new approach to measurement of local electromagnetic radiation, enabling not only measurement proper, but also topographic processing of dispersed electromagnetic and magnetic fields. This is especially important from the ecological point of view for the possibility of determining not only the value, but also the direction (vector) of fields effecting the environment on the surface measured. Knowing the vector characteristics of fields, we can elaborate efficient measures of protection, for instance, to determine the precise disposition of screens, to choose the right workplace and means of individual protection, to place industrial and domestic electric appliances, etc.

The existing means of magnetic and electromagnetic fields measurement, such as TriField Broad Band Meter, enable to detect dangerous magnetic and electromagnetic radiations, but frequently it render to be insufficient for proper installation of protection appliances, since only scale (integral) characteristics of the fields can be measured by them.

Comparatively not long ago, there were developed thin-film magneto-optical materials with an axis of weak magnetization, which are used as indicators of magnetic and electromagnetic fields. What imparts unique magneto-optic properties to these films is use of bi-substituted rare-earth iron garnet crystal with a high and no temperature dependent sensitivity constant grown by liquid phase epitaxy. The high transparency of the films and the anomalous Faraday effect enable to observe and preserve (photographing and providing input to the computer) highly contrasting pictures of blast furnace structures in the actually functioning or reflected polarized light, to implement topography and measurement of the field containing heterogeneous constant magnets, as well as to measure the electric current value in the conductor by non-contact means.

The proposed appliance of visualization, topography and measurement of magnetic and electromagnetic fields is based on a new magneto-optical system containing Bi-substituted rare-earth garnet thin-film sensors and model sources of magnetic fields, their topograms measured as related to the external sources of magnetic and electromagnetic fields. The device is also supplied with an original electromagnetic appliance increasing its sensitivity to weak

magnetic fields and precision of measurement. It is applicable for topography and measurement of both direct and alternating fields, each one separately and in their joint impact on the model topogram. Measurements can be processed in absolute and relative units (as related to the model). Using statistical methods of processing measurement data, interdependence data can be obtained, such as, for instance, tension and inductance from magnetic and electromagnetic fields on the surface measured as related to various physical sources, and thus evaluated in regard of their impact on electromagnetic pollution.

Such a device creates the necessary prerequisites for transition from elaboration of admissible norms of radiation caused by separate sources of magnetic and other fields to integrated norms taking into account the summary impact of various fields causing pollution of the urban area.

THE ROLE OF URBAN MOTORWAYS IN ENVIRONMENT POLLUTION AND CREATION OF THE SOUND FIELD

Priyatel Anatoly

In developed countries, the rate of the road building development takes a considerable lead over that of the motor car industry and that of residential and public construction. In terms of ecology, the motorway must be considered not only as an engineering construction, but also as a gaunt enterprise implementing its transportation function and interrelating with the environment.

The motorway, more than any other engineering construction, interrelates with the environment. On designing new roads and reconstructing and repairing the existing ones, all kinds of the roads impact on the environment should be taken into consideration.

The natural landscape constituting an integrate eco-system, is divided by the road into two parts, which always causes damages not only to the natural, but also to the social infra-structure, especially in the regions of traditional land tenure.

Transport contributes its considerable “endowment” to the environment pollution. In developing countries, emission from motor transport has increased for the last 25 years up to 30-75.... Air pollution caused by the motor transport, such as emission of carbonic oxide, nitric oxide, hydrocarbon or lead, mainly remain accumulated near the sources of pollution, i.e., along the motorways, in the streets, on the crossroads etc., creating localized zones of the motor transport impact. The sound characteristics of the motor transport stream can reach in average conditions 73-87 dB, while man normally endures 40 dB. For the last 10 years this value has increased for about 12-14 dB. The main portion of the sound field (up to 80 dB) falls on the area of 100-200 m away from the road proper and the urban traffic arteries.

There is observed a coincidence of ecologically dangerous road sections with those vulnerable to road accidents. This issue needs further investigation.

Using environment protection measures, a considerable reduction in environment pollution can be reached, which will bring about reduction of the negative impacts of ecological breaches. The rate of the environment pollution reduction is estimated as follows: atmosphere pollution – 3-70%; soil pollution – 50%; acoustic “pollution” (motor transport) – 4-25%; dust – 80-90%; drains pollution – 80-90%; vibration rate – 5-10 times less.

On elaborating technical documentation, there should be taken into consideration solution of ecological problems as follows:

- Improvement of sanitary-hygienic conditions of the population residing in areas adjacent to motorways and traffic arteries.

- Preservation and rational use of natural resources, including those adjacent to motorways and traffic arteries.
- Preservation of historical, cultural and architectural sites and objects determined as nature reservations.

Thus, the technical documentation is supposed to include information as follows:

- Physical-geographical and climatic characteristics of the region adjacent to motorways and traffic arteries.
- Evaluation of the road impact on the environment and the related ecological dangers.
- List of nature preservation measures to be undertaken.

To conclude the said above, it should be noted that according to the impact on the environment, three subdivisions of road objects are distinguished.

The first type is that of the motorways of the highest category, with a large number of movement lines, bridges above 500 m long. These objects are classified as ecologically dangerous environmental activities.

The second type is that of the objects exerting a considerable impact on the environment. These are motorways with less than 4 movement lines.

The third type is that of the objects with minor impact on the environment. These are motorways with 2 movement lines.

SYSTEM ANALYSIS OF THE CARCINOGENIC SITUATION IN THE CITIES OF ISRAEL

Raikhman Yakov

Now, in different cities of the country we may find certain carcinogenic situation that determines cancer sick rate index. There are essential differences in level and rates of cancer sick rate in different cities. The basic factor of carcinogenic hazard in urban areas is environment pollution by industrial waste and exhaust gases of automobiles. Impartial estimate of carcinogenic situation in the cities of Israel is possible only on the basis of system research methodology and complex estimate of environment in every city.

The fact that carcinogenic situation is not static and undergoes continuous development should be taken into consideration. When analyzing the dynamics of functioning of the system as a whole or of its separate subsystems we should take into consideration that the subsequent system behavior depends both on peculiarities of its elements' development and on initial conditions. Different initial conditions may lead to different results.

The analysis of structural functional peculiarities of the carcinogenic situation system demonstrates that the complex of environment factors forming the system consists of separate subsystems and elements of different nature that are different in peculiarities of their development and in degree of parameter stability. For example, the territorial climatic conditions remain practically unchanged for many generations while the socio-economic conditions undergo constant changes. In fact, research of such a dynamic system as carcinogenic situation reduces the problem to an estimate of the influence the unstable (socio-economic) factors produce in the background of stable (natural climatic) ones. Besides, their interaction that may increase or decrease the estimated influence of unstable factors on cancer sick rate should also be taken into consideration. It is the interaction of natural conditions and anthropogenic environment pollution in every city that determines the peculiarities of malignant tumors sick rate.

The dynamics of death rate from malignant tumors clearly represents the peculiarities of carcinogenic situation development in the cities of Israel (see Table 1). In 1990, the cancer death rate coefficients varied from 102.0 in Jerusalem to 129.4 in Haifa and 132.2 in Tel Aviv (hereinafter standardized coefficients per 100000 people). The difference between the lowest and the highest coefficients was as high as 29.6%. 5 years later, there was considerable increase of mortality from cancer in all cities of the country. The most considerable growth has taken place in the cities where 5 years ago were the lowest coefficients (in Jerusalem from 102.0 to 120.1 – by 17.7%, in Rechovot from 108.0 to 136.1 – by 26.0%). During this period of time the differences between the lowest and the highest death rate coefficients decreased almost by 2 times (down to 16.7%). In the country as a whole, there

was considerable increase of mortality from cancer (by 7.6% for 5 years). Information on dynamics of mortality from cancer during subsequent years will allow to precise the character of the discovered tendencies in development of carcinogenic situation.

Table 1. Dynamics of mortality from cancer in the cities of Israel.

| Territories | Years | | | | | An odds for 5 years – % |
|----------------------|-------|-------|-------|-------|-------|-------------------------|
| | 1990 | 1991 | 1992 | 1993 | 1994 | |
| Jerusalem | 102.0 | 102.5 | 100.3 | 112.3 | 120.1 | 17.7 |
| Zfat | 110.0 | 99.7 | 98.9 | 135.1 | 121.4 | 10.4 |
| Haifa | 129.4 | 128.3 | 133.0 | 136.1 | 141.1 | 9.0 |
| Hadera | 109.8 | 114.9 | 110.9 | 125.9 | 126.3 | 15.0 |
| Rehovot | 108.0 | 118.7 | 115.9 | 126.6 | 136.1 | 26.0 |
| Tel Aviv | 132.2 | 134.6 | 131.7 | 137.6 | 140.1 | 6.0 |
| Ashkelon | 120.8 | 116.1 | 114.3 | 141.4 | 139.1 | 15.1 |
| Beer Sheva | 125.5 | 124.5 | 121.5 | 136.5 | 139.5 | 11.2 |
| Total in the country | 123.3 | 123.8 | 122.6 | 140.1 | 132.7 | 7.6 |

Thus, Israel is now experiencing general growth of mortality from cancer accompanied with outstripping growth of mortality in those cities where lately it was the lowest. The research experience of ecological aspects of cancer spread in other countries shows that environment pollution is bound not only to sources inside the city, but also to contaminants coming from sources far outside the city. It means globalization of ecological problems and necessity of integration of researches at interdepartmental level. Information on sources, chemical nature and intensity of contamination, beginning time of their negative environmental impact, possible ways of migration will enable to accomplish system analysis of carcinogenic situation in cities. Such analysis, in its turn, will promote building of controllable model of the situation with the purpose of preventing negative consequences hereafter. Now the necessity for development and accomplishment of complex interdepartmental program “Ecology and cancer prevention in Israel” has arose.

**ON ENERGY CONSUMPTION MANAGEMENT
AT A MUNICIPAL LEVEL
Raitsin Mark, Sosnovsky Yakov**

In Israel the global complex “problem of 4 ‘E’” (power engineering – ecology – economy – energy saving) has some features.

The population density has increased 6 times for the years of the state existence. The energy consumption level per capita has grown 1,47 times for the last 15 years and is now approaching the average one in the countries of the European union; on retention of the developed tendency and the predicted population grows by 40% by 2020 the total energy consumption will increase twice and a technogenic load on the territory will grow respectively.

On retention of practically complete dependence of the country on the import of power resources, the share of their cost in the total sum of import makes less than 7%. For many groups of the consumers the power expenses are not determining. Therefore economic factors only cannot serve the obvious motives of energy saving at all management levels. The ecological motives rise, that should be taken into account in working out measures on rational nature management, including energy saving propagation as a part of the long-term training programs of an economic type of the consumers’ behavior.

In Israel the share of a mobile power engineering (mainly, of various types of transport) is extraordinary high: about 60% of the final energy consumption (in the USA – up to 40 %). The most essential reserves of liquid fuel saving and accordingly – of emissions decrease are mainly connected with the decisions at a nationwide level (priority development of public transport; restraint on motor transport growth rates at the expense of the accelerated development of its other kinds; improvement of motor transport fleet and roads structure; maximum use of the potential of modern means of computer science and telecommunications, as well as logistics methods for transport operations reduction).

At the same time in the electrical power and water consumption the share of an individual business and households is rather significant. Possible saving on resources in this field at the expense of priority low-cost and quickly recouped measures is estimated as making up to 30% of the total saving.

The expediency of an experiment in separate municipalities on working out of the legal and economic mechanism favoring the realization of the rational nature management policy is substantiated with the subsequent distribution of the results on the country scale.

In the report the basic principles of the municipal programs of energy saving and rational nature management are formulated.

The important elements of the programs should become:

- introduction of methods of energy consumption management at the enterprises based on the system energy and economic analysis;
- creation and state support of a network of specialized energy saving enterprises that apply the specified methods and carry out all complex of works at the customer's enterprise – beginning with energy audit and finishing with introduction of improvements.

ON RAINWATER USAGE IN ASHDOD
Revelis Iliia, Milov Michael, Popadin Alexey

One of the sources of water supply is rainwater usage. In Ashdod, there are a number of reasons to use rainwater as an additional source of water supply.

1. According to data provided by a meteorological station of Ben-Gurion airport, that has an observation station near Ayalon highway, precipitation level of a 50% provision year is 514 mm, and that of a 95% provision year is 283 mm, which is evidence of large amount of fresh water (up to 5 million m³ per year) that is drawn off to the sea only from built-up territory of the city.
2. The city is situated in a plain coastal area and has good amenities; its territory is planned taking into account possible rainwater overflow to lowered places or to the sea.
3. Around Ashdod, soils with quite high water permeability are deposited that may be used for storage and natural purification of rain flows.
4. Now, because rainwater carrying large amounts of contaminations from road surfaces is drawn off into the sea without treatment, the coastal strip and Lachish river are being polluted, which is inadmissible by ecological conditions.
5. In some places, effluents of rain sewage are put into network of fecal sewage, which is inadmissible because these flows are not designed for modern biological treatment plants. In these cases, reconstruction is needed.

Ashdod is situated over one of the two main aquifers – Coastal Aquifer, therefore the main task now is not to create and exploit special repository for rainwater, but to organize treatment of rain flows using special plants described in one of the articles of this book (see Tarnopolsky Marina, et al.).

EARTHQUAKES AND THE PROBLEMS OF ECOLOGY

Revelis Iliia, Revelis Larisa

Today we cannot prevent natural disasters, but we can and must get prepared to them so as to minimize the possible damage and to exclude ecological disaster. Many countries, including Israel, have maps of seismic zoning, on which the seismically dangerous zones and the utmost possible force of concussion in each of them are indicated. These maps are sufficient enough for elaboration of protecting measures against the expected seismic disaster.

Under a powerful earthquake, a number of factors appear and function during some period of time, causing tragic consequences. From the ecological point of view, the most dangerous among them are: 1) damage and destruction of storage facilities and tanks containing chemical and radio-active substances; 2) fires destroying material values and causing death of people, fauna and flora; 3) breaches of main oil and gas pipelines; 4) destruction of roads and bridges; 5) breaches of main water arteries, damages pumping plants and, subsequently, water shortage; 6) putting out of action power supply objects; 7) damage of drainage systems and waste disposal plants; 8) damage of underground and surface oil storage appliances; 9) death of people and animals (without the possibility of burying corps), causing epidemics and biosphere pollution.

The mechanism of struggling the consequences of the possible earthquake, including activities for prevention of ecological disaster, must be elaborated beforehand, since it cannot be done quickly under conditions of crisis.

For integrated solution of problems related to quick liquidation of the natural disaster consequences, it is indispensable to elaborate planned organizational measures, which must be implemented before and after the earthquake. The plans must be ratified by proper legislation and provided by financing.

The plans of preparation of towns for possible earthquake must include two divisions: prophylactic measures to be undertaken before the earthquake, and emergency measures in case of the natural disaster actually happening.

One of the substantial elements for taking correct decisions as to emergency measures to be undertaken is quick inspection of the consequences caused by the earthquake, beginning from the first hours of the disaster, specifically for the purpose of obtaining reliable efficient information enabling to evaluate the general losses and the extent of the damage caused to the objects of crucial ecological significance.

Proposed hereinafter is a draft plan for discussion of measures to be undertaken in respect with preparation of towns to the possible calamity and prevention from ecological disaster, which must be, to the opinion of the authors, co-ordinated with the Ministry of ecology and conjointly financed.

Prophylactic measures

1) Choice of objects for primary, from the ecological point of view, inspection, aiming at elucidation of preparedness of constructions, appliances, technological lines and the personnel, including the leading and managing personnel, to the possible earthquake. 2) Determination of seismicity of the sites as specified in 1. above, where the above objects are located, considering their engineering-geological conditions and the soil "seismic response". 3) Calculation of the seismic stability of the above constructions, appliances and technological lines (as specified in 1. above), taking into account the sites seismicity as specified in 2. above, and weakening of the constructions as a result of ageing and corrosion of concrete, metal, welded and bolted junctions. 4) Strengthening or reconstruction of the above (1) constructions, appliances and technological lines, which do not meet the requirements of the valid standards. 5) Instruction of the personnel providing maintenance of the potentially dangerous from the ecological point of view enterprises functioning in extremal conditions. 6) Preparation of special maps with indication of objects and areas to be inspected due to the determined priority in case of the natural disaster, including section of possible appearance of landslides, landslips, dam breaks, floods, underflooding of the territory. 7) Establishment of commissions and groups for operational inspection of consequences of the earthquake, if occurred, with determination of rights and obligations of each member of the bodies established. 8) Instruction of the inspecting personnel towards activities in extremal conditions. 9) Detection of sources and possible ways of obtaining necessary machinery and equipment for salvage operations and recovery works. 10) Creation of necessary resources of oil products for functioning of motor vehicles and equipment in extremal conditions. 11) Explanatory activities and information service for population. 12) Instruction and training activities due to the probable scenario, aiming at evaluation of the preparedness of the town to the seismic disaster.

Plan of emergency measures

The plan of emergency measures constitutes a logically grounded and indispenable activity of leaders and managers of all ranks and levels, and of the future inspectors and researchers of the calamity. The objective of these activities is to provide the necessary measures for efficient functioning in emergency situations.

The plans must be periodically revised and specified, especially after training sessions, taking into consideration technological development and new technical opportunities.

**ECOLOGY OF CITIES: ELECTROMAGNETIC WAVE PROCESSES
IN INDUSTRIAL AND MUNICIPAL SEWAGE TREATMENT
Slavin Vladimir**

Nature protection activity in the country should be directed to reduction of influences of harmful manufactures on nature, reduction of technical loadings on reservoirs, wood, field, industrial territories and recreational zones. For this purposes, it is necessary to create new technologies based on modern scientific representations, capable to catch, process, utilize pollutioners or toxincantes, softening or preventing influence of ecologically unsafe enterprise on an environment. To number of modern, successfully developing nature protection technologies concern and ecological biotechnology, based on studying and application of mechanisms of natural processes of autopurification and self-restoration soils and reservoirs under influence of natural electromagnetic fields.

The technical and economic analysis shows, that more and more widely there is use of microseaweed and the maximum(supreme) water plants and ground plants for clearing (additional cleaning) industrial sewage of heavy metals (HM) on a basis of phytoremediation. With it sources of electromagnetic waves of various frequencies are used. So, in sediment bowls sources of natural and artificial light work, at disinfection – sources of artificial ultra-violet light. It is established, that 1) accumulation HM by microseaweed and macrophytes occurs most intensively within the first day of their immersing in sewage, 2) the concentration factor of microseaweed and macrophytes, i.e. the parity(ratio) of concentration HM in biological object and the water environment, has size about $10^{-3} - 10^{-4}$, 3) different HM at their identical concentration in the environment are absorbed by microseaweed and plants with different speed, 4) Shipped microseaweed and macrophytes accumulate more HM, than floating and in part shipped plants, 5) remediation of the polluted drains can be carried out also with the help of ground plants. These plants are raised in conditions of a natural and artificial irradiation hydroponical cultures, and absorb, concentrate or besiege HM from drains by means of roots of adult plants, and also with the help of their sprouts

Experimentation on the microseaweed (microalgae) Spirulina using a small laboratory pilot has shown that once the irradiation process began the output rate of Spirulina grew dramatically. The enclosed Table 1 shows the data of the laboratory pilot experiment.

As can seen the average growth rate in percentage is over 200 %.

This effect relates to phenomena of information – energy interaction between external electromagnetic fields and resonance frequencies of biologic object's electromagnetic fields. Energy of external electromagnetic radiation absorber at biological objects resonance frequencies is used in biological membranes for ATF – molecules synthesis. The amount of hydrogen peroxide and of other

peroxide states governs the development of many biological effects that range from photosynthesis stimulation to cell damage.

Table 1. Growth Index Results of Irradiation of *Spirulina Viridas* (g/l)

| Length of Irradiation (min) | Age of Microalgal (days) | | | | | | Growth (%) |
|-----------------------------|--------------------------|------------|---------|------------|---------|------------|------------|
| | 10 days | | 20 days | | 30 days | | |
| | control | experiment | control | experiment | control | experiment | |
| 15 | 0.05 | 0.16 | 0.31 | 0.40 | 0.40 | 0.91 | 228 |
| 30 | 0.05 | 0.18 | 0.31 | 0.47 | 0.40 | 0.92 | 230 |
| 60 | 0.05 | 0.15 | 0.31 | 0.54 | 0.40 | 1.15 | 288 |
| 120 | 0.12 | 0.16 | 0.37 | 0.58 | 0.44 | 1.49 | 339 |
| 360 | 0.20 | 0.16 | 0.40 | 0.60 | 0.57 | 1.52 | 266 |

The stimulating effect induced by a single low-intensity EHF irradiation on photosynthesizing organisms may be ascribed to the development of self-enhancing mechanisms, with these mechanisms being triggered by the initial self-catalyzed reactions in the lipid phase of cells.

Building of these structures is accompanied by changes in the character of DNA bindings to membrane, changes in the complexes formation with proteins, lipids, microelements. This determines changes in protein's conformation influence the ion – transport and activate ATF – syntheses of energy transforming membranes.

Further ATF – syntheses and ATF accumulation provide for cells division process stimulation.

This biological effect of influence of microwaves assumes introduction in technology of clearing of industrial and municipal sewage of a special phase of water-preparation of microseaweed before a phase of their immersing in sewage. Realization of application of electromagnetic wave processes for the irradiation of microseaweed by water-preparation does not demand the expensive equipment and is economically favourable. It is important to note an opportunity of use of the polluted biomass of microseaweed and plants as fuel for thermal power stations that will lower volumes of import of coal and petroleum. It speaks that specific heat conductivity of conditional fuel of 1 kg and 1 kg a dry biomass of one order – 7000 kkal/kg and 5000 kkal/kg accordingly.

METHODOLOGICAL ISSUES OF DETERMINING EFFICIENCY OF WASTE UTILIZATION FROM SECONDARY SOURCES

Sushon Sergey

The waste form secondary sources is that relating to industrial and domestic waste products, which can be processed and utilized for production of goods, substituting partially or entirely the traditional raw material.

For gross calculations of the economic efficiency, the substitution coefficient reflecting correlation between the waste products and the primary raw material can be used. If the goods produced from waste products are of the same quality as those from the primary raw material, the substitution coefficient is determined by the expenses ratio between them. If the quality of goods produced from waste products differs from that of the goods produced from primary raw material, different quantity of goods produced from the two sources of raw material must be obtained, to provide equal consuming results. In this case a coefficient of consuming properties equivalence is introduced.

As far as private enterprise is concerned, it is only natural that in the decision-making process related to use of waste products the criterion of surplus profits serves the guiding principle. But these calculations do not take into consideration such issues as prevention from damages caused by the harmful impact of waste products on the environment (including expenses for public health care), the value of the land resources released, reduction of expenses for waste ground disposal, maintenance of dumps, etc. Ignoring these components reduces substantially the summary index of the waste utilization efficiency and testifies to underestimation of the importance of the issue and its impact on the socio-economical development of the country.

Proposed herein is a formula for determination of the summary efficiency of using waste products from secondary resources, taking into consideration various factors influencing the value of the economic effect. To implement calculation related to a wide range of waste products, it is necessary to elaborate a corresponding normative basis.

The experience accumulated in many countries shows that alongside private enterprises, governmental structures take part in elaboration and implementation of environment protection projects, investing considerable financial means to promote the issue.

Utilization of waste products constitutes an extremely important integrated problem for Israel. On working out the perspective development strategy of the country, it is necessary to envisage the issue of utilization of industrial and domestic waste products and reduction of their harmful impact on the environment in separate regions and in the country on the whole.

**INTERETHNOCULTURAL COMMUNITY
TO IMPROVE URBAN ECOLOGICAL SITUATION
Terletsky Diana**

Creating an interethnocultural community is an important direction of ecological situation creation in Israeli cities, especially in the ones that are historically valuable. However, differences in languages of immigrants from different countries and their impossibility to communicate to one another prevent from creation of such a community.

Therefore we propose creation of a Conversational Environmental Textbook in several languages: Russian, English, Hebrew, Amkhar, and Arabic. The Ministry of Immigrant Absorption, the Ministry of Environment, and the Ministry of Education support our proposal. Such Conversational Textbook will allow us to organize mixed volunteer groups and introduce modern ecological concepts to different ethnocultural groups of urban population. At the same time, people with higher ethnocultural and ecological standard will positively influence the rest of volunteers and, with their help, all the ethnic subcommunity.

Ashdod city administration and mayor himself pay great attention to the problem of improvement of sanitary and hygienic situation in the city. This fact could make Ashdod an initiator of such an approach for large cities of Israel. It is also possible to use immigrants – ecologists and linguists from Ashdod and materials in Hebrew and in English that the organizers of this conference in the Center of Ecological Systems and Technologies can provide.

**INFLUENCE OF NATURAL CLIMATIC, ECOLOGICAL AND
ETHNOCULTURAL PECULIARITIES OF ISRAEL ON PROBLEMS
OF UTILIZATION OF MUNICIPAL SOLID WASTES (MSW)**

Tzikerman Alexander, Ilievsky Julius

Israel is located in semi-desert zone of northern subtropical belt. However, availability of large underground aquifers (Mountain – East and West – and Coastal aquifers with total yield of approx. 775 million cubic meters) and many small aquifers gives the possibility to maintain quite large green zones in the country in general and in cities in particular. On one hand, availability of aquifers provides quite large ground water yield from drilling wells; on the other hand, the territory of Israel is highly hydrologically sensitive, which means that soil pollution may lead to pollution of the above-mentioned and other underground sources of fresh water.

The above means that ordinary plants of high temperature treatment of MSW may lead to geopollution with obvious negative consequences for water supply system. Litterness of areas near dustbins because of their overload, their tardy emptying and in places where not only solid wastes, but also semi-liquid food wastes may be found in dustbins may also lead to the same consequences.

Hence, top-priority tasks of municipal services are to organize dust collection and to prevent dust from appearing in city streets and green plantations. This task may be fulfilled in a double way. Soil of areas where the dustbins are installed must contain special sorbents that form so-called physical chemical barriers in the way of pollutions. The same barriers should be provided in the suburban rubbish heaps, including Hirva, Dudaim, Kamat-Hovav and other.

Unload of MSW from dustbins must follow a clear integrated operational schedule taking into account rate of their infill, that can be determined experimentally during different seasons and in different weather conditions. Empty dustbins must be processed with special solutions against insects. Without fulfilling these conditions dustbins in the hot climate of Israel might be even a source of infectious diseases.

Because of the above reasons, it is also important to prevent throwing MSW in yards and in city streets; this requires not only legislative basis, but also special organizational arrangements (volunteer work, green police, etc.). Positive experience of Ashdod city administration in attracting pensioners should be spread to other Israeli cities.

In order to provide adequacy of MSW collection and receiving, poliethnical character of Israeli society and social stratification should be taken into consideration when organizing MSW collection (for example, different number of dustbins per unit of population in areas of different ethnical structure – Shchunat Academaim in Lod is an example).

The best way of dust collection is differentiation of dustbins according to types of wastes (plastic bottles, glass, paper, etc.). However, Israel has only recently started experiment with separate collection of plastic bottles. When positive results are achieved, this experiment should be continued and extended to other types of wastes.

In Israeli economics, small periodical productions with considerably large amounts of wastes per unit of production predominate along with military technical production. Fight with such wastes must follow three directions: their decrease, co-operation of different productions when waste of one production is raw material for another one. Finally, it is important to develop, in co-operation with developed countries, plants for full MSW processing with minimal amount of discharges into atmosphere and minimal second wastes.

CITY POPULATION AND CITY ECOLOGY

Umansky Vladimir

Obviously, it is impossible to evaluate an ecological situation in a city without connection with physical life conditions of its population. It is the people's need for normal and comfortable life that determines the required level of ecological situation in the place where they live and stimulates growth of this level. And this is exactly why population must actively participate in inspection and improvement of ecological situation in a city.

Ashdod public committee on inspection and execution of the pre-election promises that presents interests of the city inhabitants, considers improvement of ecological situation in the city as one of its immediate and priority tasks, including improvement of cleanness of yards, streets, parks, and public gardens; decrease of noise in the city streets, regulation of parking lots for lorries, and therefore it widely attracts the city population to participate in this work.

Despite the fact that Ashdod is one of the cleanest cities with good amenities, the ecological situation in the city is quite far from acceptable. The city inhabitants don't want to put up with such a situation and actively counteract to it: they find places and objects of pollution, sources of noise, objects having harmful discharges, and offer measures for their removal, put active and persistent pressure upon city administration. It should be mentioned that productive collaboration of the Committee and Association of cities "Ashdod – Hevel – Yavne" on environment protection (Mr. Ilia Linger) attracting volunteers from "Ne'eman Nikayon" groups gave concrete practical results. Thus, group of "Het" district offered the city administration to plant additional green plantations and to make the communal public garden of this district more equipped. In the same district, by initiative of "Ne'eman Nikayon" group areas having no construction on them are cleaned and paved. In "Bet" district, due to initiative and persistence of a "Ne'eman Nikayon" group quite a volumetric project on equipping area of market in this district – a place usually uncared-for and inconvenient for buyers – is being conducted. In the "Yud-Gimel" district volunteers put their shopping center in order, and now, the group in the "Yud" district does the same in their shopping center.

By public demand, the following streets were equipped with amenities: Seyfan 5-7 ("Het"), Prakhim 4, 28 ("Het"), Nathan Elban 24 ("Hei") and in other places.

Association on environment protection attracted a large group of volunteers to control harmful discharges of some industrial plants. A volunteer group of "Alef" district initiated works on control of influence of electromagnetic radiation from antennas of secular phones.

**NEGATIVE IMPACT OF GLOBALIZATION
ON URBAN ECOLOGY OF SMALL COUNTRIES
Vasjukova Elena**

Globalization exerts an extremely negative impact on the urban ecology of small countries, such as Israel. Let us set forth a number of instance to prove the statement above.

First, it is only natural to start with motorization. Big countries with a developed motor-car industry can provide an adequate – or almost adequate – increase in the motor-car fleet as related to road-building and to a series of legislation measures. Thus, in several USA states, one can purchase a car only under condition of parking premises provided. This is practically impossible in case of small countries, and the situation here becomes a mere disaster. Taking into consideration the necessity of maintaining repair shops with their extremely dangerous draining appliances, in light of the fact that underground waters are the prevailing source of fresh water in Israel, motorization can become here the forerunner of the ecological crisis.

An autarkic (self-sufficient) system of management is practicable only in big developed countries with various minerals and soil treasures. Small countries are content with incongruous, alien to them imitation of infrastructures. As a rule, this endeavor cannot result in a reasonable integrated system, and becomes an odd reconstructed adaptation of technological solutions fitting the big countries.

The hydrologic structure of Israel does not allow use of refuse chute appliances, but nonetheless the subject has been discussed for many years. Another ecological problem: combined transportation of municipal and industrial waste using common collectors transferring the waste products to the municipal waste disposal plants. Since in the Israeli towns the municipal sewage prevails the volume of the industrial waste products, the municipal waste disposal plants envisage biological systems of rectification. This means that presence of ions of heavy metals in the industrial waste ejected by minor car repair metal-cutting workshops, as well silver ions ejected by photograph studios, inhibit the system of bio-rectification, bringing about considerable deterioration of the refined water quality and possible pollution of underground sources of fresh water.

Small countries, especially their urban areas, are exposed to negative anthropogenic impact because of misunderstanding that globalization, which provided universal availability of technological achievements gained by big developed countries, must undergo adaptation to the concrete situation inherent in each small country.

Center of Ecological Systems and Technologies (ECOST)
Ministry of Immigrant Absorption of Israel
Union of Immigrant Scientists of Israel

**The 5th Annual Ecological
Immigrant Scientists Conference
from the cycle “Ecological Problems of Israel”**

**TECHNOLOGIES FOR WATER TREATMENT
AND DESALINATION AND FOR WATER SAVING**

By financial support of
Ministry of Immigrant Absorption of Israel

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PROGRAM OF THE CONFERENCE
**”TECHNOLOGIES FOR WATER TREATMENT AND
 DESALINATION AND FOR WATER SAVING”**

| | |
|--|----------------------|
| Registration of participants | 9.00 – 10.00 |
| Greeting to the participants | 10.00 – 10.30 |
| Paper and report presentation: | |
| Prof. Leonid Krasilschikov <i>Estimation of Natural Water Resources in Israel and Development of Methods of Their Protection from Pollution and Exhaustion</i> | 10.30 – 10.50 |
| Prof. Nonna Manusov <i>System of Underground Water Protection from Pollution as the Main Factor of Environment Protection Development Strategy</i> | 10.50 – 11.10 |
| Dr. Israel Edelson, Prof. Igor Medvedev <i>New Technologies of Water Treatment and Desalination</i> | 11.10 – 11.30 |
| Dr. Leonid Blyankman, M.Sc. Mark Krieger, M.Sc. Leonid Briskman <i>Water Recycling for Metal Finishing Industry</i> | 11.30 – 11.50 |
| Dr. Michael Milov, M.Sc. Alexey Popadin, M.Sc. Efim Kafitin <i>Water Desalination Technologies Using Thermal Pumps and Other Thermal Methods</i> | 11.50 – 12.10 |
| Adv. Valentina Nelin <i>Water Legislation in Israel</i> | 12.10 – 12.30 |
| Coffee break | 12.30 – 13.00 |
| Dr. Aron Kitayev <i>Urgent Problems of Water Saving in Israel</i> | 13.00 – 13.20 |
| Dr. Ilia Moskovich, Dr. Galina Tzaur <i>Influence of Fresh Water Composition on Human Health</i> | 13.20 – 13.40 |
| Prof. Michael Iolovich <i>New Filtration Materials for Water Treatment</i> | 13.40 – 14.00 |
| Dr. Efim Manusov <i>Automatic Recycling Water Supply Systems of Sport, Hygienic and Ritual Constructions</i> | 14.00 – 14.20 |
| M.Sc. Petr Gorovetz, M.Sc. Max Nudelman, M.Sc. Nora Nudelman <i>Water Treatment Method Using Disintegrators</i> | 14.20 – 14.40 |
| Discussion | 14.40 – 15.30 |

TABLE OF CONTENTS

| | |
|---|----|
| Ashkinazi Larion, Zilberberg Yakov Silver Extraction From Wastewater of Photographs | 66 |
| Blyankman Leonid, Krieger Mark, Briskman Leonid Water Recycling For Metal Finishing Industry | 67 |
| Dinevich Leonid, Leskov Boris To the Question of Possibilities of Precipitation Increase in Israel | 70 |
| Dobroborsky Boris Problems of An Integrated Quantitative Evaluation of Potable Water Quality in Israel and Optimization of Its Chemical Structure | 74 |
| Dorosh Andrey, Solovjov Boris Acoustic Methods of Filtration and Measurement of Liquids | 76 |
| Edelson Israel, Medvedev Igor, Manusov Nonna Rectification of Chemically Polluted Waste Water Using New Electron- Emitting Technology..... | 78 |
| Farfel Leonid Hydrogeochemical Investigation of Drinking Water..... | 80 |
| Guberman Felix Use of Water of Marginal as Real the Method of the Real Fresh Water Supply Increasing | 81 |
| Kafitin Efim Thermal Methods of Water Desalination in Urban Ecological System..... | 82 |
| Kitayev Aron Ways of Solving The Problems of Water Supply In Israel..... | 84 |
| Koren Pavel Method of Fine Treatment of Industrial Sewage Containing Heavy Metals With Winning Utilizable Metal-Ferrite Sediment | 87 |
| Krasilshchikov Leonid Evaluation of Natural Water Resources in Israel and Elaboration of Methods of Their Protection from Pollution and Exhaustion | 89 |
| Manusov Efim Control of Water Purification and Disinfection in Sewer Process | 91 |
| Manusov Lidia Influence of Domestic Filters Construction on Ecologization of Municipal Complex at Underground Water Supply..... | 93 |

| | |
|--|-----|
| <i>Manusov Nonna, Martynov Tatyana, Rudnik Michael</i> Silicate Sorbents for Solution of Ecological Problems of Israel..... | 94 |
| <i>Medvedev Igor, Edelson Israel, Manusov Nonna</i> Aquamin Plants for Water Treatment and Desalination | 97 |
| <i>Milov Michael, Popadin Alexey</i> Installation for Desalinated Water Extraction from Industrial Wastes and Sea Water by Means of Thermal Pumps | 99 |
| <i>Moskovich Iliia</i> Methodology of Studying the Impact of Fresh Water Composition on Human Health | 103 |
| <i>Nudelman Max, Gorovetz Petr, Nudelman Nora</i> A Short Review of Mixing and Dispersion Methods and Equipment | 105 |
| <i>Palchitsky Alfred, Mirmov Naum</i> Technology of Virus Desinfection in Wastewater..... | 106 |
| <i>Radin Sergey</i> High Intensive Fluidized Bed Dissolver/Mixer | 107 |
| <i>Radin Sergey</i> New Suspension Input Device For Vertical And Horizontal Thickeners..... | 108 |
| <i>Tarnopolsky Marina, Manusov Nonna, Shatz Naum</i> Automatic Sorption Device for Wastewater Treatment from Petrolic Pollution | 109 |
| <i>Tzaur Galina</i> Research on Influence of Desalinated Water on Human Health | 113 |

SILVER EXTRACTION FROM WASTEWATER OF PHOTOGRAPHS

Ashkinazi Larion, Zilberberg Yakov

Now, in photograph production and in processes using photographic materials continue to use photoreagents that include silver, ammonium, sulfites, and other materials. The significant part of these components does not stay in the manufactured products, but is dump into wastewater.

As numerous observations show, practically all photostudios that specialize in consumer service and are located in shopping centers or individual shops as well as enterprises carrying out cartographical and similar works dump the above-mentioned wastewater into urban system of water drain. According to rough average estimations, in Israel as a whole, approximately 2000 cubic meters of wastewater containing about 10 tons of silver is dump into water drain.

The drains should pass multistage system of treatment including biological treatment as well. The components found in wastewater, particularly silver compounds are poisonous for biologically active silt forming the basis of drain treatment system, and they interfere with effective treatment of the drains. According to the law of State of Israel of 1981, the content of silver in industrial wastewater drain must not exceed 0.05 gram per liter. The actual content of silver in drains is 4 to 7 grams per liter.

The study of this problem has shown that technology for neutralization of these solutions by silver extraction has been developed in a number of developed countries, for instance in USA, and the appropriate equipment has been designed.

We have improved this equipment by applying local materials from wastes of manufactures working in Israel, and this has lead to considerable reduce of the equipment cost in comparison to purchase from abroad. Our equipment allows extracting silver from waste directly before throwing it into drain; and the extracted silver is received in a form of granules or ingots whose quality is appropriate to the consumer requirements. Our equipment was installed and tested in several photostudios in Haifa, Hadera, and other cities in the North. Several dozens of kilograms of silver were received, and it was used in jewelry production.

The technical and economic calculation shows significant efficiency of the described process ensuring high degree of silver extraction and good compensation of expanses. For example, with investment of 7 to 8 thousand dollars 600 kilograms of silver may be received per year, and the gross profit will be 25 to 30 thousand US dollars. Investment of 400 to 500 thousand US dollars will allow organizing production of 6 tons of silver per year and the gross profit will be 600 to 700 thousand US dollars per year.

WATER RECYCLING FOR METAL FINISHING INDUSTRY

Blyankman Leonid, Krieger Mark, Briskman Leonid

1. Background

Regulations by the Ministry of Environment determine the quality of wastewater discharges from metal finishing processes and also limit their quality by requiring significant recycling of these discharges.

Tech-Jet is a factory that manufactures blades for jet airplane engines. An important part of the production process is treatment of the blades – made of titanium, nickel or steel – in wet chemical metal finishing lines.

A wastewater treatment system installed by Nirosoft Industries makes Tech-Jet a “zero discharge” plant, that completely recycles its wastewater from the metal finishing processes.

2. Wastewater Characteristics

Wastewater is generated from the rinsing of the blades after their treatment in various chemical baths in the metal finishing line. Each chemical bath is followed by a three-stage counter-flow cascade rinse. Cascade rinsing substantially saves rinse water consumption in comparison to single-stage rinsing.

The following chemical baths are used in the Tech-Jet metal finishing line:

1. Titanium blades: solutions containing nitric acid, hydrofluoric acid
2. Nickel blades: solutions containing nitric acid, hydrofluoric acid, hydrochloric acid, ferric chloride
3. Steel blades: solutions containing nitric acid, chromic acid.

The waste stream reaching the water treatment system varies in quality depending on the production: what types of blades, how many of each type.

Heavy metals of concern present in the stream are titanium, iron, nickel and hexavalent chrome (from chromic acid).

Design flowrates for the treatment system:

Total flow: $4\text{m}^3/\text{hr}$

Chrome stream: 1.5 nrVhr

3. Description of Treatment System

The design of the treatment system at Tech-Jet combines a variety of technologies allowing maximum water recovery and optimal operating parameters at minimum cost possible. The treatment process includes the following stages:

1. *Chrome reduction*: Chemical conversion of hexavalent chrome to trivalent chrome by controlled dosing of acid and SMBS (chromate stream only).
2. *Flow balancing and pH adjustment*: All wastestreams, including the reduced chromate stream, enter a mixed and aerated balance tank where flow and quality homogenization are achieved and pH is adjusted to an optimal value for precipitation of heavy metals. In this tank iron oxidation (ferrous to ferric) is achieved and coagulant (ferric chloride) is dosed.
3. *Metal hydroxide precipitation*: Wastewater is pumped at a constant flowrate (4 m³/hr) from the balance tank to two circular clarifiers. Metal hydroxide solids precipitate to the bottom of the tank and create a sludge, which is periodically removed with a pump to a gravity thickener. Thickened sludge (solid phase) is disposed as hazardous waste, the liquid phase from the thickener is returned to the balance tank.
4. *Sand filtration*: Clarified water is pumped to two sand filter units (in parallel) for removal of residual solids which did not precipitate in the clarifiers. The sand filters are backwashed automatically based on differential pressure, using water from the clarifiers. Backwash rinse water is sent to the balance tank.
5. *Ultra-filtration (UF)*: UF membranes, prepared by a special patent by Nirosoft Industries, are used for further lower water turbidity and suspended solids content to levels which are acceptable for feed to nano-filtration membranes. UF membranes are periodically cleaned by an automatic CIP (cleaning in place) system. Reject stream from the UF stage is sent to the balance tank.
6. *Nano-filtration (NF)*: NF membranes are utilized to achieve partial removal of salt ions and conductivity and complete removal of any residual heavy metals that were not removed before this stage of the treatment system. NF product is at a quality, which allows recycling to the production lines at Tech-Jet. Make-up of any water losses due to the treatment process is with de-ionized water, prepared by a separate reverse osmosis (RO) unit. Concentrate/reject stream from the NF membrane unit is designated for evaporation, thus significantly reducing the volume of material, which is to be disposed as hazardous waste (along with sludge from the clarifiers).

4. Results

Water quality at the various stages of the treatment system is detailed in the Table 1 below.

Table 1. Water quality at the various stages of the treatment system.

| <i>Treatment Stage</i> | <i>Conductivity</i> | <i>pH</i> | <i>Ti</i> | <i>Fe</i> | <i>Ni</i> | <i>Cr</i> |
|--------------------------------------|---------------------|-----------|-----------|-----------|-----------|-----------|
| Entrance to balance tank (untreated) | 1.5-3.0 | 1.5-3 | 10-60 | 15-30 | 1 – 10 | 1 – 15 |
| After clarifiers | 1.5-2.5 | 9-10 | 0.5- 1 | 0.2-0.5 | 0.2-0.5 | 0.2-0.: |
| After sand filters | 1.5-2.5 | 9-10 | 0.3 | 0.3 | 0.3 | 0.3 |
| UP product | 1.5-2.5 | 9-10 | 0.01 | 0.02 | 0,3 | 0.04 |
| NF product | 1.0-1.5 | 9-10 | 0.01 | 0.01 | <0.1 | <0.04 |
| NF reject | 6.0 -7.0 | 9-10 | 1.6 | 0.2 | 3.4 | 0.4 |

Units: Conductivity – mS Ti, Fe, Ni, Cr – mg/l

The results indicate a constant and consistent improving of water quality as it goes through the various stages of the treatment system, eventually reaching quality (NF product) which allows recycle to the production lines, with zero discharge of wastewater to the sewage system.

5. Summary

A wastewater treatment system combining of a variety of treatment technologies allows a metal finishing industry to recycle wastewater and achieve “zero discharge” to the sewer system. Pollutants are removed by metal hydroxide precipitation and concentration by evaporation of NF reject, and disposed as hazardous waste. The system allows Tech-Jet to comply with regulations of the Ministry of Environment and achieve savings on costs for water consumption, wastewater discharge to sewer and hazardous waste disposal.

**TO THE QUESTION OF POSSIBILITIES
OF PRECIPITATION INCREASE IN ISRAEL
Dinevich Leonid, Leskov Boris**

The paper sets forth the technology and presents the results of long-term activities aimed at precipitation increase from clouds of various types during the cold periods of the year in Ukraine and Moldova. The experiments implemented in the two regions accomplished each other, extended the data series and enables to develop a unique and highly efficient technology for activities aimed at precipitation increase from various types of clouds.

It is indicated that the impact of clouds seeding with the purpose of precipitation increase depends not only on concrete meteorological, synoptic conditions of the cloud process development, but also on the technology chosen for effecting the given concrete cloud. It is proposed to use the technologies of exerting impact on clouds, which were developed in Ukraine and Moldova, in activities aimed at precipitation increase in Israel.

The task of precipitation regulation is the basic component of the general problem of exerting impact on atmospheric processes. This is explained by sharp deficiency of water throughout huge areas of the globe, as for instance, vast droughty territories of the Central and South-Western Asia, South-East of Europe, North and South-West of Africa, Australia, South-West of North America, etc.

Thus, in many countries scientific research was launched with the purpose of developing technologies which could enable increase in precipitation by means of exerting impact on the cloud systems. These studies perceived a large scale in the USA. The first reliable general conclusions were drawn in 1963-69. Due to the data obtained, increase in precipitation in certain American projects reached 12-20%. For 12 years of effecting clouds in Santa-Clara (California), 625 mm of additional precipitation were obtained, which comprised a 12.7% addition to the regular rate. It was particularly emphasized that this method was the cheapest one, as compared with other possible ways of obtaining water in this region.

Considerable additional precipitation – up to 50% and more – was obtained in the Necaxa river basin in Mexico. In Japan the corresponding figure exceeded 20%, while in several areas it reached 150%. Here, the increase in precipitation was registered 50-100 km beyond the borders of the direct impact. In Australia, France, Italy, Spain, China and other countries studies in this field have been carried out for many years.

Analysis of the results obtained as a result of implementation of numerous projects in the USA enabled in to set forth quite optimistic conclusions as far as the opportunities of artificial increase in precipitation are concerned.

In a substantial review of activities for precipitation increase provided in, numerous experiments carried out in the USA and in other countries, as reported in press in 1989-1997, are considered. The authors of the review point out a number of remarks set forth by many scientists discussing the technology of implementation and methods of evaluation of the experiments carried out in the USA, Israel, Australia and other countries. Nonetheless, the review contains an indication that increase in precipitation obtained in the experiments of orographic clouds seeding in the USA was 10%, sometimes reaching up to 24-100%. The same review provides information on successful results obtained in the North of Israel. Analyzing similar activities in Australia, it is indicated that cloud seeding above plain were not efficient. More substantial results were obtained upon orographic clouds seeding on the Tasmania island (precipitation increase of 30%), while it is indicated that the profits-expenses ratio for this value (30%) is 13:1. The same review provides references to the satisfactory impact obtained in experiments carried out in South Africa.

Though, it must be noted that in the considered review many doubts and uncertainties as to the findings and their evaluations are indicated by different authors.

Such spectrum of evaluations, to our opinion, hardly corresponds to the actually obtained results. The reason is very likely that of the level of reliability of the algorithms realization and evaluation of the experiments. In this respect it seems advisable to undertake further attempts to evaluate the previously implemented experiments. It is thus indispensable to provide a more precise determination of the seeded cloud space coordinates, and to find with more confidence territories where the seeding effect is supposed to be exposed (taking into account the physics of artificial precipitation formation due to the wind direction and speed in the seeded clouds and under them).

In the USSR the studies aimed at increase in precipitation began at the end of the 40-ies within the framework of the Chief Geophysical Observatory in Leningrad and the Central Aerological Observatory in Moscow.

Somewhat later such studies were organized at the Institute of Experimental Meteorology, scientific-research institutes for hydro-meteorology in the Middle Asia, Ukraine and Transcaucasus, within the framework of the Moldavian service for active impact on hydro-meteorological processes, and in other research and productional institutions. Actuality of the problem for vast territories of the country, support of the Government and the considerable success of the first experiments enabled to develop a wide range of technical means and re-agents for various types of precipitation forming processes.

Among these technical means were specialized airplanes, aircraft means of cloud seeding by various re-agents, surface rockets and appliances, surface generators, aircraft and surface specialized radars, aircraft and surface

measuring equipment, a wide range of ice-forming, hygroscopic and freeze-reagents etc. On the basis of these technical means, in the course of the last 40 years numerous technological schemes have been developed by various research schools, with the purpose of exerting impact on the cloud processes aiming at increase in precipitation under synoptic-climatic conditions, which are characteristic of various regions throughout the world.

In the 80-ies and 90-ies the Central Aerological Observatory, using a considerable part of the technical means and technologies, which had been developed by that time, performed a series of large-scale, including international, successful productional experiments of precipitation increase.

In 1959 activities towards precipitation increase from clouds of summer and winter periods were launched at the Kiev Scientific-Research Hydrometeorological Institute (UKRNII). Further on, these activities perceived a substantial development. Here, on the basis of considerable experimental data, methodological premises were developed and vast experience accumulated in the field of precipitation increase from clouds of various types.

In Israel, long-term experiments indicated that precipitation increase in the Southern part of the country can reach 17-18%, if the technology specially developed here for this purpose is used. At the same time, similar experiments in the central regions resulted in zero and even negative results. The technology developed in Israel under the guidance of Professor Gagin envisages seeding of a certain layer of the atmospheric air, which is supposed to be involved within a short period of time into the precipitation forming process of the oncoming clouds. Aircraft means of seeding were applied to realize this technology. Experimental data obtained showed satisfactory results. As many researchers assume, this technology enabled to perform the most reliable and convincing experiment providing justification to the artificial methods of obtaining increase in precipitation from clouds.

Though, many researchers, the authors of the present article among them, assume that the accepted in Israel technology is efficient not for all cloud processes developing here.

The clouds which can be effected in Israel are mostly observed during the winter and the transition (late autumn, early spring) periods. A characteristic feature of precipitation forming processes in clouds is a large scale of their types and high changeability in space and time, even within the same synoptic situation and the same short period of time. Quite frequently different types of clouds are observed within one synoptic process in different periods of the day, in different parts of the frontal section or different regions of the country. Thus, for instance, in one region of the country convection with intensive thunderstorm activity and heavy cloud-burst precipitation is being developed, while simultaneously in its other region precipitation come down from stratum clouds. As shown further on, these factors must be taken into account when

developing technologies of exerting impact on cloud processes and choosing corresponding technical means and re-agents. Many specialists assume that a considerable effect in precipitation increase in all regions of Israel can be obtained only by means of a flexible (combined) technology enabling to provide direct seeding of cloud cells or cloud layers using re-agents with various mechanisms of impact. It must be noted that at the Israeli universities a strong theoretical foundation providing activities related to precipitation increase in Israel, based on a flexible technology, has been established.

Taking into account the vast experience in seeding clouds of various types in the Moldavian and the Ukrainian experiments, it seems interesting to consider their results with the purpose of their possible use in Israel, in addition to the accepted technology.

**PROBLEMS OF AN INTEGRATED QUANTITATIVE
EVALUATION OF POTABLE WATER QUALITY IN ISRAEL
AND OPTIMIZATION OF ITS CHEMICAL STRUCTURE**

Dobroborsky Boris

The problem of potable water quality in Israel is one of the most actual at the moment.

Operating national and international standards (USEPA, EC and other), regulating ultimate concentration of various substances and impurities in water, contain up to 120 names, being subject to a control.

The analysis of account materials about water quality in Israel from 1994 till 1998 has shown that the following substances reach the most dangerous concentration: HCO_3 , Zn, NH_4 , K, Fe, SO_4 , Mg, Mn, Cu, Ca, and CaCO_3 .

As data of the reports of Ministry of Public Health Services of Israel have shown, in all sources of potable water the enumerated units correspond to operating norms.

However it is known, and it is a disadvantage of all operating standards, that the values of ultimate concentration of every one of harmful chemical substances or impurities do not provide simultaneous presence of other harmful chemical substances or impurities, though it is well known, that simultaneous presence of several harmful chemical substances render on an organism of the person exponentiating effect.

Thus, potable water appropriate according to its structure and acceptable concentration of chemical units included in it and impurities to all operating standards can appear harmful for health of a person.

Besides it is well known, that water may be harmful for health not only from surplus of these or those chemical substances, but also from their disadvantage.

The objective of this research was to define the possibility of application of the method of quantitative evaluation of effect that various loads have on a human organism (Method of Dobroborsky-Kadiskin, developed in 1995-96) for quantitative evaluation of potable water quality in Israel.

The analysis of scientific materials, circumscribing mechanisms and outcomes effects of various chemical units and impurities present in potable water, upon a human organism, was mainly devoted to time of their effect and originating thus functional shifts, and time of restoring of these functional shifts after termination of effect of chemical units and impurities because of the theories of biological equilibrium.

The general view of changes of functional shifts taking place when chemical substances affect a human organism and when the organism restores itself after the effect is terminated is represented on Fig. 1.

Outcomes of researches have shown following:

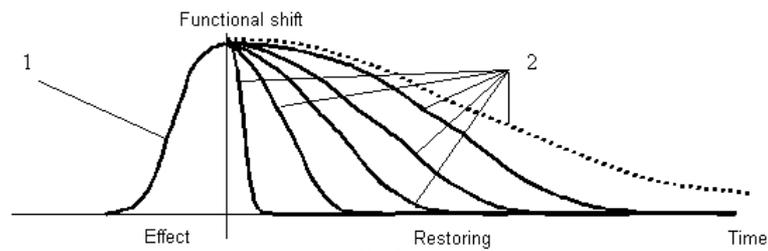


Fig.1

General view of growth (1) and restoring (2) functional shifts at effect of various chemical units

The time of restoring of functional shifts of an organism changes in a very large interval: from several seconds (for example, after an unpleasant effect from bad taste of water) up to many years, when a lack or predominance of necessary units in water cause serious diseases (for example, mineral balance violations).

Nevertheless, despite complexity of a problem, it can be solved with the help of the method of Dobroborski-Kadiskin by organization of researches.

The most dangerous for human health chemical units contained in potable water must be detected originally in the conditions of Israel; their quantitative characteristics, each one separately and determined, and at cumulative effect on a human organism (common and structural ergoemcost).

Then, when the first task is solved, other chemical units affecting human organism should also be subject to research.

As a result of these operations, the final total and optimal chemical structure of potable water will be defined, which should necessary be aimed at characteristics.

**ACOUSTIC METHODS OF FILTRATION
AND MEASUREMENT OF LIQUIDS
Dorosh Andrey, Solovjov Boris**

The proposed original acoustic filter doesn't have disadvantages of regular filters, and it is intended for long-term continuous filtration of a wide range of liquids, from slightly polluted water to highly viscous polluted liquids with thin suspended solid fractions. Such filtration is obtained by means of effecting the filtrating liquids by acoustic vibrations of the sound and ultrasound ranges.

The principle of acoustic filtration constitutes creation of a barrier in the acoustic wave by means of undulatory movement of the liquid on the surface of the vibrating filtration plate, which resists penetration of rigid particles through the plate of the filter. At a certain distance from the plate, concentration of rigid particles increases. As a result, they stick together and sink onto the bottom. At the same time the liquid phase passes freely through the vibrating filtration plate. Moving away the zone of compression of the suspended particles from the vibrating plate depend on the size of the particles, viscosity of the liquid, vibration frequency and amplitude of the filtration plate.

The acoustic filter comprises an electromagnetic, electro-dynamic or magnetostrictional vibrator, which is embodied in a shield and rigidly bound with the acoustic transformer of a core or an exponential type. The acoustic transformer in its turn is rigidly bound with the vibrating filtration plate. The plate is hung up to the frame by means of an elastic hanger bracket. The above elements constitute a unified vibration system, in which the filtration plate performs bucket (piston-like) vibrations. The filtration plate contains the lower radially rigid hung-up grating and the upper fixed netting, the space between them filled with soft filtration material. The polluted liquid is supplied through an inlet socket to the lower part of the appliance and is heightened to the filtration plate. The liquid phase freely passes through the filtration plate and is moved away through the upper socket. The rigid particles are thrown away from the lower vibrating grate of the plate, stick together and sink onto the conic bottom of the frame. From there, the unloading socket is removed from the appliance.

Thanks to the advantages as specified above, the proposed acoustic filter can be very perspective and widely used in various technological processes.

The principle of functioning of the measuring device for determination of the level of partition of liquids is based on registration of the partition zone position in the liquid, which is characterized by presence of a considerable gradient of the ultrasonic rays damping.

The measuring device contains a vertical bar with acoustic transformers fixed on its bottom edge: the radiator and the receiver. By means of the performing mechanism, in which the upper edge of the bar is placed, the bar with the acoustic transformers is sunk into a reservoir with liquid. The performing mechanism contains an appliance of remote transmission of the acoustic transformers position. The information provided by the appliance is supplied to an electronic signaling device specifying the level and the control of the performing mechanism. The indicator of the partition level of liquids is connected to the electronic device.

The range of the measured levels depends on the type of the performing mechanism and the parameters of the technological equipment.

The sensitivity related to the gradient of the suspended particles concentration is at least 2% at the frequency value 1 mHz.

The spheres of application of the appliance are: lighters of technical water in water rectification constructions; lighters of salt solutions and thickeners of the concentrate in mining-chemical industry.

RECTIFICATION OF CHEMICALLY POLLUTED WASTE WATER USING NEW ELECTRON-EMITTING TECHNOLOGY

Edelson Israel, Medvedev Igor, Manusov Nonna

Electron-emitting processing of toxic compounds dissolved in water is implemented by means of bombarding by accelerated electrons causing formation of radiolytic products in the form of free active radicals and ions, such as, for instance, electron hydrates, hydrogen atoms, hydroxyl radicals of oxygen and radicals of hydrogen superoxide. These particles are characterized by very high reaction capacities, thus the processes of their interaction with dissolved admixtures elapse with high speed.

As compared with prevalent methods of wastewater rectification (chemical, electro-chemical, ion-exchanging, sorbing and others), the main advantage of the electron-emitting technology is its universality.

In the international register of potentially dangerous toxic elements above 500 titles are listed. The electron-emitting technology enables to effect most of them, which cannot be said about other technologies.

The energy of accelerated electrons is used for modification of chemical, physical and biological properties of the object exposed to the rays emitted. While the organic and non-organic pollutants are being destroyed, the processes of precipitation and coagulation are accelerated, the color and the smell are diminished, disinfection takes place, and biological growths in technical systems are avoided, which is extremely important for closed branchy water supply systems. A considerable advantage of the electron-emitting technology is that, in addition to purification from the main pollutants, it destroys highly toxic micro-admixtures, which cannot be obtained by using other methods.

As an example of the electron-emitting method application, the results of processing waste water of a petrochemical enterprise is provided hereinafter.

The polluted waste water of this enterprise contains butyl alcohol, gasoline, diesel oil, kerosene, coal tar, bitumen, methanol, ammonia, phenol (carbonic acid), Na₂S, NaHS, benzpyrene, cyanide, sulpho-cyanide, urea, dimethyl-terephthalate, diethyl-hexanol, dioctyl-phthalate, xylain, styrene, benzol, oil carbohydrates, chlorides, sulphides, polymers (ethylene, propylene).

To purify the waste water of the enterprise, there was used an electron-emitting appliance with parameters as follows:

| | |
|------------------------------------|----------|
| Type of accelerator | ELV-8 |
| Energy of electrons, meV | 1.0-2.5 |
| Maximum power, kW | 80 |
| Current on the beam (maximum), mA | 50 |
| Productivity, m ³ /hr | 700-1500 |

Table 1 presents the efficiency indices of using the electron-emitting technology.

Table 1. Efficiency Indices of Using the Electron-Emitting Technology

| <i>Product</i> | <i>Concentration, mg/l</i> | |
|------------------------------|----------------------------|----------------------------|
| | <i>Input value</i> | <i>After rectification</i> |
| <i>PH</i> | 8.9 | 8.3-8.4 |
| <i>Oil products</i> | 3.28 | 1.6-2.0 |
| <i>Volatile fluoride</i> | 11.6 | 0.16-1.6 |
| <i>Ammonia</i> | 144 | 11.1-94.5 |
| <i>Methanol</i> | 55.5 | 0.0-29.8 |
| <i>Hydrogen sulphide</i> | 0.02 | 0.0 |
| <i>Surfactants</i> | 0.13 | 0.04 |
| <i>BOD₅</i> | 194 | 11-104 |
| <i>COD</i> | 340 | 34-220 |
| <i>Aromatic hydrocarbons</i> | 2.06 | 0.0 |

The electron-emitting technology of rectification enables to obtain as follows:

- decrease in harmful components concentration down to values providing efficient biological purification;
- increase in clarity of polluted water due to removal of substances effecting the color;
- purification without adding other substances.

Biological testing by using sterile cultures of luminescent plants shows that the rectified water became non-toxic.

HYDROGEOCHEMICAL INVESTIGATION OF DRINKING WATER

Farfel Leonid

The proposed work is about investigation of pollution conditions in liquids connected with chemical substances solution, migration and sediment. These processes take place mainly in surface and underground water, which is why we should have clear notion about complicated geochemical phenomena taking place in natural waters. These processes are indissolubly connected with such factors as chemical composition of natural water, elements in transference forms, physical chemical thermodynamics in hydrogeochemical systems, acid-base equilibrium and redox states, mass transfer, and hydrogeochemical zones.

The investigation is based on data of chemical analyses of surface and underground water found in boreholes, soils or other materials from different archives. Processing this data will let us determine composition of polluted water, e.g., mineral and organic substances, gases, microflora, isotopes, etc. This, in turn, will let us determine main forms of element migration and classify them according to their possible states in natural water.

The results of the proposed work will be map compiling of hydrosphere pollution distribution in the investigated region. In this map, hydrogeochemical conditions will be shown of pollution areas of different types of formation. The map will be accompanied with hydrogeochemical sections characterizing polluted water vertical zone. These materials will help to understand formation mechanism of water pollution areas. They will give possibility to prognosticate their distribution and to work out protective measures.

**USE OF WATER OF MARGINAL AS REAL THE METHOD
OF THE REAL FRESH WATER SUPPLY INCREASING
Guberman Felix**

Possibility of significant saving of fresh water could be obtained by substituting water of marginal quality in some activities that now use potable freshwater. "Marginal" is, of course, a relative term; reclaimed wastewater, for example, is a special case of marginal quality water. Brackish or saline ground water, in some cases even seawater, may be used for some of the just-described uses of wastewater. The discussion here is limited to brackish water, defined as having chloride content greater than 400 mg/l or an electrical conductivity greater than 1.5 dS/m, and to the special case of potentially contaminated but otherwise potable water delivered to consumers.

The most common use of marginal quality water is of brackish water to irrigate crops that have a high tolerance for salinity. Much of the brackish ground water in the study area can be used directly for irrigation without desalination. The yields of some crops, such as strawberries or subtropical and deciduous orchards, are reduced when irrigated with water with an electrical conductivity greater than 1.5 dS/m, although the fruit may be of higher quality because of increased sugar content. Other crops, such as cotton and barley, are not affected at levels of 8 dS/m or more. Management practices for using brackish water in agriculture include restricting the use of brackish water to tolerant crops and tolerant varieties, although the latter are not widely available; mixing water sources, when required, to achieve lower salinity; intermittent leaching; use of drip-irrigation technology when practicable; use of poor quality water only toward the end of growing season; and avoiding irrigation during hot weather.

To obtain brackish water, it is necessary to equip additional wells, and the corresponding equipment requires considerable investments. To reduce these expenses, it is proposed to use a boring key developed by the author. The essence of its functioning is screwing together and unscrewing the boring mill pipes in the process of descending and ascending operations. Simplification and, subsequently, higher reliability of the derrick is thus obtained. In addition, the drifting speed increases by 7-8%, and its cost is reduced by 5-7%. Subsequently, the brackish water output from small aquifers becomes simplified. It is obvious that speed increase and cost reduction of drifting bring about subsequent cost reduction of the brackish water output by 10-12%.

It must be also taken into consideration that output of low-salination water from main aquifers using the above method is 35-45% cheaper than the price of that of the freshed seawater.

In Israel, with its underdeveloped infrastructure of searching activities and absence of boring appliances production, any breakthrough in this sphere will enable to use the desalinated water of underground aquifers.

THERMAL METHODS OF WATER DESALINATION IN URBAN ECOLOGICAL SYSTEM

Kafitin Efim

For industrial desalination of sea water, the phenomenon of reverse osmosis is used. For technologies requiring less energy expenses, reverse osmosis has also moved aside the technologies of vaporizing desalination.

It is possible to obtain a considerable decrease in power-consuming of vaporizing desalination at the expense of complete utilization of the condensation heat and its use for vaporization. Power-consuming due to the proposed technology is lower than that required for reverse osmosis desalination technique. This technological process of desalination envisages rectification of sea water by means of hydromagnetic separation and one-time evaporation and rectification of the salt solution.

Hydromagnetic separation is implemented by means of unified insertions into the pipes supplying sea water for desalination and further transportation of the final product. This process also neutralizes aggressive industrial waste components with utilization of useful products.

Evaporation and one-time rectification is implemented each in its unified module. The height of the modules is about 800 mm, and they are mounted in a vertical column, so that the condenser of the lower module functions as the heating appliance of the upper one. Taking into consideration the heat losses, the difference between the boiling temperatures of the neighboring modules is preserved at the level 2-3⁰C. The necessary temperature drop is created by the compressor increasing the vapor temperature of the highest module up to the value of the total temperature drop of all the modules in the column, and delivers it to the condenser of the lowest module. The whole heat of the vapor condensation is used for the sea water vaporization of the upper module. The heat exchange between the distillation products and the fresh portion of the sea water is implemented in regular heat exchangers. Desalination in the columns is processed under any pressure, from the highest value down to discharged one. The productivity of the process is first of all proportional to the partial pressure of the water vapor.

The heat impact under desalination by freezing is 6 times lower than that under evaporation. The high price of cold and the possibility of recuperation of condensation heat for the new portion of sea water brought about neutralization of this advantage. Thus, a technology of obtaining cheap cold in a low-temperature steam-power cycle is proposed. The technology proposed envisages cooling and freezing of the sea water with conversion of the total amount of the extracted heat into electric power. To obtain 1 kg of fresh ice, 2 l of sea water is needed. The sea water is cooled down to 0⁰C and then frozen by further heat withdrawal. The saline cold residuum is sent back to the sea or transferred to further industrial processing with the purpose of extracting

useful substances and compounds. The fresh ice is melted by the heat of the sea water supplied for desalination. On obtaining 7 kg of fresh ice, 1 kW of electric power is produced.

The steam-power cycle developed by the author, in addition to obtaining fresh water, enables to reduce the temperature of open reservoirs. By reducing the reservoir temperature not only the surface evaporation can be brought down, but also the night and even the day condensation of the atmospheric moisture can be obtained. This opens the technical perspectives of rescuing the dried-up Dead sea and of reducing the Kinnereth evaporation losses.

Exploitation expenses for production of fresh water and electric power are negligible, since the required heat energy is extracted from the sea (attached herein is a comparative analysis of the traditional power station and of that generating fresh ice as proposed above).

**WAYS OF SOLVING THE PROBLEMS
OF WATER SUPPLY IN ISRAEL
Kitayev Aron**

For a long time there have been considered in our society the problem of water economy, up to attempts of reducing sanitary norms of water consumption, volitional reduction of water supply to the agricultural and the industrial sectors, price increase, development of non-traditional resources, such as desalination appliances, and even import from Turkey.

On the hand, this multitudes of varieties testifies for urgency of the problem, and, from the other, demonstrates the fact that the authorities responsible for water supply have no concrete scientifically-based programs providing solutions of the problem. Their counting on promotion of water consumption culture at the level of the consumer does not even bring the society nearer to solution of the problem as a whole.

Reduction of the sanitary norms below the standards established render to be a direct violation of the consumer's right, not to mention the sanitary-epidemiological consequences of such measures. As far as the agricultural and the industrial sectors are concerned, volitional reduction of water supply will inevitably bring about reduction in volume of production or close-up of enterprises. The problem can neither be solved by increasing the price of water consumption. Development of such non-traditional measures as desalination appliances, let alone their productivity, set forth a series of crucial problems, which cannot be handled for the time being. These are the problems related to the impact of "artificial water" on the human organism, problems of changes in the water quality as a result of mixing water from different resources, and others.

Analysis of the situation confirms that solution of the problem must be sought in new interrelations between the water supplier and the water consumer. These interrelations must be based on guarantees provided by the supplier as to scientifically grounded limits and norms of water supply and, correspondingly, guarantees provided by the consumer as to using water within these agreed limits and norms.

This must be the corner-stone directive upon elaboration of new "Rules for consuming public water, its supply and destination regularities". Sticking to these rules under signing agreements related to water supply, control and check-up of their observation must provide in the residential sector, as the world-wide practice testifies, an economy of about 5-7 per cent. In the industrial sector this value can reach 30-40 per cent, but only if preconditioned by payments of the enterprise based on price regulation.

For the time being, the enterprise is paying for the water consumed as for power resource, and, regardless the price and the actually used water, includes

the expenses in the price of the products and the services delivered. Thus, there is no necessity to use water sparingly and to economize at the expense of additional investment in introducing waterless technologies or in repeated use of water. All expenses of the enterprises related to excess expenditure are paid by the consumer of the products and services delivered.

An alternative to this situation, a stimulus for saving of water must be the requirement to the enterprise to ground the quantity of water needed for actual production of goods and services. This grounding must be considered the limit providing the production needs of the enterprise. Simultaneously, there must be established that payment for water consumption above the limit determined for the enterprise is not included in the basic cost of the product, and it must be paid according to an increased tariff out of the profits of the enterprise. The rate of the increased tariff must be determined by the local self-governing authorities, taking into account the local conditions as related to the water balance of the territory. In this situation the expenses of the producer for activities aiming at water consumption reduction may become attractive not only in sense of water economy, but also for cutting down the waste water volume and, subsequently, reduction in payments for the sewerage system.

Solution for the problem of water supply to the agro-technical complex renders to be the most difficult one. Here, there cannot be a uniform approach to determination of limits for irrigation; besides, it seems ineffectual taking into consideration the peculiarities of the branch, which depends on the impact of natural conditions. A natural way out in this situation is use of purified, up to the required level, domestic and industrial waste water, at least for irrigation of technical crops, all the more, the corresponding techniques are widely known. Undoubtedly, at the first stage construction or reconstruction of appliance for profound rectification of waste water require financial means to be invested by the governmental sector and by investors. But these expenses, envisaged in the consumer price of the water supplied, will be indemnified for within a short period of time, taking into account the scope of water consumption, especially if the price of water supplied from natural resources is charged with a scientifically grounded taxation, which is widely accepted in all countries suffering from water shortage. This taxation will provide additional financial means for development of infrastructure related to water supply and, at the same time, will stimulate use of more profitable secondary water for the agro-technical complex, as well as for various industrial technologies.

This, in addition to water economy, will contribute to solution of one of the crucial ecological problems – protection of underground water resources and open reservoirs from their pollution by sewage water. Rain drainage can be similarly treated. But, unfortunately, the said above cannot solve the water infrastructure problems within a short period of time, since there is another one, which renders to be crucial for water economy. This is the problem of

transportation from the source to the end consumer. In principle, the transportation losses are inevitable, and their rate, under competent exploitation of systems, is evaluated within the limits of 7-9%, and in arterial conduits 2-3% of the total volume of the water transported.

There are different ways of losses reduction, such as establishment of structures with direct subordination to the municipal water supply department, incorporation or privatization of the municipal water infrastructure, or any other, combined form of ownership enabling to specify the owner, who is responsible not only for the current moment, but also interested in efficiency of the system as a source of long-term income.

Still, incorporation has also its difficulties, connected with evaluation of the actual technical state of the infrastructure. No investor will invest money before having evaluated the ratio of his expenses for the system resuscitation to the volume of the expected profit. To do so, one is supposed to use quite a complicated methodology, which must be applied to each concrete object with its technical certification.

The above review of the situation shows that there exists no unambiguous solution for any one of the problems discussed, for lack of a clear legislation basis in the country, which adapted itself to the conditions of water famine. I.e., there is an urgent need for a sound integrated program of activities, envisaging interconnection of legislative, economic and technical aspects. Taking into account that the program is aimed at solving water supply problems in many branches of economy, specialists with knowledge in infrastructure management, lawyers, economists must be involved, to accelerate elaboration of the program and its further ratification. The sooner such a program is elaborated, the sooner the priorities in this integrated system will be determined. The program must envisage stages which will bring already in the course of the current year tangible results in water economy and improvement in the ecological situation.

**METHOD OF FINE TREATMENT OF INDUSTRIAL SEWAGE
CONTAINING HEAVY METALS WITH WINNING
UTILIZABLE METAL-FERRITE SEDIMENT**

Koren Pavel

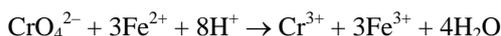
The method under discussion uses technology having utilizable metal-ferrite sediment as an end product, in contrast to the majority of existing technologies having toxic waste that has to be buried as an end product.

The method was tested in laboratory conditions with industrial sewage of galvanic industries in Israel ("Mizape Bialik", "Karmo-chrome", etc.) and with model solutions containing high concentration of heavy metals (Cr^{+6} – up to 500 mg/l, Zn^{2+} up to 500 mg/l, Ni^{2+} – up to 30 mg/l). We succeeded in obtaining treated water with adequate indices (general chrome – 0, zinc – 1.0 mg/l, nickel – 0). The results of the sediment analysis held at Ben-Gurion University in Beer-Sheva showed ferrites content of up to 80%, which makes it usable in some industries (a preliminary agreement was reached with some companies in Israel and abroad).

At present, a stationary and portable versions of an automated system are being developed for flow rates of 0.5 m³/h. The preliminary evaluated cost of system operation is comparable to that of the existing equipment.

Brief description of the technological process

The sewage treatment process consists of three main stages: galvanic coagulation, ferritization, and dehydration. Galvanic coagulation is a standard process conducted in reservoirs filled with coke and metal cutting. As sewage is carried through the filling, it is enriched with cations of iron (II) and its acidity is reduced. The generated cations Fe^{2+} being a reducing agent react with chromate-ions reducing hexavalent chrome to trivalent chrome cation:



Furthermore, iron is oxidized to trivalent cation and oxide is consumed.

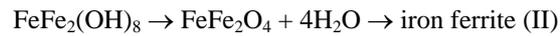
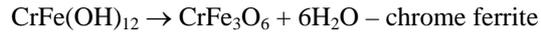
The second stage (ferritization) is performed in a sequencer of steps so that in the beginning non-dissolvable complexes of bivalent and trivalent metals and trivalent iron are produced.



Then they are dehydrated under energy action (application of magnetic field) and amorphous sediments are turned into an ordered spinel type crystal structure:



In particular, crystal structure zinc ferrite ZnFe_2O_4 is generated, which is virtually insoluble in diluted acids and alkalis.



Ferrites (unlike hydroxides) have virtually zero solubility. Mostly, the residual concentration of heavy metals in treated water is higher than 0.003-0.005 mg/l.

The dehydration process is considerably facilitated owing to crystalline structure of ferrites, which eases filtration; moreover, the use of a flocculent accelerates their sedimentation, namely extraction from treated water. Hydrated sediment is subject to drying in order to bring it to the needed condition. Since standard dehydration and drying equipment is used, no additional costs are involved.

Laboratory tests on the dehydration method were very successful. Industrial tests of the first pilot system are scheduled to February 2002.

**EVALUATION OF NATURAL WATER RESOURCES IN ISRAEL
AND ELABORATION OF METHODS OF THEIR PROTECTION
FROM POLLUTION AND EXHAUSTION**

Krasilshchikov Leonid

The Middle East is on the verge of ecological crisis, its main reasons being shortage of water resources, their exhaustion and pollution. The collisions between the countries of the region become especially strained in the periods of water shortage, such as the year of 2001. All the countries of the region suffered from acute decrease in water supply to the agricultural complex. Constant calls for water redistribution, wide use of desalinated sea water, transfer from water-abundant countries are heard.

Nonetheless, in spite of the extremely aggravated situation, no corresponding investigations of the current situation (except for Kinnereth water resources) are being implemented, to study the changes taking place in the total area extent and in specific underground water lines, their chemical composition, pollution and exhaustion. No geological structure of the territories is specified, to expose possible depth collectors of underground resources. No analysis of the existing resources is implemented, to provide forecasting of conditions of their perspective utilization, both from the quantitative and the qualitative points of view, no water distribution in the bordering zones is studied.

To solve the problems related to rational use of water resources, their protection from pollution and exhaustion, it is necessary to understand clearly the mechanism of formation, movement and relief of water within the limits of specific regions, and to predict changes in this mechanism under the impact of man's engineering activities.

The water resources of Israel and other countries of the Middle East are formed mainly at the expense of atmospheric precipitation, which is estimated as reaching the average value of about 10 mlrd m³ in Israel. Precipitation is distributed irregularly in time (both in terms of long-term observations and over separate seasons of the year) and throughout the territory. In long-term observations, dry, average and water-abundant periods are distinguished, with considerable differences in the scope of precipitation. Thus, for the basin of the Mediterranean Sea (the Israeli section) the average annual amount of precipitation comprises about 5-6 mlrd m³. In a water-abundant year the corresponding value increases almost twice as much, and in a dry year it falls down to the value, which is 2.5 times less than the average one. Similar is the situation in other regions. The corresponding territory indices show average annual differences ranging from 1000 mm in the north, 500-600 mm in the center and 15 mm in the south of the country.

The atmospheric precipitation is consumed on the surface drain, which is mainly concentrated in numerous streams and presented in the form of cloud-burst flows following rains. Use of the main streams in the Mediterranean

basin and of the Kinnereth lake is systematically observed (for 15-40 years). The Dead Sea streams have not been studied adequately. There are data reflecting surface drains for 5-6 streams, out of the general number of 50-55 flows. The annual average value of the drain coefficient, i.e. the ratio of the drain volume to the quantity of precipitation, is 0.048, reaching 0.13 in a water-abundant year. At the same time, the corresponding value in other regions of the world, including those in dry countries, ranges from 0.5 to 0.9.

The value of evaporation in Israel actually has not been studied. The corresponding literature provides data related to the evaporative power, i.e. the quantity of moisture which can be evaporated from the water surface.

Infiltration of cloud-burst flows has been studied in Israel for plain and mountain zones within the limits of the Mediterranean hydrological basin. Due to these studies, the average annual index of water-bearing complexes infiltration supply reaches 580-600 mln m³. The corresponding value for a water-abundant year is 1250 mln m³.

The main sources of the Israeli underground waters, those of the sea coast and of the mountain regions, are the main subject of researches. These sources are intensively exploited, and, subsequently, undergone intensive processes of exhaustion and pollution. Development of these processes, mechanism of their distribution, both surface and sectional, perspectives of their further impact on the quality and quantity of the underground water at various sub-elevations remained practically unstudied. There is a necessity to put in order the knowledge related to the state of the underground hydrosphere and the processes effecting it, including technogenic processes.

It is proposed to study of the underground hydrosphere current state by means of development of a set of hydro-geological maps. The map will reflect not the situation of the source as a whole (as provided by materials of the institutions engaged in hydrological services), but that of specific sub-elevations, which render to be independent underground objects of water exploitation. The maps will characterize both surface and sectional distribution of sub-elevations, their lithologic composition, parameters and water abundance of deposits, the chemical composition of the underground water. The set of maps will enable to distinguish the currently existing and the perspective interconnection between the sub-elevations, between separate phenomena taking place in them. The hydro-geological maps will enable to elaborate mathematical models and to forecast the conditions of further exploitation of the complex, the potential of the output increase, to expose dangerous development and distribution of processes of both surface and sectional exhaustion and pollution. The final result is the scheme enabling elaboration of measures for management, integrative and rational use of water resources, preserving favorable natural conditions of the environment and providing protection of water resources from their exhaustion and pollution.

CONTROL OF WATER PURIFICATION AND DISINFECTION IN SEWER PROCESS

Manusov Efim

The problems of control related to sewer processes are very complicated due to the following reasons: first, it is impossible to use regular continuous methods of analysis of water quality parameters in sewer processes for they are continuous themselves. Second, the lack of controllability in many sewer devices.

Hence we have three main problems which have to be solved in order to create a control system of sewer water treatment process (SWTP). First of all we should select that minimal set of water quality parameters which is necessary for estimation of a given SWTP. Then we need to develop such methods of measuring for these parameters that would allow us to use the instrumentation. And, finally, we need to modify the SWTP in order to provide the required controllability.

All these problems were solved in development of a sewer process for a simultaneous purification and disinfection of water. The process was implemented with usage of combined complex devices (CCD) comprising a germicidal filter and UV-reactor connected consecutively in a special way. Such CCD increases the germicidal efficiency at least in 2.5-3.0 times comparing with the separate elements it comprises. It provides a good controllability, as well.

The turbidity and colourness of the water are the main factors that affect the microflora inhibition effect and UV-irradiation. Without their discrete measuring one can not implement an efficient control system of SWTP with a usage of CCD. In order to measure the turbidity a nephelometric method is presently used while for colourness measuring a visual comparison of the colour of the tested water with a platina-cobalt solution of various concentration is used. The microflora density is presently measured only by complicated bioassays.

It is known that the microorganisms when exposed to UV-irradiation, adsorb a certain part of this irradiation and it, actually, provides the existence of the disinfection process. The value of UV-irradiation dosage absorbed depends on the UV-light wavelength and the type of microorganisms. Thus, in a monochromatic radiation through a stratum of microorganisms, the intensity of the radiation in the special cell length L will depend according to Beer's Law, on the L value and absorption coefficient K_a while the latter is defined by the total microflora intensity in the cell, the types of microorganisms comprising the microflora and, mostly probable, by the number of every type of microorganisms. The difficulty lies in the light scattering by the cell substance.

In order to reduce the light scattering influence a new method is proposed. This method presumed a comparative photometric measuring of the monochromatic light transmitted through two cuvettes, one of them containing water with microorganisms and another one containing filtered disinfected water. The both cuvettes have identical opalescent plates in the output of the transition beams. The required properties of the opalescence are uniform, moderate and constant opalescence over a wide range of light wavelengths. By using different opalescent plates the absorption spectra of microorganisms were measured and they ranged from 220 nm to 1300 nm. It was found that the value of UV-radiation wavelength which provides the maximal light absorbance for *E. Coli*, bacterial viruses, yeast, etc., is approximately 261 nm, i.e. the value lies between the germicidal effectiveness wavelengths for low and medium pressure UV-lamps.

The control system must include a flowing transmitted cell and automatic driving pump and spectrophotometer must be equipped by special device, generated quantity of which would be a control signal for automatic drive of pump. For water of low turbidity (less than 0.7 NTU), it is possible to use control system which is reacting on disturbance of microorganism density of water in hygienic set. However, in this case it is difficult to calibrate the spectrophotometric special device, that there are different species of microorganism have a different UV radiation absorption. On practice, the control systems have a discrete or relay control law, that is the disinfection and purify system the threshold of microorganism density must be kept definite only by working condition.

Feedback loop of control system can also be used for calculation of generalization coefficient K , which refers to microorganism species in germicidal water. It allows to create the computer-aided control system, which allows to optimize the microbial inactivation process. The method of numerical calculation of inverse tasks is used for coefficient K calculation.

**INFLUENCE OF DOMESTIC FILTERS CONSTRUCTION ON
ECOLOGIZATION OF MUNICIPAL COMPLEX AT
UNDERGROUND WATER SUPPLY**

Manusov Lidia

Ecological medical problems associated with water supply essentially affect the volume of water consumption in urban conditions. The more complex the water pipe network, the greater the probability of water loss because of appearing disrepairs in water-supply system. Highly effective domestic filters make it possible to essentially simplify the water pipe networks and therefore to decrease water consumption and to exclude entrance of pollutions from potable water into municipal wastewater and to raise effectiveness of local or town wastewater treatment plants.

However, the simplest and the most widespread domestic filters as a sorbent use activated carbon that not appears to be a place for reproduction of microorganisms that aggravate initial quality of fresh water. Our experience shows that processing activated carbon with AgNO_3 solution makes any filter suitable for fresh water disinfection. Processing activated carbon in such a way before putting it into a filter we will receive a widely applicable domestic filter.

Such approach especially important in Israel where aquifers appear to be the main sources of fresh water (Ashdod and its environs are a Coastal Aquifer). Bacteriological standards for drinking water state for a Coastal Aquifer that if routine microbiological test reveals more than three coliform microbes and/or one fecal coliform in a water sample of 100 milliliters, such water is unfit for drinking. Dozens of thousands of tests on the microbial quality of drinking water are conducted every year by Mekorot and by local authorities under the supervision of the Ministry of Health [1, p. 27].

Thus, in such large cities as Ashdod and in underground water supply system only usage of effective domestic filters will be able to ensure drinking water quality stability.

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**SILICATE SORBENTS FOR SOLUTION
OF ECOLOGICAL PROBLEMS OF ISRAEL
Manusov Nonna, Martynov Tatyana, Rudnik Michael**

Silicates, which are salts of silicic and alumo-silicic acids, are generally associated in our apprehension with components of the earth crust (natural silicates actually constitute 80% of the earth crust ore-forming minerals) or with various silicon-based materials, such as ceramics, bricks, cement, concrete, fireproof materials, glass and even silicate dyers. Much less people are aware of the sorbing capacities of some types of silicates (such as zeolites – alumo-silicates, the crystallic structure of which is formed by tetraeristic compounds of SiO_4 and AlO_4) or of the possibility of obtaining from them filtration materials [2] with high keeping capacity, for instance, as of 2×10^4 avogramm order. These can be obtained on the basis of fireproof clay, burnt up to the condition of loosing plasticity, and colloid clays formed from volcano tuff and ashes in the sea bottom, shamot-concrete filters combining high keeping capacity and sorbing properties.

Quite an important factor of using silicates for ecological purposes is their wide distribution, including in our region, as well as distribution of technology for obtaining from them various materials by processing in tunnel stoves, both of periodic and non-stop operation modes [3,4].

To understand the use of silicates for ecological purposes, let us consider the natural ecological peculiarities of our region (Middle East Region – MER) [5].

Applying the modern ecological approach to MER conditions [5], the main indicator of sustainability for MER to be accepted is that of the fresh water resources (FWR) condition. It is known that the main FWR in Israel and other MER regions, as well in some other regions are underground aquifers, for example, the two largest Coastal and Mountain aquifers, and others [5]. Subsequently, the natural ecological peculiarity for Israel is its ultimate (excluding the Negev region, which is also quite vague) hydrological sensitivity (HS) to technogenic and generally anthropogenic environmental impacts (AEI). In generally accepted terms, this means that the largest part of Israel actually constitutes a sanitary zone (SZ), where any discharge of untreated industrial and municipal wastewater (UIMWW) and solid and toxic wastes must be forbidden, highways and railway tracks cannot be constructed, fuelling stations and wastewater collectors cannot be maintained, which render to be impracticable [5]. It is necessary to exclude any possibility of the underground layer pollution and to provide an utmost use of local purification schemes and special ecological barriers for industrial and agricultural waste installation appliances, parkings, etc.

MER as a whole and Israel in particular constitute an almost total SZ; small industrial enterprises are predominant here, and their industrial wastewater per unit of product is 10 as much as that for large industrial plants. Subsequently,

regular local wastewater treatment plants (LWWTP) are not efficient here and render to be economically unjustified. It is thus practically impossible to apply here the experience of developed industrial countries. As a result, a typically “oriental” solution has been accepted: to construct group WWTP and to transfer the industrial wastewater through the collectors used by the municipal authorities. First, this may cause penetration of WW into underground aquifers, and, second, the industrial WW pollution may cause inhibition of biological WWTP, which prevents from obtaining the permissible level of microflora at the output WWTP, as it has been discovered in Jerusalem at the new group purification appliances [6].

Finally, a new politico-ecological peculiarity has recently appeared, i.e. presence of both Israel and the Palestinian authorities within one mountain aquifer [7]. The only possible solution is establishment of politically agreed common sustainable FWR management [8]. In other cases the solutions must be technical and, to our opinion, with use of silicates and silicate-based materials.

First, silicates and silicate-based materials, as, for instance, modified zeolite and ceramsite, can be used for purification of sewage and natural waters [2].

Thus, zeolite, which is obtainable in our region, can be used in the minced form in HWWTP metal processing enterprises, in automobile workshops and fuelling stations for the first stage of purification (with further purification by means of mezzo-porous natural coal [9]), for filters mounted in wadi ravines near agricultural husbandries, garbage-piles for solid wastes, roads and railways, or in special drainage ravines walling-up the above objects (Table 1).

Table 1. Filtration through minced zeolite

| <i>Pollutions</i> | <i>Pollution concentration in initial water, mg/l</i> | <i>Pollution concentration after filtration, mg/l</i> |
|-----------------------|---|---|
| 1. Petroleum products | 0.70 | 0.09 |
| 2. Chlorides | 734.0 | 192.0 |
| 3. Sulphates | 100.0 | 43.7 |
| 4. Iron | 2.97 | 0.52 |
| 5. Lead | 0.01 | 0.0025 |
| 6. Nickel | 0.01 | 0.0057 |
| 7. Zinc | 0.11 | 0.046 |
| 8. Chromium | 0.015 | <0.01 |

Ceramsite can be used for purification of natural water from iron [8], and as ceramsite-concrete – in erecting parking plots, as well as in organizing garbage-piles for solid wastes.

For distillation of drinking water supplied to the consumer, ceramic bacterial filters can be used, which are obtained from specific types of clay soils (with $Al_2O_3 \approx 37\%$) and an electrocore component. Such filters are characterized by

high keeping capacity (~10.0 l/m² per hour and more). These filters can function under temperature up to 300°C and water pressure up to 3.0 Mpa. The filtrating material can also be used for keeping mechanic additives (selectivity up to 80-95%), ash components (selectivity up to 75-90%) and asphalt-tar compositions (selectivity up to 40%). In general, these filters are implemented in a form of hollow “candles”, but they can also be made as long (up to 1.0-1.2 m) pipes and even plates, which enables to use them for the purpose of walling-up water wells, purification of drainage ravines of agricultural wastes, in so-called rain sewage ravines, i.e. for highways and many other objects. The method of the filters re-generation depends on the field of their application. They can be produced in our conditions, since they need the same equipment as that used for production of ceramics [3,4].

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**AQUAMIN PLANTS FOR WATER
TREATMENT AND DESALINATION
Medvedev Igor, Edelson Israel, Manusov Nonna**

The 30-year experience in creation of water purification systems was connected with creation of the unique technology, apparatuses and materials for water treatment which have no analogues in the world practice.

The principal achievement of Aquamin is creation of demineralization plants for sea and artesian water without application of any chemical reagents at the minimum power, operating and prime costs.

The method of Aquamin is surprisingly simple, cheap in operation and perfectly pure with respect to ecology. Aquamin plants are characterized with stable output parameters (TDS), lower sensitivity to mechanical contamination and bacteria, lower sensitivity to free chlorine.

Comparative Table

| PLANT PARAMETERS | REVERSE | OSMOSIS | AQUAMIN | |
|---|---------|---------|---------|-------|
| Plant Capacity, m ³ /day | 328 | 1000 | 6480 | 12000 |
| Operating Temperature, C | 25 | 25 | 25 | 20 |
| Max. Temperature, C | 30 | 30 | 30 | 55 |
| Recovery Rate, % | 70 | 65 | 60 | 85 |
| Feed Pressure, bar | 27.6 | 28.4 | 15 | 3 |
| Feed TDS, mg/l | 2724 | 1955 | 1735 | 1599 |
| Product TDS, mg/l | 300-500 | 300-500 | 300-500 | 400 |
| Number of Operators | 3 | 5 | 12 | 3 |
| Number of Engineers | – | 1 | 2 | 1 |
| Power Rating, kW | 38 | 78 | 350 | 250 |
| Plant Availability, day/year | 340 | 340 | 340 | 350 |
| Membrane Replacement, years | 3 | 3 | 3 | 5 |
| Plant Life, years | 15 | 15 | 15 | 15 |
| Chemical Consumption: | | | | |
| Sulphuric Acid (98%), kg/day | 52 | 117 | 880 | 0 |
| Scale Inhibitor, kg/day | 1.4 | 4.6 | 32.8 | 0 |
| Caustic Soda, kg/day | 24.4 | 110 | 434 | 0 |
| Exhaust Chlorine Gas, kg/day | 0.3 | 1 | 6.5 | 0 |
| SPECIFIC PRIME COST, US\$/m ³ /day | 419 | 246 | 225 | 165 |

The technology of Aquamin represents the electromembrane process provides purification, disinfection and demineralization of water with higher efficiency than all other technologies. Aquamin combines four major water treatment

procedures in one efficient system. It combines electro dialysis, electrolysis, electroosmosis and electromembrane in one design configuration. Aquamin Company holds all the processes, apparatuses and materials, which are known in the world practice for demineralization and purification of water by filtration, ion exchange, sorption, reverse osmosis, electrolysis, electro dialysis, distillation, radiolysis, etc., which are provided since 1964 with patents of RST, Russia, England, Spain, USA, etc.

The equipment is very compact and its arrangement do not require large premises.

Range of plant capacities (m³/day): 2.4 12,000.

Lay-out of plant for brackish water treatment with capacity 2,400 m³/day is in two 20' containers; for sea water – in 5 containers.

Specific lay-out for sea water treatment – 2.0 m² per 1 m³/h of purified water.

Aquamin plants provide the following water treatment:

- from water hardness of 99.9%;
- from heavy metals and ferrum of 99.5%;
- from organic admixtures of 98%;
- from nitrates, nitrides and ammonia of 100%;
- from sulphuretted hydrogen of 90%.

Water purified by Aquamin treatment plants can be used in medicine, microelectronics industry, pharmaceuticals, photographic print, accumulator feeding, etc.

Today the Aquamin technology is used for multiple circulation of water in space orbital stations, for purification of technological water in any power stations in Russia, in the water supply system on the Balkhash Lake (Kazakhstan), at the plant for demineralization of artesian water in Chaco Valley (Paraguay), at the plant in Barcelona (Spain), at the plant of sea water desalination in Inchon (Rep. Korea), etc.

The application field of Aquamin plants is wide, including water demineralization for cattle-breeding, fruit and vegetable farms, demineralization of whey in diary factories, purification of water from nitrates, nitrites, arsenic, mercury, boron, etc.

Production of demineralized and drinking water may be combined with complex processing of solution into acid, alkali and solid mineral salts, which will enable to use these plants as harmless for the environment.

**INSTALLATION FOR DESALINATED WATER EXTRACTION
FROM INDUSTRIAL WASTES AND SEA WATER
BY MEANS OF THERMAL PUMPS**

Milov Michael, Popadin Alexey

The idea of using thermal pumps for obtaining steam condensate from liquids is not a new one, and it is widely used in technological processes related to chemical production.

The characteristic feature of these installation appliances is that the thermal pump forms a certain circuit or a zone with the environment, causing irretrievable losses of energy and heat.

Utilization and secondary use (re-cyclene) of heat with utilization of hydraulic losses within the circuit has been implemented in the "DISKOP" installation as proposed the Israeli authors (M. Tuval, "Technological repository", Ariel).

The disadvantage of this installation is the unstable functioning of the evaporation – condensation circuit and tough interdependence between the regime and physical chemical parameters of the functioning milieu.

We developed general principles of the appliance herewith proposed, which is devoid of the above disadvantages. The proposal is based on technical solutions as follows: 1) Utilization of the waste low-potential heat and of the heat re-cyclene by means of two thermal pumps. 2) Use of the thermodynamic cycle temperature pressure between the low- potential heat carrier and the deeply cooled heat carrier, caused by the difference between physical properties of conventionally accepted pure water and dense saline solutions. 3) Division of the initial milieu into two circuits and creation of an aerodynamic stream, enabling to cause simultaneous absorption of aerosol from smoke gases and evaporation in the turbulent air stream. 4) Use of two sources for the milieu, one of which, i.e. the sea-water, is practically inexhaustible, which makes the installation insensitive, in terms of its productivity, to expenditure of the liquid industrial waste. 5) Introduction of re-agents into the milieu, to exclude fall-out of salts from the temporary liquid in the evaporation and the condensation zones of the milieu inside the technological equipment. Simultaneous introduction of re-agents and division of the initial streams provide "insensibility" of the installation to the character and the quantity of pollution in the liquid industrial waste and possibility to function on the sea water.

The principal scheme of the installation is presented in Fig.1. All the equipment used in the principal scheme can be conventionally divided into circuits as follows: 1) The circuit of pollutants concentrate, in the form of a collector from the block of preliminary purification (IV), heater drainage (21, 33), separator collection (27, 28) to the tank for cooled pollutant collection with partial recycling (35). 2) The circuit of clarified initial milieu, in the form

of a technological cycle from the clarification tank (IV, 23, 24), through the heater (21), the evaporation- condensation block (12, 11, 1, 2, 3, 9, 10) with partial recycling (1, 2, 26, 27, 15, 18). 3) The aerodynamic circuit, in the form of the equipment blocks providing intensification of the evaporation process, pumping the hot air into the cycle, and hot gas vent into the cycle. The circuit includes an aerator (4), an air passage through the evaporation-condensation block (1, 2, 3), a gas turbo-generator (15, 17, 18, 19, 20), and ends in a heater (21, 22).

The three circuits described above are interconnected by thermal pumps providing recycling of heat with simultaneous input of the environmental warmth. The thermal pump of recycling drainage heat (29, 31, 30, 32) returns the heat to the cycle from the environment through the equipment (34, 35, 21).

The heat recycling thermal pump of the evaporation-condensation process (5, 6, 3, 7, 4, 8) returns the evaporation heat into the cycle and introduces the heat with the environmental air (4).

The first and the second circuits are maintained by system of re-agent input (III). Introduction of re-agents into the system enables to provide as follows: 1) To protect the equipment from salt rigidity. 2) To implement neutralization of the obtained condensate and acids, absorbed from smoke gases, which will enable to protect the equipment from corrosion. 3) To create conditions for “insensitivity” of the installation to the character and the quantity of pollutants in the milieu; to provide reliable functioning under use of sea water.

The liquid industrial waste and the sea water (25) are supplied to the input tank (23) after the block of mechanical purification (IV), which is installed at each one of the streams. The scope and the parameters of purification are determined according to the water quality of the streams in each concrete case. Re-agents are introduced into the tank (23) by means of a batcher pump (13). The two streams of the processed milieu are introduced to the heater (21).

The first stream is introduced through a tube serving as condenser to the mixer (12) after interim purification.

The second stream is dispersed and introduced to the smoke gases, which are supplied to the heater as warming milieu. The direct contact of smoke gases with the dispersed liquid milieu provides simultaneous passing of two processes: absorption and evaporation. The steam enters the tubes, which are cooled by the first flow, becomes condensed and discharged again to the contact zone. The liquid milieu from the contact zone of the heater (21) is discharged through the neutralizer (33) to the drainage cooler (29). The first of the two divided streams enters the dispersing evaporator (1), where it is intensively evaporated in the stream of hot air. The vapor, after having been separated (2), is supplied to the condenser (3), and the separated moisture and the milieu with high content of additives partially enters the drainage cooler

(29) through the regulating appliance (28), and the rest is supplied to the drainage heater (30).

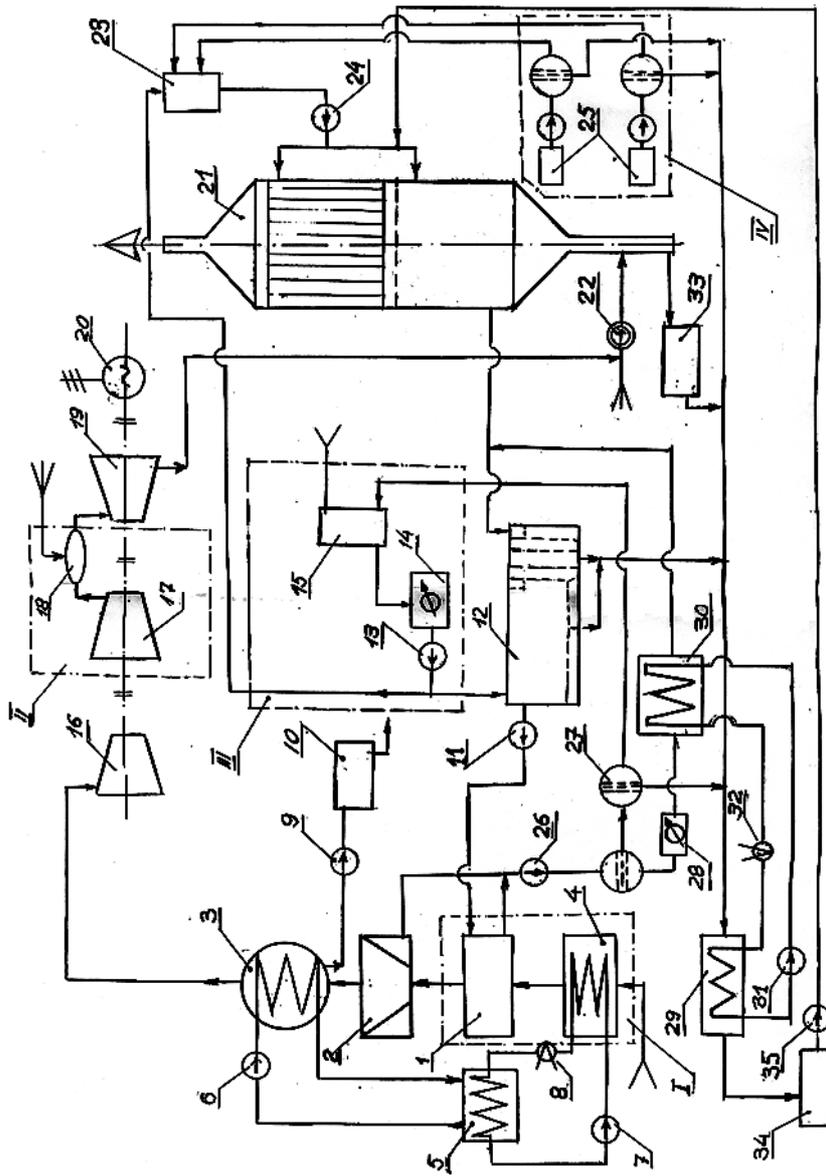


Fig. 1. The principal scheme of the installation for desalinated water.

The drainage cooler (29) and the drainage heater (30) are interconnected by means of the thermal pump (31, 32). The energy (heat) potential of the concentrate, discharged from the cycle, is supplied to the part of drainage, which returns to the desalination cycle through the mixer (12). To activate evaporation in the dispersing appliance (1), an air stream is formed, while the input air is supplied through the radiator (4) and the condenser (3), which are interconnected by means of the second thermal pump (7, 8).

This pump provides a temperature pressure in the condenser up to 60-70°C and transmits the heat energy to the vapor-air mixture and evaporation heat to the air at the cycle input.

The air stream is formed by the turbo-expander, which is an appliance comprising an axial compressor with large-scale volume characteristics (16), the drive of which is the gas-turbine installation (17, 18, 19). The surplus power of the appliance is used for electric power production (20), applied to the own needs of the entire installation. The turbine 400-450°C exhausts are directed to the heater (21).

Upon functioning of the installation, desalinated water is discharged from the condenser (3) to the collector (10), and the pollutant concentrate – from the collecting tank (31) to subsequent dehydration and burial.

Thus, as a result of using low-potential heat discharged to the environment from the technological cycle of the industrial enterprise, by means of two thermal pumps, a two-fold problem can be solved: environment protection and production of desalinated water as a by-product for technical needs.

The novelty of the technical solution above is in elaboration of three technological cycles working with different milieu, the concentrate of pollutants, the clarified water and the air, with are interconnected by means of thermal pumps. For the first time two thermal pumps are used directly in the cycle, and not as junction components.

The heat streams directed to heat re-generation and heat exchange intensification in contact evaporators are efficiently used, providing heat exchange in the process. Simultaneously, the two-fold problem of smoke gases “moist purification” and liquid industrial wastes neutralization has been solved. The installation is inert to the character of pollution and the range of expenses, and it is easily adjusted to any kind of liquid waste products and their solutions of any quantity and any ratio characteristics of their components, which provides its universality. Depending on the physical-chemical composition of pollutants and on the local conditions, the quantity of residual water in the brine and the problems related to its further utilization are determined.

**METHODOLOGY OF STUDYING THE IMPACT
OF FRESH WATER COMPOSITION ON HUMAN HEALTH**
Moskovich Iliia

Fig. 1 presents by means of an algorithm the methodological scheme of such studies. On the basis of a priori known interrelations between types of water pollution substances (WPS) and types of diseases (TD) (see Table 1), there are distinguished WPS substances which are included in fresh water supplied from the source in question (WR). Analysis of the range of changes in WPS is provided, chosen as principal indices (PI). Statistical evaluation of PI impact is maintained, based on the knowledge of interrelations between types of WPS and TD (Table 1).

Table 1. Interrelations between types of WPS and TD.

| <i>No.</i> | <i>Types of Pollution</i> | <i>Types of Diseases</i> |
|------------|--|--|
| 1 | Bacteria and viruses | Acute intestinal diseases, viral hepatitis, viral diseases |
| 2 | Chlorine organic hydrocarbons | Poisoning |
| 3 | Chlorides and sulphates | Gastric-intestinal, cardiovascular, deviations in the urination system, urolithiasis |
| 4 | Nitrogen and chloride containing compounds | Chronic nephrites and hepatites, toxicosis of pregnancy, inborn development anomaly |
| 5 | Nitrides | Suppression of haematogenic activity |
| 6 | Boron, bromine | Diseases of children's digestion organs |
| 7 | Aluminum | Depressing impact on the children's central nervous system and the immune system |

Quantity of the above compositions in one the aquifers is provided below in Fig.1.

One of the important elements of the methodology is grouping of components. The first group of WPS comprises bacteriological and parasitological indices, color and turbidity of water, as well as content of polycyclic aromatic hydrocarbons. As a rule, it works well to solve the problem of disinfection, except for cysts (regular methods of rectification).

The second group of WPS includes oil products, synthetic space-activity substances (SSAS), sulphite-recurring agents and viruses, i.e. WPS with moderate efficiency of rectification.

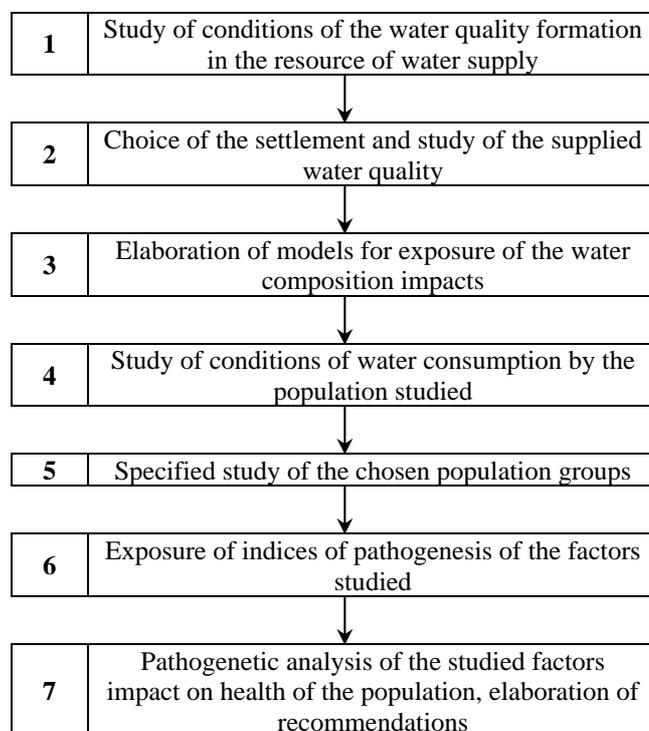


Fig.1. Algorithm of the investigation methodology for studying interrelation between water composition and the state of human health.

The third group of WPS includes ions of heavy metals, nitrogen containing compounds, radio-nuclides, the saline composition. To exclude the components of the WPS 3rd group, special methods of rectification are needed, including sorbing and oxidation-sorbing facilities and even desalination methods.

To the fourth group of WPS we refer secondary pollution, such as aluminum components resulted by processing active chlorine, carcinogenic by-products of chlorination, formaldehyde at ozonization and other by-products of chemical transformation in the process of primary rectification.

Study of diathesis (predisposition) of the risk group (RG) to diseases must be combined with simultaneous observation of a large group of population, in order to obtain information on frequency of various diseases and, specifically, on indices of their development. Formation of representative excerpts is made due to features related to age, sex, specific situations (such as pregnancy).

A SHORT REVIEW OF MIXING AND DISPERSION METHODS AND EQUIPMENT

Nudelman Max, Gorovetz Petr, Nudelman Nora

All mixers used in different branches of industry, including paint and varnish industry, were borrowed from inorganic industries: batch mixers and mills of different types (anchor, roller, pneumatic and ball mills).

Standard mixers are usually classified according to the type of processed materials: loose material, liquids, low-viscosity liquid materials and high-viscosity materials; to the method of mixing: mechanical, gravitational, pneumatic or hydraulic; and to the mode of operation: periodic or continuous.

Practically all standard mixers are bad dispersants because working elements of devices do not contribute much to the process whereby dispersion is achieved: collision and friction of particles against each other. Therefore mechanochemical effects of dispersion (as the first stage of modification) practically do not occur in mixers designed for treatment of loose and low-viscosity materials. Mixers for high-viscosity materials have low efficiency.

The necessity to combine modification of processed materials with dispersion and rapid homogenization has led to the use of mills, extruders and other devices comprising elements of the former. A high gradient of force action in these devices is achieved by a high-speed rotation of dispersing elements which are uniformly distributed throughout the mixing chamber. In so doing, distinctions are blurred between mixers for loose and high-viscosity materials as well as distinctions between different methods of mixing by standards mixers.

As can be seen from literature, operating experience with some of these devices (for example: disintegrators, cavitation mills and rotary pulse devices) in inorganic industries indicates that highly efficient mechanochemical processes may be conducted using such devices. Changes in reactivity, solubility, heat capacity and other properties have been reported (T.C. Khodakov "Physics of Milling". Moscow, "Nauka", 1973). However, in most cases these changes do not occur in high-molecular substances used in production of paints, glues, varnishes, etc.

Analysis of the causes of non-acceleration of pigments homogenization process in film-forming substances revealed that one of the main anti-acceleration factors, common for most heterogeneous processes in disperse systems, is a method of application of energy to such systems.

In this context it becomes topical to develop high-efficiency mixing-dispersing devices to be included in a system for a high speed processing of composite polymer systems used in production of varnishes and paints. Such devices should ensure the production of highly dispersed liquid polymer systems and polymer-pigment compositions.

TECHNOLOGY OF VIRUS DESINFECTION IN WASTEWATER

Palchitsky Alfred, Mirmov Naum

All objects of environment are polluted with viruses. The municipal wastewater, wastewater from agricultural farms (stock-raising farms, poultry farms, slaughter-houses) and food industry plants (factories for processing milk and so forth) are the most polluted with viruses. Viruses are discovered in 64% of assays of wastewater. Technologies of biological treatment of wastewater are the most applicable. These technologies use aerotanks, biological filters, or biological ponds. These devices have systems of mechanical, hydrodynamic, or pneumatic aeration. For example, no more than 54-59% of viruses in wastewater can be desinfected depending on a construction of aerotanks and of their aeration system. The viruses do not perish in biological filters of any construction.

The effectiveness of using chlorine for virus desinfection in treated wastewater is 37-58% (residual chlorine is not less than 1.5 mg/l). The effectiveness of virus desinfection can be enlarged up to 91% if big doses of chlorine are used (residual chlorine is more than 10 mg/l), but thus the considerable quantities of halogens with carcinogenic and mutagenous properties get in water sources. The proposed technology of virus desinfection in wastewater is based on biological treatment method. Principle of process partitioning into several phases is a distinctive feature of the offered technology. For this purposes, aerotank is divided onto three compartments. Improved system of pneumatic aeration containing disk aerators is put into the two outer compartments. This aeration system intensifies the process of activated sludge saturation with oxygen of air, and the efficiency of oxygen use achieves 15-20%. The existing systems of pneumatic aeration provide efficiency of oxygen saturation no more than 8-10%. The central compartment of the aerotank is divided into three parts: central part and two lateral parts for gravitational precipitation of suspended particles. To intensify the precipitation of activated sludge, the central part is fabricated as a regulation device of a lamellar type. The plates of regulation device can turn onto a necessary angle concerning the stream. The application of regulation device of a lamellar type accelerates precipitation of particles by 10-12 times. Thus, we purge water in two stages of oxygenation and in two stages of gravitational precipitation. This technology raises the intensity of absorption of viruses and of pathogenic microflora by activated sludge by 1.8-2.0 times. Wastewater treated according to the offered technology may be used for watering fields, parks, and gardens, replenishment of pools for fish breeding, and for any other technological needs without any restrictions.

The technological cost of treatment of 1 m³ of wastewater with complete desinfection of viruses and of pathogenic microflora is \$0.03-0.04.

HIGH INTENSIVE FLUIDIZED BED DISSOLVER/MIXER

Radin Sergey

The main aim of the project is elaboration of compact apparatus, which provides high dissolving/mixing output of reagents at full keeping the molecular structure of reagents.

The project is based on "fluidized bed apparatus" idea that has to do with intensive mixing of solid particles, when liquid moves in vertical direction through the apparatus. Solid particles interact with current of the liquid and pass into "fluidized" condition and form "fluidized bed". In "fluidized bed" condition they shift and run around chaotically along the whole volume.

When they move, the solid particles carry away a part of liquid, which provides its intensive and equable mixing inside the apparatus. At the same time, particles of dissolving reagent or solid particles of suspension, trained to separation/thickening, mix intensively.

Use of multisectioned fluidized bed dissolver/mixer allows to improve technological characteristics of some processes. The essential advantages of multisectioned mixers/dissolvers are:

- high intensity allowing to increase the productivity repeatedly;
- complete reagent dissolving without any destruction of organic macromolecule structure;
- formation of floccules, uniformed in sizes and provided the best conditions for precipitation/thickening;
- creation of solution with identical dissolved reagent concentration all over the solution volume.

Besides, it is necessary to point out that there are no mechanical rubbing details in the apparatuses.

Experimental investigations, carried out at pilot and industrial conditions showed high efficacy and reliability of apparatuses. They also showed that we have possibility to increase productivity by 50-70% or to reduce flocculant expense by 40-60%.

The conducted patent investigation makes it possible to state that the proposed project is an absolutely new solution and has features of novelty needed for patenting.

**NEW SUSPENSION INPUT DEVICE
FOR VERTICAL AND HORIZONTAL THICKENERS
Radin Sergey**

The project concerns to separation and/or treatment processes of manufacture suspensions and sewage.

Nowadays a lot of technological schemes, concerned with ecology, such as sewage treatment, separation and thickening of industrial suspensions, maintain vertical and horizontal thickeners.

Vertical thickeners (height \gg diameter) are employed for separation of suspensions with quite large solid particles. The efficiency of the process is defined by liquid movement from suspension input installation into liquid outlet one, by its situated pulsation and rotation, by equability of solid particles distribution along the thickener surface.

I propose a new suspension input device, carried out at spiral rectangular form with a crevice, situated in its lower part. Such execution of input device allows the suspension to precipitate in the settler equability all over the thickener area. Besides the input device shape prevents from appearing of intensive pulsation and turbulence.

All these stabilize the liquid movement and decrease its mixing in the thickener. At consequence suspension separation conditions improve and this lets to raise the separation effectiveness and/or to increase the settler output. The suspension input device proposed was manufactured as a 7 m diameter settler. The investigation showed that this new construction allows to raise the vertical settler efficiency by 35-50%.

The horizontal settlers (height \ll diameter) are employed for thickening and clarification of suspensions maintaining very small particles. As a rule, to increase the thickening velocity auxiliary surface active substance – flocculent is added into the suspension to promote particles aggregation.

There is worked up the suspension flocculent mixer based upon a “fluidized bed” idea. In this mixer, both currents are mixed heavily and the flocculent disperses equably all over the suspension volume. This generates formation of equal sized big flocculates coming down at equal velocity. Some different mixer constructions are suggested for different suspension types.

The trials accomplished at horizontal, 24 m diameter settler showed that the “fluidized bed” mixer allows to decrease the flocculent expense by 30-40% or to raise the settler productivity by 40-50%.

**AUTOMATIC SORPTION DEVICE FOR WASTEWATER
TREATMENT FROM PETROLIC POLLUTION
Tarnopolsky Marina, Manusov Nonna, Shatz Naum**

When we select a method for wastewater treatment from petrolic products at vehicle service enterprises in Israel we should take into account such factors as shortage of water supplies and therefore the need for wastewater recycling, the fact that wastewater is moved to urban sewage, shortage of industrial areas, high concentration of vehicles in the country and, subsequently, a great number of vehicle service enterprises. All these factors may be considered when devices with special sorbents are used. These devices provide a high degree of wastewater treatment and even enable wastewater recycling.

Sorption technology being used for wastewater treatment nowadays uses either expensive synthetic sorbents or macro/micropore coals activated according to special technology. None of these methods provides a high degree of treatment from petrolic products, because macropores are actually only transportation channels. On the other hand, although micropore coals with a pore radius of 12-15Å provide an effective action of sorption forces in the pore, but according to our researches, the volume filling of micropores in removal of petrolic products from water plays much less role than in adsorption of other components residing in the wastewater [4]. Moreover, one should take into account high cost of the coal chemical or thermal activation process and low mechanical durability of casual active coals that affects the treatment devices operation durability.

Therefore we searched for natural coal sorbents that 1) do not have the aforesaid disadvantages, 2) do not require any activation, 3) have a specific surface of over 20 sq.m./gr and a high mechanic durability. Such sorbent was found among long-flamed non-cooking coals having a low-degree metamorphism with pores of 35-40Å of diameter and pore volume of 0.3-0.4 ml/gr [2]. The high sorption ability of these coals that according to Dubinin's classification are called mesopore coals, and their efficiency as sorbents allow us to exclude activation processes, simplify the technology of transforming them into sorbents, and reduce the costs. This transformation can be performed on the base of their exclusive discharging, crush and dispersion [4].

The sorbent is produced by MIU-SORB from Russian coals in three fraction types: MIU-S1 (particles of 2.0-5.0 mm), MIU-S2 (1.0-3.0 mm), and MIU-S3 (0.5-1.0 mm). Usage of non-cooking coals for MIU-S sorbents enables their complete utilization as a fuel, which is extremely important in the conditions of Israel.

The sorbent can also be used for extraction of phenols and heavy metals ions. Moreover, it meets the technical and hygienic requirements for its usage in water supply systems.

We propose a pressure adsorption filter of columnar type with descending direction of stream called MIU-Sorber (Fig. 1) and manufactured by MIU-SORB Ltd. as an adsorption and filtration set. This set requires periodic washing by contradirected stream with speed that provides enlarging of sorbing layer by 1.2-1.4 times. It also requires periodic regeneration of the sorbent by hot water and alkali.

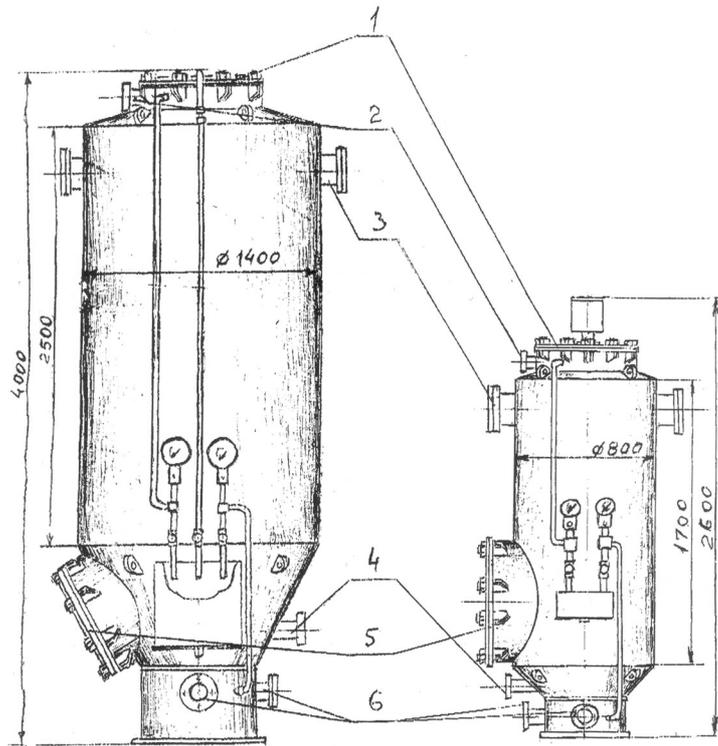


Fig. 1. MIU-SORB filters for water purification.

- 1 – hatch for sorbent charging
- 2 – pipe for water transfer for purification and removal of polluted water after cleaning
- 3 – illuminators
- 4 – pipe for hydraulic removal of sorbent
- 5 – hatch for mechanic removal of sorbent
- 6 – pipe for filtrate removal and for cleaning water input and output

The working speed of wastewater filtration is selected according to the conditions of adsorption processes invariety and the hydrodynamic mode of the device. As we know, the diffusion criterion of Nusselt does not depend on

hydrodynamic mode when the Reynolds criterion is big enough. It gives the possibility to calculate the dynamics of adsorption process using the kinetic coefficient of internal mass transfer. Here we must take into consideration the necessity to keep the invariety condition during the whole period between washings, i.e. we must ensure that a certain Reynolds criterion will be higher than rated within the possible range of flow speed.

The researches of adsorption dynamics of petrolic products removal from wastewater by selected mesopore coals show us that the value of adsorption constant is high enough (differential reduction of the free mol energy in adsorption is higher than 20 KJ/mol). It gives the possibility to assume the flow speed ranging from 6 to 9 cu.m./sq.m.h. It is assumed that the working line of the adsorption process corresponds to the relation of Zeldovich along with the whole range of flow speed variations.

The process of adsorption is limited only by the internal transfer mass within selected water flow speeds; the dynamics of adsorption considerably depends on the size of the sorbent particles. The aforesaid variants of sorbent fractions (MIU-S1, MIU-S2, MIU-S3), as the researches show, provide selected total output adsorption curves for a sufficiently wide range of variations of the initial concentration of the adsorbed product. It is possible to calculate the necessary residence time of wastewater in the device and the optimal height of sorbent layer for the conditions of diffusion stationary mass transfer [1].

The researches of MIU-Sorber as controlled object solved the problem of automation of this device. Special devices were used to control water level in the vessels, water flow output, pressure reduction, petrolic products and sediments concentration, etc., [3]. We developed a new method of automatic control of the limited period of sorption filter use between washings and of the periodical regeneration of the sorbent. This method was used for automation of the device. It increases the average efficiency of treatment process during the batch. It also prolongs this period to 2 years. This prolonged duration of each batch when the petrolic products concentration remains constant for 2 years, enables us to use a periodical (discrete) control of petrolic products concentration in the treated water without using complicated and costly devices of constant control.

The use of MIU-Sorber set for wastewater treatment from petrolic products reduces concentration of these products from 3.0-20.0 mg/l to 0.5-1.5 mg/l even during the first stage of processing. The final processing reduces their concentration to 0.1-0.3 mg/l with $\text{pH} \leq 7.5$ even if the water is resided by surface active substances products. When the initial concentrations are lower than the aforesaid, the stage of final processing is not necessary at all. Thus, it is possible to move wastewater to urban sewage and to use it for irrigation and, in some cases, for recycling purposes.

The high-degree treatment ability of this device is combined with reduced capital and maintenance costs: 2-5 times lower than the units using usual active coal. It also reduces almost by 2 times the size and the cost of purification installments.

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**RESEARCH ON INFLUENCE
OF DESALINATED WATER ON HUMAN HEALTH
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Shortage of fresh water of good quality now becomes an urgent problem for many countries in the world.

Wide inculcation of water-desalinating plants has lead to the need to conduct complex researches on state of health of people using desalinated water.

This work presents data on study of state of health of people using water of different mineral composition (group 1 – people using desalinated water; group 2 – people using water of optimal mineral quality; and group 3 – people using highly mineralized water).

To study state of health of cardiovascular system, we used methods of functional samples with load that provide greater accuracy for evaluation of possibilities of blood circulation apparatus. The research revealed that 8-10-year-old children using highly mineralized water suffered from increased systolic pressure. Yet, children using desalinated water as well as water with normal mineral composition had reliably lower systolic pressure.

To evaluate the natural reactivity of children using water of different degree of mineralization, we used methods of determining skin bactericidal and lysozyme activity.

Children using desalinated water and water of normal mineralization had high characteristics of skin bactericidal under different exposition as compared to children using highly mineralized water. Studying lysozyme activity showed similar results.

Thus, study of some characteristics of state of health of people using desalinated water for a long time shows its favorable influence on their organism.

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