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No. 141

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CONTENTS PAGE

CONTENTS (Continued) Page

USSR

WESTERN EUROPE

GREECE

1977 OUTLAYS FOR ENVIRONMENTAL PROTECTION INCREASED

Warsaw AURA in Polish Feb 77 p 1

[Text] Our New Year "message" contained some overly optimistic remarks concerning the implementation of the first stage of the comprehensive program to shape and protect the environment up to the year 1990. The fulfillment of tasks intended for 1976 is especially disappointing, particularly in the field of air pollution control. In many plants investments in air pollution control were not even initiated; in others they were implemented on a considerably limited scale. The steelworks Katowice and Lenin as well as the Miasteczko Slaskie Zinc Works, the cement plants Wiek and Ozarow, and Jaworzno II Electric Power Station were particularly negligent here. Neither did we complete the 1976 tasks in water pollution control. The greatest culprits are chemical plants (Police and Rokita), the food and procurement industry, and those plants subordinate to the foreign trade and maritime economy ministry (North Port). One must seek the reasons for this situation both in air and water pollution control in inadequate investment ceilings and in the lack of adequate processing power of the specialized enterprises. So, we start new tasks with a big ballast of deficits.

And what will the year 1977 bring us? The consolidated environmental protection draft plan for 1977 (according to ministerial and voivodship materials) allows for investment outlays in the field of air and water pollution control and neutralization of industrial wastes to a total amount of over 9 billion zlotys. Outlays for air pollution control are to rise 2.5 percent in comparison to that stipulated to be carried out in 1976. Thus, this year 2,350 million zlotys are to be spent. Among basic goals should be considered the installation and modernization of exhaust gas purifying equipment and airtight sealing of production equipment. Metallurgical, energy, chemical, cement, and mining industries will absorb 93 percent of these financial resources. For example, the Glogow Foundry designates 316 million zlotys, Katowice Steelworks-108 million zloty, and Jaworzno III Electric Power Station-137 million zlotys for air pollution control. In the chemical industry 69 percent of the ministry's outlays are the tasks of the Grzybow Sulfur Mine (238 million zlotys). In the cement industry 83 percent of the ministry outlays are absorbed by the investments of the Wiek and Ozarow cement works.

The investment resources budgeted for air pollution control in 1977 cannot be considered adequate. Outside the plan remained many plants whose excessive emission causes considerable pollution. Delays in the implementation of these investments in new or reconstructed plants can have a rather negative effect on the status of the atmosphere's purity at the moment that these installations are put to use. The Katowice Steelworks, the Lenin Steelworks (2.8 billion zlotys of the outstanding investments, or the Skawina Electric Power Station (implementation of tasks shifted from the years 1969-75 to 1978-86) need an augmentation of these outlays.

The annual operational efficiency of dust collector equipment anticipated for activation in 1977 is specified at over 1.5 million tons in the field of dust reduction and 107 tons of gases. The total quantity of dust extracted will rise 1,618,000 tons throughout 1977, i.e., by 7.7 percent in relation to the initial level. On the other hand, the percentage of dust extracted in relation to that produced will rise from 91 to 92.5. The quantity of dust emitted into the atmosphere will decrease by 239,000 tons (11 percent), chiefly in the cement industry. The continuing lack of effective methods to limit gas emissions is the main cause of their rise from 2,494,000 tons to 2,692,000 tons, i.e., by 7.9 percent for the year 1977.

In the field of water pollution control the 1977 draft plan covers investment outlays in the amount of 4,627 million zlotys for the construction of sewage treatment plants. Almost 70 percent of the outlays for water pollution control is in the administration, local economy, and environmental protection ministry, in the chemical industry, as well as in the food processing and procurement industry. The program for building municipal sewage treatment plants envisions, among others, their completion for the cities: Wloclawek, Lublin, Bystrzyca, Poznan, Szczecin. The greatest outlays for water pollution control are concentrated in the Katowice (about 670 million zlotys), Gdansk, Bydgoszcz, Tarnow, Wroclaw, and Lublin voivodships. The resources allocated for the construction of sewage treatment plants in 1977 will not, however, guarantee corresponding progress in the implementation of obligations stemming from water rights. Many plants and cities in which the sewage administration urgently needs to be put in order do not provide the necessary outlays for this purpose.

In the plan for the year 1977 573 plants that produce over 5,000 tons of wastes annually provided for ventures to neutralize industrial wastes. This year will bring us 168 million tons of wastes, i.e., 10 percent more than in the year 1976. Their economic utilization will increase from 58 million tons to 69 million tons (19 percent). Outlays of over 2 billion zlotys have been planned (chiefly power and steel industry) by 78 plants. The 1976 tasks have not been carried out. Again, among the culprits figure the Katowice and Lenin steelworks, as well as the Kozienice Electric Power Station, the Inowroclaw Soda Works, and the Wloclawek Cellulose-Paper Works.

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YUGOSLAV ENVIRONMENTAL PROTECTION AGENCY CHIEF INTERVIEWED

Maribor 7D in Slovenian 17 Mar 77 pp 12-13

[Interview of Magister Graduate Engineer Milivoj Todorovic, secretary of the Federal Community for Environmental Protection, by 7D]

> [Text] The year 1977 was declared the year of protection and improvement of man's living and working environment. We have discussed the goals of this monumental project and the objectives which will have to be accomplished with Magister Graduate Engineer Milivoj Todorovic, secretary of the Federal Community for Environmental Protection.

[Question] Could you tell us, please, who had the idea and initiative to declare this year in which we are celebrating Comrade Tito's 85th birthday and the 40th anniversary of his ascendancy to the leadership of the party also the year of protection of man's living and working environment?

[Answer] The idea for proclaiming this year as the year of protection and improvement of man's living and working environment was advanced by Miha Spiljak, president of the Yugoslav Trade Unions Federation Council, at a conference on the role and objectives of associated labor in improving man's living and working environment in this country. This conference took place in Pristina in the middle of last year. The presidency of the Yugoslav League for Environmental Protection took steps to implement this idea. Its sponsor is the presidency of the Federal Conference of the Socialist Alliance of Working People [SAWP] which related the noble concept of protection and further development of natural and man made values with the work of comrade Tito and the jubilee celebrated by the Yugoslav peoples at the 85th birthday of Comrade Tito and the 40th anniversary of his ascendancy to the leadership of the party. Pursuant to the proposal of the presidency of the Federal Conference of SAWP the Federal Council of the Assembly of the Socialist Federal Republic of Yugoslavia declared on 1 February 1977 the year 1977 as the year of protection and improvement of man's living and working environment.

[Question] It appears that the proposal was adopted unanimously and without complications. To what circumstances can we attribute such prompt action?

[Answer] I would attribute this primarily to the thorough preparation of the secretariat of the SAWP Federal Conference presidency. I mean primarily the initial agreement and support of the republics and regions. Moreover, the presidency first made its own contribution to the year of protection of man's living and working environment by simultaneously adopting both the proclamation of the year and the basic program of social activity in this year.

[Question] What can you tell us about this basic program of social activity in the year of protection and improvement of man's living and working environment?

[Answer] The foundation of the basic program of social activity is the determination of our self-managing society to uphold the right and duty of the working people and citizens of all self-managing social entities to create the necessary conditions and fight for a healthy living environment, which is an integral part of socioecenomic development, and the fact that the entire course of development of our society has already created the conditions necessary for a more perfect coordination of industrial and urban development and demands for protection and improvement of man's environment.

[Question] Does this mean that the present forms of threat to nature and man's environment are primarily consequences of our society's accelerated industrial and urban development?

[Answer] With accelerated industrial and urban development we accomplished very important results. This development, however, is also accompanied by threats to the basic elements of man's living and working environment--earth, water, air, and food. In some places the natural balance has been disrupted, which threatens the people's lives and well being. I would, however, point out that the development goals, especially in their long range effects, and the requirements for protection and improvement of man's living and working environment are mutually interrelated and connected, consequently, failure to pursue either of them is in the long run equally detrimental.

[Question] What goals are set by the basic program of social activity for the year of protection and improvement of man's living and working environment?

[Answer] I shall simply quote part of the basic program of social activity which pertains to the goals that must be achieved. The working people and citizens should be the protagonists of the decision making and action in the protection and improvement of their living and working environment. It is necessary to create a more favorable social atmosphere for the improvement of man's living and working environment. This can be accomplished by raising the level of awareness and understanding of the fact that this is

an essential element of a healthy and creative life. The cultural level must be raised by ideopolitical activities, education and training. Habits must be formed and reinforced along with a sense of responsibility for protection and improvement of all natural and man made values. Protection and improvement of these values must become a permanent concern of all self-managing entities, particularly the TOZD's [Basic Organization of Associated Labor] and local communities while social agreements and self-managing contracts must become the ways and means for resolving all questions in this area. It is necessary, as a matter of development policy, to define more precisely the most important components of protection and improvement of man's living and working environment so that all this may be included in the development plans. It is necessary to reach a higher degree of cooperation and coordination at all levels from the organizations of associated labor and local communities to the federation and international relation in all actions for protection and improvement of man's environment.

[Question] Which areas should, in your opinion, receive special attention so that we may accomplish all these goals?

[Answer] The basic program of the SAWP Federal Conference for the year of protection and improvement of man's environment is very clear and precise also in this respect. It is best that I again give a direct quote: It is necessary to work thoroughly and intensely for the self-managing organizing and education of every social factor so that he may effectively implement the social goals of protection and improvement of man's living and working environment. Special attention should be given to the self-managing and interest-oriented organizing in this area. The working people and citizens must, as subjects of social planning within the organizations of associated labor, local communities, and other forms of social organization, prepare precisely defined plans of action for protection and improvement of man's environment. In accordance with the provisions of the law on associated labor it is necessary to concentrate on these actions because they will make the greatest possible contribution toward protection and improvement of man's environment.

The piling up of noxious substances in man's environment should be avoided by sensible distribution of production capabilities and by exporting technology. During the year of protection and improvement of man's living and working environment it is necessary to prepare protective plans for all plants and installations that can cause harm to environment specifying in detail the required protective measures. It is necessary to adopt legislation specifying the standards, obligations, rights, and responsibilities stemming from the Constitution. At the same time the social activists will endeavor to faithfully observe the laws and regulations in this area.

It is necessary to develop scientific research and to utilize to the greatest extent possible the scientific findings in the implementation of goals for the protection of man's environment. All that are concerned with education and training must enrich their programs with topics from this area and in

accordance with their social role contribute to the improvement of the cultural level, awareness, and habits on which the improvement of man's living and working environment depends. The press, radio, television, and other information media will, by their creative work, assist in keeping with their social role to the staging of a broadly conceived social campaign for the protection of man's environment.

[Question] It appears that so far social actions for protection and improvement of man's environment have not always achieved satisfactory cooperation and coordination between all factors who can contribute to a more effective protection and faster improvement of the natural and man made values of man's environment.

[Answer] Because of the nature of the problems of protection and improvement of man's environment which is very complex, closely interrelated and interdependent, it is necessary to achieve optimal cooperation and coordination between all social activists. Of particular importance is cooperation of the republics and regions in solving questions of mutual concern and their increasingly greater role in fostering and strengthening cooperation between the organizations of associated labor and groups performing scientific research. Mutual cooperation is equally important with respect to the role of our country in international relations and our positions concerning the accelerated transfer of technology from the developed to developing countries. It is precisely engineering and technology that helped us to rapidly and effectively remove the effects of pollution and to set up preventive measures so that pollution cannot occur.

[Question] In conclusion, we are interested in what the role of SAWP is in implementing the objectives set for the year of protection and improvement of man's living and working environment and what obligations derive from the stated directives?

[Answer] The presidency of the SAWP Federal Conference communicated an appeal to all sociopolitical organizations and communities at all levels to prepare plans and set their immediate objectives in carrying out the basic social action program in this year of protection of man's environment. On the other hand, the presidency of the SAWP Federal Conference set as a goal for itself and its agents to carefully follow and direct the implementation of the basic program in the year of protection and improvement of man's environment.

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ECOLOGY TECHNOLOGY EXHIBITION, SYMPOSIUM IN LJUBLJANA

Environmental Engineering

Ljubljana DELO in Slovenian 5 May 77 p 2

[Article by Zdravko Stefanol]

> [Text] Ljubljana, 4 May--On Monday, 9 May 1977, the second international exhibition "Environmental Engineering 77" will be opened at the Economic Fairgrounds in Ljubljana. So far 68 exhibitors from 10 countries have announced their intention to participate. Of these, 42 are from this country, 8 from the German Federal Republic, 6 from Switzerland, 4 from Italy, 3 from Austria and 1 each from Belgium, France, Hungary, The Netherlands, and the United States of America.

Similar to the first international exhibition a year ago almost half of all the exhibitors this year are again from Slovenia. In addition to a number of important research and engineering design organizations, such as the Jozef Stafan Institute, Elektroprojekt, Smelt, and Inzeniring of Kranj, and communal economy organizations which will present entire systems and technological processes of active environmental protection, this year's exhibition also will include a number of manufacturing organizations who already are producing the most diverse equipment for purification of air and waste water, improvement of manufacturing processes, and the like. To enumerate but a few: ITC Klima of Celje, IMP of Ljubljana, Gostol of Nova Gorcia, SOP of Krsko, Maribor foundry, Hidrotehnik of Ljubljana, the TOZD of the Ljubljana communal enterprise "Proizvodnja Komunalne Opreme," and so on. The strong participation of both our research as well as engineering design organizations in our republic understand the socio-economic importance of active environmental protection and on the other hand perceive the great opportunities for development that are opening for

our economy through the mastery of the technology and production in this field. A rather strong representation of thermal insulation processes and materials, which will be shown at this year's exhibition by Termika of Ljubljana, TIM of Lasko, and departments of some construction enterprises, are an indication that we are beginning to pay greater attention to more rational management of thermal energy.

Within the framework of the exhibition there will be three professional conferences. Attending the first of these conferences on "Engineering and Business Cooperation in Environmental Protection," will be the experts of the Organization of Economic Cooperation and Development who will present papers on collection and return of waste material to production, that is, on the organization and utilization of recycling in production. Our experts have prepared papers on energy and water conservation and on systems, equipment, and devices for the purification of air and protection of its quality and on protection of people in their working environment. The second conference, on the topic of "Environmental Influence on Humans," will deal with the protection of people as a starting premise of our policy and social action, while the thrid conference on, "Community and Environment," will be concerned with the supply of potable water, problems of waste water, and collection of waste in the communities and the economy.

Ecology Week Begins in Ljubljana

Ljubljana DELO in Slovenian 10 May 77 p 2

[Article by Silvestra Rogelj]

> [Text] The 1977 Ecology Week in Ljubljana was officially inaugurated this afternoon with a speech by Zora Tomic, president of the Federal Committee for Health and Social Care, at the opening of the international exhibition "Environmental Engineering 77." Within the concept of the year of protection and improvement of man's living and working environment in the Socialist Federal Republic of Yugoslavia the Ecology Week was organized by the Slovenian Academy of Arts and Sciences, republic Committee for Environmental Protection, republic Committee for Health and Social Care, Research Committee of Slovenia, and the Economic Chamber of Slovenia in cooperation with the Economic Fairgrounds in Ljubljana.

This year's Ecology Week, which will last until 15 May, will be richer in comparison with last year's week. Concurrently with the international exhibition "Environmental Engineering," which will be open all week, there will be three conferences on environmental protection topics. First, on Tuesday, domestic and foreign experts including representatives of OECD in

Paris, will discuss problems concerning technical and business cooperation in environmental protection activities. They will deal with the areas of waste material recycling, energy and water resources conservation, protection of the bodies of water, protection of air, and protection of people at their work. On Wednesday communal leaders will get together at the "Community and Environment" conference where they will discuss the supply of drinking water, collection of waste material in the communities and the economy, and the problem of waste water.

The conference on "Environmental Influence on Man" will be held on Thursday and Friday. This meeting is broadly conceived both in its subject matter as well as in the number of participants. Following a general session with the introductory papers of Dr Augustin Lah, Dr Anton Fazarinc, and Dr Marjan Tepina the conference will continue in three groups. The first will discuss the medical aspect of the relationship between man and his environment, the second the living environment and its influence on man, while the third will converse on the legal, conservationist, cultural, and other aspects of the relationship between man and the environment.

Active Protection of the Environment

Ljubljana DELO in Slovenian 11 May 77 p 2

[Article by Silvestra Rogelj]

> [Text] Ljubljana, 10 May 77--A two day conference on technical and business cooperation in environmental protection activities began this morning, within the framework of Ljubljana's 1977 Ecology Week, with the opening speech by Dr Hilliard Roderick, director of environmental matters of the OECD in Paris, in which he briefly outlined the dimensions of the policy of environmental protection in the economy and international relations.

The conference, attended by 130 domestic and a few foreign professionals, has several objectives. The participants will in their papers show the economic importance of environmental protection action, particularly the collection and recycling of waste material, rational management of air, water, and energy resources, and protection of people at their work. They will find out about the state of affairs in this country with respect to organization and production capabilities of research, design, planning and manufacture of systems and devices for active protection of the environment. The conference itself should also stimulate business cooperation between the organizations of associated labor. To advance international cooperation the organizers of the meeting also plan a meeting of the participants at the international exhibition "Environmental Engineering" where there will be a roundtable discussion of conditions and opportunities for entering into agreements on cooperation and representation.

Today the participants at the conference discussed the problems of collection and recycling of waste material in industry and the problems of water resource conservation. The introductory paper on the topic of waste materials was read by Magister Marjan Ivanc who spoke about organization of retrieval and recycling of waste materials in production. He emphasized that the importance of waste materials collection is already being recognized in this country but that notwithstanding the favorable social climate supporting such endeavors numerous obstacles are frequently encountered.

In the first place the marketplace for waste or secondary raw materials still has no tradition in Yugoslavia and, moreover, there is scant information as to who is collecting and who needs what. In many instances we are still encountering prejudices against use of secondary raw materials and, moreover, their valuation is often inadequate because we frequently fail to consider the savings in expenses for environmental protection.

Professional Engineer Srecko Brus, deputy president of the Republic Committee for Environmental Protection, acquainted the attendees with the preparatory work and the substance of the draft law on handling waste materials. This will be the first law of this kind in Yugoslavia. Its importance. however. is extraordinary both for the economy as well as for the prevention of the depletion of natural resources and pollution of the environment.

The problem of solid and liquid sulfate waste in Slovenia was presented to the participants by Professor Dr Joze Slivnik. Deposition of this kind of waste not only ruins the environment but also causes economic damage. There are numerous possibilities for their reprocessing in the manufacture of products which we need and must, at present, import. Professor Dr Franc Cegnar pointed out how returnable packaging economically protects the environment. Dr Janze Zgajnar then discussed the processing of animal waste.

Conservation of water resources was discussed in the introductory paper by Professor Dr M. Dular of the Chemical Institute Boris Kidric. He pointed out that in Slovenia the growth of settlements exceeds the development of sewer systems and the system of filtering installations which has as a consequence deterioration of our water quality. The water is as polluted as if there were 8 million of us. We are aware of this and we are about to embark on an extensive campaign for construction of filtering installations. However, these will be truly effective only if we proceed to build them systematically. Here Dr Dular pointed out the need for an information system that would serve as a basis of all decision making. He said that only on the basis of adequate, timely, and precise information on the environmental situation and trends can an effective policy of environmental protection and a plan for correcting the present deficiencies be developed.

Technology Destroys and Saves

Ljubljana DELO in Slovenian 12 May 77 p 9

[Article by Silvestra Rogelj]

> [Text] Ljubljana, 11 May 77--Often we complain about technology because it is supposedly destructive of the environment. We are forgetting, however, that there are people behind it. Technology is neutral by itself and man can use it to his advantage or disadvantage. This is once again proven by the international exhibition "Environmental Engineering," at the Economic Fairgrounds in Ljubljana which is currently open within the framework of the Ecology Week.

At this exhibition 66 domestic and foreign exhibitors are showing their equipment, systems, and machinery which, as one visitor put it, are helping us to remain alive. And he was right, because without the filtering equipment and other measures our environment would soon deteriorate so that it would soon be difficult to live in it.

"Environmental pollution is a cancerous growth of the civilization of our time," proclaims the marquee at the pavillion of the Jozef Stefan Institute. Science can no doubt contribute substantially to the stemming of this dangerous disease of the 20th century. Environmental engineering is becoming a life sustaining need of our time. This challenge could not be ignored even by the Jozef Stefan Institute and it must be said that it responded effectively.

The Institute's contribution at this year's exhibition is one of the most interesting even for laymen. There is no one among us who would be indifferent to the fate of Poljanska Dolina [Poljane Valley] or the waste from the Cinkarna of Celje. At the exhibition is was shown how the experts from the institute succeeded in making the technology of uranium ore processing at Zirovski Vrh a closed process, so that water in the mine's environment will remain pure because of their work. No less interesting is the schematic presentation of the process by which the waste sulfuric acid from the Cinkarna of Celje will be reprocessed into an important component of artificial fertilizers.

As a special achievement of the institute we must also mention the first automatic measuring apparatus of domestic manufacture for monitoring the environment. The apparatus continuously records the ecological, hydrological, and meteorological data which are processed by a computer.

Visitors can at any time see displayed on the television screen the amount of noxious substances contained in the air they are breathing at the moment and the like. The automatic monitoring station is connected with sensitive measuring devices displayed by Meloy Laboratories.

To those who in winter read with concern the air pollution data we can tell that the Meteorological Institute has already bought all available devices for the measuring of air pollution from the above mentioned firm and will now be in position to monitor air pollution throughout Slovenia.

And another thing for those who believe that in Ljubljana one can get more fresh air in a closed room than out in the open. If you scoop some air in a plastic bag outside the exhibition hall and bring it near the instrument, the indicator of noxious substances will immediately point to a higher value.

So that we may not only monitor the degree of air pollution but also take action, the communal enterprise Ljubljana, along with other manufacturers of filtering equipment, took care of the problem by purchasing from the firm Werner devices for measuring the gases released through chimneys. Armed with these devices the enterprise's chimneysweeps will next winter be able to establish which chimneys are exuding too much smoke.

Similar is the situation with the water resources. In addition to numerous instruments, which to a layman represent only some kind of black boxes, but which the experts know to be extremely sensitive and complex computerized measuring devices for monitoring water pollution, one also can see quite a few pieces of equipment which purify polluted water so that it is almost potable. Of these the display of the enterprise Kanalizacija, which demonstrates with models the water purifying process performed by equipment already in operation at Posocje, Skofljica, and Donava, attracts the greatest number of visitors who can observe the process in action.

The attention of businessmen, however, is attracted primarily by the first purifying installation by Smelt of Ljubljana which is entirely of domestic manufacture. Foreign exchange restrictions and customs duties will thus no longer be a barrier to purchase of filtering equipment. We could go on and on enumerating the displayed machinery, equipment, and systems from those that are protecting us at work to those which reprocess the waste materials into useful raw materials. The panoply of environmental engineering is broad and diverse. And that is what it should be for such is, unfortunately, also the diversity of that technology which destroys our environment.

Environment's Warning

Ljubljana DELO in Slovenian 13 May 77 p 2

[Article by Silvestra Rogelj]

> [Text] Ljubljana, 12 May 77--The Conference on the Influence of Environment on Man began today at the Economic Fairgrounds. The meeting, which is sponsored within the framework of Ljubljana's 1977 Ecology Week, was opened by Dr Janez Batis, prorector of the University in Ljubljana.

The participants were next greeted by Dr Avgustin Lah, president of the republic Executive Council which outlined the purpose of the conference--to discover through study and research the environmental phenomena and their effects on us and thus make a contribution toward the improvement of the society's organization and regulations with respect to the relationships between nature, the society, and various environmental factors.

He said that this year 92 research proposals from the field of environmental protection have been registered. Economic organizations are co-sponsoring and promoting primarily the priority topics stemming from the agreements and development plans. He pointed out that while we have already done a great deal we probably have invested more funds in research than we recovered through application of its results. We must do more to obtain international recognition of our achievements.

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DAMASCUS SEWERAGE, IRRIGATION SYSTEMS, WATER POLLUTION UNDER STUDY

Damascus AL-BA'TH in Arabic 10 May 77 p 9

[Article by Samih Abu-Takk: "On the Way to Fighting Water Pollution: Projects to Improve Irrigation Network and to Control Barada and al-A'waj Floods and Preparation of New Damascus Sewer Network Proceed Hand-in-Hand; Public Works Ministry Seeking Unified Legislation to Combat Pollution"]

[Text] The Ministry of Public Works and Water Resources has been surveying since the beginning of this year the irrigation networks branching from the Barada and al-A'waj rivers in preparation for implementing a project that seeks to improve and regulate these networks which irrigate the greater part of the agricultural lands in the Damascus City Governorate and the Damascus Rural Governorate where more than 2 million people live.

Minister of Public Works Explains Importance of Project

Our AL-BA'TH correspondent has conducted an interview with Nazim Qaddur, the minister of public works and water resources, on the objectives and the progress of work in this project.

His excellency the minister said that the project is twofold: first, surveying the irrigation networks branching from the Barada and al-A'waj rivers. These are very old networks and have no technical designs. Moreover, they are not government-owned networks and, therefore, the annual investment and maintenance work needed for them depends on the beneficiaries. Because of the deteriorating condition of these networks as a result of pollution, misuse of agricultural lands and negligence of maintenance and in view of the need to raise the standard of these networks, to expand the cultivable area and to introduce modern technology in investment, the situation required that a project be submitted to improve the aforementioned networks. Realization of this objective is dependent on drawing a clear picture of the present condition of these networks. This is the objective of the work being currently carried out by the Irrigation and Water Resources Directorate of the Ministry of Public Work, namely to survey the irrigation networks branching from the Barada and al-A'waj rivers.

Survey work was started at the beginning of 1977. It is expected that this work and the designs resulting from it will be completed by the end of 1978 when the Irrigation and Water Resources Directorate will produce a comprehensive technical dossier containing the results of the survey, the (recommendations) and the designs for these networks. It is worth noting that the said directorate is conducting the survey work and is preparing the dossier through its own resources.

Regulating Barada and al-A'waj Floods and Studying Damascus City Sewers

Second, the survey on the irrigation networks branching from the Barada and al-A'waj rivers also includes the following studies which are being carried out at present: a study on the Damascus water basin, a study on controlling the floods of Barada and al-A'waj and a study on the project for the Damascus city sewers. These studies are expected to be completed in 1979 and they will form the basis for submitting the project to improve the irrigation networks branching from the Barada and al-A'waj rivers and for implementing the project within the framework of the fifth local five-year plan.

Where Have We Reached in Regard to Fighting Pollution?

[Question] Have the technical studies to fight water pollution in the Barada basin started and how far have they advanced?

[Answer] The General Directorate for Combating Water Pollution of the Ministry of Public Works last year completed surveying the sources of water pollution in the Barada River and in the canals branching from it, especially in the Ghawtat Dimashq area. The sources of pollution of the Barada river water are the waste materials dumped in the river and its canals by the residential concentrations and by the industrial installations. The aforementioned directorate also collects monthly water specimens from certain spots along the course of the river from its headwaters to al-Zabadani plain and down to al-'Ukaybah lake into which the river flows. These specimens are analyzed chemically, bacteriologically and physically and the results of the analyses are then mapped out on a graph showing the development of pollution and the sources of this pollution.

In the light of all this, the General Directorate to Combat Water Pollution keeps up its campaign against the existing plants to make them treat their wastes before dumping them into the river and its canals. It must be admitted that we encounter extreme difficulty in insuring this due to the inadequacy and the disorderliness of the legislation to combat pollution. However, we should keep in mind that the ministry is now seeking the issuance of unified legislation for this purpose. The draft legislation has been completed and submitted to the authorities concerned.

On the other hand, the Ministry of Public Works continues to implement the plan drawn up by the Ministry of Housing and Utilities to organize

the sewers of the residential areas in the Barada basin with the aim of protecting the Barada waters from pollution resulting from human wastes. It is worth noting that the Ministry of Housing and Utilities is currently studying a modern and independent sewerage network and treatment plants for the city of Damascus through a contract concluded with an international consulting company. Within the framework of the same contact, the ministry is also conducting a study to control water pollution in the Barada River. This study is expected to be completed at the beginning of 1979.

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MAN DECIDES THE FATE OF THE BIOSPHERE

Moscow TRUD in Russian 5 Jun 77 p 3

[Interview with Academician A. V. Sidorenko, vice-president of the USSR Academy of Sciences [AN SSSR], chairman of the AN SSSR Scientific Council for Problems of the Biosphere: "World Environmental Protection Day; Man Decides the Fate of the Biosphere"]

[Text] [Question] In this century's recent decades the problem of environmental protection before mankind has become more acute. Man's creative activities--the construction of plants and factories, the development of mineral deposits, the increase in the amount of land under cultivation, etc.--frequently carry with themselves destructive influences on nature. Where, do you think, is the way out of this contradiction?

[Answer] Until quite recently there existed a regard for nature as an inexhaustible source of free blessings. The modern era is characterized by the powerful intrusion of man into nature's processes, and in a number of countries farming and economic activities have begun to take the environment out of its dynamic equilibrium. Among the distinct consequences of such influences (the exhaustion of fossil fuel, the lack of clean fresh water, climatic changes, etc.) the most urgent is the problem of environmental pollution by the harmful by-products of industry.

According to a World Health Organization estimate, man in his activities uses about 500,000 chemical substances and this number is growing. There is data about the harmful qualities of 40,000 of them, including 12,000 toxic ones used in industry.

A great number of examples could be cited about their destructive effect on nature. Up to 5,000 tons of mercury are dumped into the sea annually with industrial waste products. Now mercury has been observed in many living organisms. Agriculture has widely used the well-known preparation DDT. For 25 years about 1.5 million tons were disseminated. Research has shown that DDT breaks down very slowly and that the earth still holds about one million tons. This preparation, as already reported in the press, has been noted even in the livers of penguins.

Due to the intensive burning of petroleum and gasses into the atmosphere the content of carbon dioxide is on the rise. A number of scientists propose that in time this might lead to a global climate change and rise in temperature. After all, carbon dioxide acts like a glass allowing solar radiation to pass through but holding back return heat currents.

The capitalist countries are suffering very significant damage from environmental contamination. In 1970 in Japan it reached 23 billion dollars. In just this year in the USA air pollution, based on preliminary calculations, amounts to 25 billion dollars.

... The protection of nature by man has a long history. Parks and natural preserves were set up a long time ago. And even though such measures are necessary even today, they are already insufficient. The time has come to actively do battle with the inefficient use of natural resources and with environmental pollution from industrial waste. Man must be cognizant of his part in the unified system of "man-society-nature," and not place himself above nature as he did earlier.

[Question] The 25th CPSU Congress underscored the growing importance of environmental protection. In the documents of the congress this problem is examined as an important trend in the activities of the party and the state. What measures have been outlined and are being carried out in this regard?

[Answer] In the Soviet Union the efficient use, conservation, and regeneration of natural resources, a thrifty regard for nature are constituent parts in the program for the building of communism. The Soviet government displays tireless concern for protection of the biosphere as one of the main sources of wealth and the well-being of society.

In recent years we have done a vast amount of work in the field of efficient use and regeneration of natural resources and to prevent and remove the negative consequences of influences on the natural environment. Laws have been approved on the use and protection of the land, minerals and water. The decree of the CC CPSU and the USSR Council of Ministers "On the Efforts to Protect Nature and Improve the Use of Natural Resources," and a number of other important documents have been approved.

In yesterday's published plan for the Constitution of the Union of Soviet Socialist Republics it was written: "In the interests of present and future generations the USSR is taking the necessary measures for protecting and for a scientifically substantiated and efficient use of the land and its minerals, plant and animal life, for keeping the air and water clean, providing for the regeneration of natural resources and improving man's environment."

Earmarked for the 10th Five-Year Plan, based on the use of the latest scientific and technical means, is the significant improvement of control over the condition of the environment and the sources of its contamination, the introduction of new and efficient methods and systems to develop mineral

deposits, intensification in the struggle against discharges of harmful substances into the atmosphere, and the realization of other natural protection measures.

In order to maintain the purity of the water basins plans call for construction of sewage treatment plants in cities with an overall capacity of 21 million cubic meters daily, in rural areas--an overall capacity of 20, and in industry--30 million cubic meters. New waste free engineering schemes will be introduced. A complex of measures to prevent removal of mineral fertilizer and toxic chemicals from agricultural land will be realized. Allocated for the preservation and regeneration of fish resources are 50 million rubles.

In all, 11 million rubles have been allotted for environmental protection in the 10 Five-Year Plan. Our task is to use these funds with maximum efficiency.

[Question] Of course, it is desirable that harmful substances generally do not enter the atmosphere and water. But in the modern era the development of technology in attempting to achieve this is not always successful. And here, apparently, doesn't a large role have to be played by different restrictive measures?

[Answer] The USSR has established maximum permissible concentrations for more than 2,500 harmful substances. These and other restrictive standards relate to the air of industrial premises, the atmospheric air of inhabited areas, to water for drinking and for domestic and economic use, and to the soil. Therefore it must be noted that the Soviet standards in an overwhelming majority of instances are stricter than in other countries.

New natural economic standards for the condition of the earth's interior, the forests, and preserved territories, and norms for restricting noise, vibration and other things influencing the environment are being developed.

[Question] However, effective measures conducted by only one country cannot obviously provide the solution to the whole complex of problems for protecting the earth's biosphere...

[Answer] Naturally, the activities directed towards environmental protection and revivifying the biosphere cannot only be limited to national boundaries. It is well known that contamination of the air or water basin of one specific spot on the earth is telling on other territories. This is promoted by many natural phenomena--like constant air flow and sea currents. This means that the question of broad international cooperation is becoming more acute.

I must especially underscore the significance of lessening international tension, the building of a system of international relationships based on the principle of peaceful coexistence among states with different socio-

economic structures to solve environmental protection problems. The conditions of peace and international cooperation create a more favorable setting for successful resolution of the entire complex of these problems. Principally, an important role has been played in this area by the decisions of the Conference on Security and Cooperation in Europe that took place in Helsinki, where great attention was devoted to environmental protection problems.

We are deeply convinced that this social problem will be solved by mankind as we strive for peace and cooperation.

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ECONOMIC IMPACT OF ENVIRONMENTAL PROGRAMS IN UKRAINE

Kiev EKONOMIKA SOVETSKOY UKRAINY in Russian No 6, Jun 76 pp 45-51

[Article by O. Balatskiy, candidate of economic sciences (Sumy)]

[Text] The problem of environmental pollution is worrying all mankind. The objectives set in the Basic Guidelines for National Economic Development in the USSR During 1976-1980 require the development and implementation of environmental protection measures and measures to ensure the intelligent use and reproduction of natural resources.

The problem of the relatively rapid rate of environmental pollution and the equilibrium between man and nature deserves great attention.

The economic impact of new equipment does not only depend on its utility characteristics, but also on the degree to which expenditures on its reproduction are taken into account. In addition to expenditures on the reproduction of the labor force, expenditures on the reproduction of the environment must also be given consideration. Considerable additional expenditures on environmental protection are inefficient from the standpoint of the enterprise, association or branch, since they do not increase the profits of enterprises. But these expenditures have grown considerably during the last 10-15 years in connection with an increase in the normatives governing the disposal of waste. Laws regulating the permissible concentrations of some substances have become much more rigid (by 100-300 percent in the case of some pollutants). At the Shchekino Chemical Combine, purification installations account for up to 40 percent of the cost of all fixed productive capital. Up to 25 percent of all capital investments in the pulp and paper industry enterprises being built in the Baykal region are being spent on purification units. In the metallurgical industry, these expenditures amount to 20-40 percent of total capital investments.

Total expenditures in the USSR in 1970 on the entire group of environmental protection measures amounted to more than 11 billion rubles.

Around 3,000 gas and dust catchers were built in the Ukrainian SSR during the Eighth Five-Year Plan for a total cost of 121 million rubles, and the total amount spent on environmental protection was 0.9 billion rubles. During the Ninth Five-Year Plan, almost 1.5 billion rubles was to be spent for these purposes.

In addition to the work being done to establish and remodel purification units and to improve and modify technological processes, plans are also being made to move shops and enterprises outside the city limits and to close down old production units, particularly those which pollute the environment.

At present, however, the funds allocated in plans for the observance of environmental protection norms and regulations are virtually paid out without any kind of computation of their economic impact; this should not be permitted. An entire complex of organizational, economic and moral conditions must be set up to govern the greater development of industrial production with the simultaneous protection of the environment or even its improvement.

Before we begin to examine the theoretical principles for determining the economic impact of the protection of the environment against pollution, we should consider the ways in which the economic impact of environmental protection measures is calculated. In recent years, we have gained a greater understanding of the meaning of the economic impact of national production, capital investments and new equipment. Profound and extensive economic research has led to a situation in which, as G. Ovchinnikov and others write, no one now objects to the most general definition of the criterion of economic impact as the relation of the result (effect) to the expenditures giving rise to the result. The standard methods for calculating the economic impact of capital investments state that the criterion for the national economy as a whole is the relation of the increase in annual national income (the net product) with its stipulated physical structure in comparable prices ($\Delta Д$) to the capital investments (K) in the sphere of physical production that give rise to this increase.[1]

$$Э_{КПН} = \frac{\Delta Д}{K}.$$

But this definition has its drawbacks. For example, the impact of the production sphere is almost completely ignored and the impact of science and education is only partially taken into account. We can see from the above-mentioned that the national economic impact is usually defined only as the result of capital investments directly in the area of physical production in economic literature and in practice. This restriction is theoretically incorrect.

The development of science and technology and their incorporation into production contribute toward a rise in the level of social labor productivity. This is why investments in science, education and public health have an impact. The development of new natural resources should be combined with the protection of these resources, and the development of industrial activity should be combined with the protection of the environment against pollution and with capital investments for these purposes.

P. G. Oldak approaches these important economic categories in a new way. He gives a broader interpretation to the concept of national wealth and shows that wealth as a product is replaced by the concept of wealth as potential for economic growth, and proposes the concept of metapotential, by which he means the combined characteristics of general national systems. Metapotential is characterized by the following elements: economic potential, technical potential, the potential of the human factor and military potential.

A rise in one of these indicators will not attest to an increase in metapotential. In the same way, when we are determining the economic impact of environmental improvement, we cannot limit ourselves to a mere increase in the final national product. The other elements of metapotential must also be taken into consideration.

In our opinion, two approaches are possible here:

An approach involving the assessment of each element of metapotential in terms of several indicators with their subsequent reduction to an integral criterion or several general criteria. Here the choice of several general indicators would be more practical;

An approach involving the broadening of the economic criterion by including economic assessments of scientific and technical potential, the potential of the human factor and economic potential.

Without denying the applicability in principle of the first approach to the determination of an integral indicator of metapotential or economic growth, and even admitting that this approach would be the more progressive one in the theoretical sense, we will nonetheless advocate the second.

During the course of a debate printed in VOPROSY EKONOMIKI in 1974 on the advantages of using national income as the best measurement of the impact of socialist production, articles by A. Notkin and P. Pochkin point out certain premises that indicate the effect of other elements of metapotential on this indicator. They write that the sphere of non-physical production affects the production of national income by means of reciprocal ties. More specific statements are made by T. Khachaturov and B. Vanshteyn, who propose that the economic impact of social measures and improvements in working conditions be taken into account. They suggest the intensification and development of new procedural approaches to the assessment of impact and the choice of variants for the functioning of national production with consideration for social results in its various spheres and branches and on various organizational levels.

Although economic science as a whole has not concerned itself with a concrete explanation of the relationship between production and the environment and between man and the environment, individual studies and proposals contain suggestions on the methods and principles for conducting this kind of research.[2]

In our opinion, the presence of two approaches to the determination of an integral indicator or a group of indicators is completely natural. Each approach supplements the other. While the first is the more general of the two, the second essentially represents the economic part of the first. During certain stages in the development of economic science, it can replace the first. As this development progresses, the economic criterion will constantly be broadened by means of the inclusion of economic assessments of scientific and technical potential, the potential of the human factor and the ecological potential. But the first approach, that is, the assessment of each element of metapotential in terms of several indicators with their subsequent reduction to an integral criterion or several general criteria, will always be a more general approach than the second.

We feel that the research should commence with the second approach and, as our knowledge grows, we can move to a higher level--to the first approach.

As we stated earlier, the impact of national production represents the relation of the result to the expenditures giving rise to this result. When we move on to the determination of the impact of environmental protection, we can say that it will be reflected in the increase in national income (net product), economic potential and human potential. The amount of the economic impact of environmental improvement can be defined as the difference in total national economic expenditures between the variant envisaging environmental protection measures and the existing situation plus the difference in the results of both variants.

$$\Im = (З_x - З_y) + (R_y - R_x),$$

where $З_x$ signifies complete national economic expenditures without the institution of environmental protection measures; $З_y$ signifies total national economic expenditures after the institution of these measures and with consideration for the expenditures on these measures; R_y signifies the result of measures to protect the environment against pollution; R_x signifies the result without these measures.

Total national economic expenditures are calculated in the sphere of production and the sphere of consumption. The results affect the sphere of production, the sphere of consumption and the environment. The mechanism examined above cannot be used now in the practical sense due to the insufficient development of economic science at the present time. For this reason, we must use a simpler instrument. In our opinion, we can use the difference in the results of both variants rather than the results of human activity. One of the elements of this difference will be the amount of reduction in losses in one variant as compared to the other.

The mechanism for using total national economic expenditures was described by the author in his article, "The Price of Air,"[3] where he suggested that economic impact be determined according to the following formula:

$$\Im = З_o - \dot{З}_o + \Delta Y,$$

where 3_o and $3'_o$ signify total expenditures on environmental protection in both variants; ΔY signifies the losses prevented in one variant as compared to the other.

Total expenditures on environmental protection measures represent the combination of expenditures on scientific research, experimental testing, the technical preparation of production units, the development of purification equipment, the development of new technology, etc.

The accomplishment of environmental improvement measures can be calculated for a long period of time or the short range. Two approaches can be taken to the determination of the economic impact of these measures:

Determination of the total economic impact of the introduction of sanitization measures over a relatively long period of time;

Determination of the annual economic impact of the introduction of sanitization measures.

In the first case, it would be possible to use total national economic expenditures, while in the second case these expenditures should be averaged. On the national economic level, total production expenditures take the form of so-called averaged expenditures, which represent total overhead costs (C) and a percentage of total capital investments in accordance with the normative coefficient of economic impact E_H, that is, $3=C+E_HK$.

When total sanitization expenditures are being calculated, the time factor must be taken into account. Such measures are usually worked out and introduced over a space of 5-10 or more years. It then becomes necessary to average these expenditures to conform to some specific period of time. Total expenditures on sanitization measures 3_o and $3'_o$ which take place prior to the initial time referent are averaged according to the following formula:

$$\alpha_t = (1+E_H)^T,$$

and after this time referent:

$$\alpha_t^{-1} = \frac{1}{(1+E_H)^T},$$

where α_t and α_t^{-1} signify coefficients of reduction; T signifies the period of reduction (in years); E_H signifies the normative coefficient of impact.

This method is used to average all day-to-day expenses and one-time outlays on sanitization measures and on the sphere of production and the environment. As we have already mentioned, it takes a long time to work out and introduce the set of sanitization measures. The results of this work will be apparent for 10-15 years or even for the lifetime of several generations. In order to maintain this result after the set of measures has been introduced at

individual production units and industrial regions and branches, certain operational costs must be paid and capital must be invested. The latter does not apply to all types of environmental sanitization, but only to a part of this field. For example, the use of a new technological process for the production of cellulose with much lower expenditures of water will not require new capital investments for environmental protection during the operational process. Naturally, worn out equipment will have to be replaced, but this will only be dictated by the needs of the basic production unit.

But the use of purification equipment after blast furnaces will make it necessary to replace worn-out parts by means of funds for environmental protection. Therefore, capital will be invested in environmental sanitization for several years in principle.

The years serving as the basis for the averaging of expenditures can be any year, but, in our opinion, it should be the year when there was a dramatic reduction in losses t. The losses incurred by society through environmental pollution prior to and after the introduction of sanitization measures can be expressed for any period of time in the present and future according to the materials presented earlier. Then the national economic impact of the investment of capital in environmental protection for the period of time between the time of investment t_H and the time t_K after the year of dramatic reduction will be equal to the total economic impact observed during all years of the plan period.

Expenditures on scientific research, personnel training, the development of equipment, its mastery, the mastery of a new product or technology that has no ill effect on the environment and so forth can be regarded as capital expenditures which begin at some point $t_{H'}$ and decrease considerably by the year of dramatic reduction in losses t_1. Naturally, we can assume that investments continue to be made at the time of t_1, but they are negligible in size.

Day-to-day expenditures on sanitization measures grow from t_H to t, after which they can remain unchanged or can increase somewhat.

The amount of economic loss from the nonintroduction of sanitization measures will grow, even if pollution levels remain constant. This is the result of a constant increase in the potential of laborers due to the rise in labor productivity, the increase in fixed capital in industry, public utilities, transportation and communications and the rise in public prosperity.

The actual economic loss during the period from t_H to t_1 will gradually decrease. During the year t_1 it will decrease dramatically, and then more gradually. This process will apply to a measure taken on the scale of the branch, the nation or the individual operating subdivision. For a newly opened individual facility, the beginning of the process will be different.

The total national economic impact of the introduction of sanitization measures will be equal to:

$$Э = \sum_{j=t_н}^{j=t_к} З_0 \alpha t_j - \sum_{j=t_н}^{j=t_к} З_0 \alpha t_j + \sum_{j=t_н}^{j=t_к} \Delta У \alpha t_j,$$

where t_H signifies the year of the commencement of expenditures on sanitization measures; t_K signifies the year of expenditures or losses.

The change in losses must be taken in actual quantities or determined by the empirical method.

The method for determining the total economic impact of the introduction of a group of sanitization measures over a relatively long period of time is quite complex. It does have great advantages, however, when the principle of planning according to final results is implemented. In all probability, this method has great potential and should be used a great deal in the future. It also has several drawbacks. The main ones consist in the inadequacy of our present knowledge of the economic chain of total national economic expenditures and the methods for predicting losses over a long period of time.

This method for calculating economic impact will be perfected in the future as our knowledge grows. In addition to determining the total economic impact over a relatively long period of time, it is also necessary to calculate the annual economic impact of the introduction of sanitization measures.

When we began our discussion of the economic impact of sanitization measures, we spoke of the expansion of part of the national income (by means of including other elements). It is a fact that the criterion of the economic impact of environmental protection and sanitization takes the form of an increase in national income, economic potential and human potential. We then began to discuss total national economic expenditures. A transition must be made to average expenditures. Average expenditures must reflect the total expenditures of the society on the development, mastery and manufacture of new equipment, including capital investments and day-to-day expenditures during a specific period of time. The year is such a period.

The minimization of average expenditures serves as a kind of instrument and indicates the most efficient variant from the standpoint of an increase in national income. The two traditional elements of averaged expenditures are obviously inadequate for the resolution of economic problems connected with the environment. At present, these elements are day-to-day expenditures (C) and capital investments with the coefficient of impact (E_HK).

The further development of economic science indicates the need for taking expenditures of future labor into consideration when administrative decisions are being made. In other words, the making of these decisions must be based not only on past and present labor, but also on the future labor which will have to be expended to eliminate losses.

For this reason, in addition to the two elements mentioned above, the amount of the harm, which will occur in other branches and subdivisions of the national economy, as well as at the enterprise itself, during the course of final and intermediary production with the given level of capital investments and day-to-day expenses, should also be used. The author was the first to suggest this kind of method, in accordance with which the economic impact of the purification of industrial waste was calculated as the difference between expenditures:

$$\Theta = (З_1+Y_1)-(З_2-Y_2),$$

where $З_1$ and $З_2$ signify average expenditures on the development and operation of purification installations in the base and proposed variants; Y_1 and Y_2 signify the harm caused by the base and proposed variants to the national economy.

Later, a group of researchers from the Sumy Branch of the Khar'kov Polytechnical Institute imeni V. I. Lenin took this idea further, and their findings were then published.[4]

In the case of capital investments in projects which will harm the atmosphere at the same time that they are manufacturing a product, the indicator of relative economic impact must represent minimum average expenditures with consideration for the harm, that is:

$$C_i + E_н \cdot K_i + Y_i = \min, \text{ where}$$

C_i signifies the annual cost of manufacturing the product with technology i; K_i signifies the capital investments needed to obtain the product by means of technology i; Y_i signifies the harm suffered by the national economy when a product is manufactured with technology i.

The relative economic impact of capital investments in the sanitization of the environment will be equal to:

$$\Theta = (Y_1+C_1+E_н K_1)-(Y_2+C_2+E_н K_2) = (\Delta C+E_н K)+\Delta Y.$$

If capital investments are made at different times, they must be averaged to one specific time by means of the coefficient of reduction. This was described earlier.

In addition to the proposals of the author and the group of Sumy economists, there is the formula suggested by M. A. Vilenskiy for taking environmental damage into consideration when the national economic impact is being determined; he suggests a formula for calculating the national economic impact of the utilization of new equipment, which has the following appearance:

$$\Theta_{нх} = (C_3+E_н K_3)-(C_{нт}+C_к)+(E_н K_{нт}+K_к)\sum_{i=1}^{n} Уп_i \cdot$$

where C_3, C_{HT}, and C_K signify the operational costs of the equipment being replaced, the new equipment and the means used to prevent its negative effect on the environment; K_3, K_{HT} and K_K signify capital expenditures on the replaced equipment, the new equipment and the means preventing its negative effect on the environment; $Y_{\Pi p}$ signifies the prevented harm suffered by the environment due to the negative effect of the new equipment in branches related to the branch where this equipment is used; n signifies the ordinal numbers of related branches.

M. A. Vilenskiy's approach contains, in addition to some indisputable premises (the demand that prevented harm be taken into consideration), some assumptions that, in our opinion, are not completely correct. For example, capital expenditures on the replaced equipment and new equipment are calculated by means of the coefficient E_H, that is, they are already averaged expenditures. Capital expenditures on the means preventing the negative effects of the new equipment on nature (it would be more correct to say the environment) are calculated at the same time. In the same way, the amount of harm prevented is considered in its absolute quantity rather than on an annual basis.

This means that he proposes that the national economic impact of the introduction of new equipment be determined by adding the annual impact to the impact deriving from the reduction or complete prevention of harm over a period of several years. In our opinion, it would be more correct to use two approaches to determine the economic impact of environmental protection.

The following might be included in the system of indicators of the economic impact of environmental protection measures: a) the hypothetical annual economic impact of sanitization measures; b) the recovery period of additional capital investments in environmental sanitization measures; c) the size of capital investments in the variants examined; d) day-to-day expenditures (overhead costs) for each variant; e) amount of harm caused by each variant; f) proportional amount of harm to "public health" in total harm caused by each variant; g) amount of time required to carry out measures; h) achievement of permissible pollution levels in residential neighborhoods.

The recovery period of total capital investments (T_{OK}) can be calculated according to the following formula:

$$T_{OK} = \frac{\Delta K}{\Delta Y + \Delta C}.$$

The actual coefficient of impact (E_Φ) is the opposite quantity of the recovery period:

$$E_\Phi = \frac{\Delta Y + \Delta C}{\Delta K}.$$

The proportional amount of harm to "public health" is of great significance when the sequence of measures to protect the environment (atmosphere) from pollution is being determined. The measures which will result in a maximal reduction of this harm must be instituted first.

The theoretical premises presented above were used to determine the economic impact of the protection of the atmosphere at enterprises in the Ukraine.

During 1970-1975, studies were conducted by the Sumy Branch of the Khar'kov Polytechnical Institute imeni V. I. Lenin to determine the economic impact of the sanitization of the atmosphere in Zhdanov, Makeyevka, Zaporozh'ye, Sumy and Novyy Rozdol. Let us examine these studies and analyze the results which were obtained.

The first stage involved the development of a system for the collection of data on atmospheric pollution, public utilities, agriculture, forestry, industry and the rate of illness of the populations of these cities. Within a period of 10 years, two metallurgical plants in Zhdanov invested around 25 million rubles in gas and dust catchers. The annual operational cost of their maintenance was around 6 million rubles. The economic impact of the sanitization of the atmosphere, determined by the degree of reduction in the harm cost to the environment, was equal to more than 5 million rubles a year. The recovery period of capital investments in the gas catchers at these plants was slightly more than 5 years. At the same time, calculations show that this recovery period could be shortened by means of a change in the sequence of capital investments in the development and installation of purification units at the metallurgical enterprises in Zhdanov. As an analysis showed, the harm from atmospheric pollution by harmful wastes from the Agglomerate Plant imeni Il'ich was relatively small, since this plant is outside of the city. For this reason, it would have been expedient to first invest funds in gas catchers at the Plant imeni Il'ich and the Azovstal' Plant, located within the city limits.

If additional funds had been invested in gas catchers at the Azovstal' Plant in the amount of 15 million rubles of the funds invested at the Agglomerate Plant imeni Il'ich, the discharge of dust by the Azovstal' Plant could have been reduced by an average of 85-90 percent.

After this kind of redistribution of funds, the total losses incurred by the economy of Zhdanov would have been 3 million rubles a year lower. Most of the harm prevented would have been directly connected with public health--the main consideration in the job of sanitizing the atmosphere.

The economic impact of the installation of gas catchers according to this variant would have been 7.5 million rubles a year, and the recovery period of the additional capital investments would have been shortened to 3 years.

The largest sources of harmful waste in Makeyevka are the Metallurgical Plant imeni Kirov, the Yasinovka Coking By-Products Plant and the mines and territorial concentration plants, which are in direct proximity to one another and form a single industrial complex.

At the Makeyevka Metallurgical Plant, the amount invested in purification installations and related units was 6 million rubles, and operational expenditures are 1.4 million rubles a year.

Environmental protection measures reduced the potential discharge of dust by 70 percent, of sulphur anhydride by 20 percent and of carbon monoxide by 25 percent. Potential discharge should be regarded as the possible discharge resulting from a specific level of production. For example, at the Makeyevka Metallurgical Plant, gas catchers trap around 750 tons of dust a day, returning 450 tons to production. This dust is a mixture of coke, foundry sand, abrasive dust and lime. The potential discharge is equal to the actual existing discharge plus the amount of waste trapped.

The estimated economic loss was reduced by 60 percent in comparison to the potential loss. The hypothetical annual economic impact of the sanitization of the atmosphere was around 30 million rubles. Due to the fact that the plant is located in the center of the city, each ruble invested in purification units produces around 5 rubles of economic impact annually. Any measures directed toward the reduction of discharge into the atmosphere in this city will have maximum impact within the near future.

During 1970-1974, the amount invested in environmental protection measures at nine large plants in Zaporozh'ye was 26 million rubles. Annual operational expenditures are around 6 million rubles. During this time, the absolute quantity of dust discharged into the atmosphere by these plants was reduced by 29,000 tons a year. The reduction in the possible (potential) discharge was 77,000 tons and the economic impact was more than 20 million rubles a year.

These studies indicated the great impact of the sanitization of the environment in the Donbass and the cis-Dnepr Region. At the same time, a differentiated approach must be taken to the resolution of this important statewide problem. The strategy of atmospheric protection must be based on economic research in this area.

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ECONOMIC IMPACT OF WATER CONSERVATION

Kiev EKONOMIKA SOVETSKOY UKRAINY in Russian No 6, Jun 76 pp 51-58

[Article by L. Chernega, candidate of economic sciences (Khar'kov): "Assessment of the Economic Impact of a Group of Water Conservation Measures in the Ukraine"]

[Text] Questions of environmental protection and water conservation, an important element of this total protection, are becoming a matter of great concern, not only for specialists working in this field of science, but also for a large group of public and state organizations.

When forecasts are being drawn up in regard to the development of branches of the national economy, one of the most important aspects of this process is the evaluation of future levels of technical progress, on the basis of which the economic efficiency of each branch is determined.

Forecasting the effect of water conservation measures involves certain difficulties; in addition to the difficulty of determining possible changes in the technology for carrying out these measures, there is the no less difcult task of assessing their economic impact. The society does not obtain a direct increase in physical production from large capital investments in water conservation and greater operational expenditures on the implementation of conservation measures, that is, in this case, the basic criterion for assessing the economic impact of productive expenditures is lacking. This criterion, according to the existing procedures for determining the economic impact of capital investments,[1] is the relationship of the expected increase in national income to planned capital investments. Consequently, it is virtually impossible to determine the absolute economic impact of expenditures on water conservation measures in the general sense. In connection with this, when various groups of water conservation measures are being compared, only the relative economic impact can be determined, and this makes it possible to choose the optimal solution to the problem.

1. USSR Gosplan, USSR Gosstroy and the USSR Academy of Sciences, "Standard Methods for Determining the Economic Impact of Capital Investments," Ekonomika, Moscow, 1969; USSR Gosstroy, "Instructions for Determining the Economic Impact of Capital Investments in Construction," Construction Norm 423-71, Izdatel'stvo literatury po stroitel'stvu, Moscow, 1972.

Table 1

Basic Indicators of Development of Water Management in Ukrainian SSR in 1973 as Compared to 1966 (%)

Район и отрасли промышленности (1)	Общее водопотребление (2)	Потребление свежей воды (3)	Потребление оборотной воды (4)	Удельный вес удовлетворения потребности в воде за счет оборотной воды (5)		Рост промышленного производства (6)	Изменение удельных норм водопотребления (7)
				1966 г.	1973 г.		
(8) По республике в целом	158	111,8	210	45,1	59,9	168	94,0
(9) в том числе по районам:							
(10) Донбасс	152	71,5	256	37,5	62,9	144	105,5
(11) Приднепровье	136	111,5	170	43,9	54,4	165	82,4
(12) Южный	174	171,5	215	19,4	23,9	173	99,4
(13) Левобережье	193	118,8	229	67,1	46,6	178	91,6
(14) Правобережье	313	440,0	195	52,3	32,6	191	164,0
(15) Волынь	409	156,9	1415	20,0	69,4	180	227,0
(16) Подолия	439	701,0	143	47,0	15,2	193	227,0
(17) Прикарпатье	134	93,6	153	68,9	78,3	199	67,3
(18) в том числе по отраслям промышленности:							
(19) энергетика	162	109,8	286	29,7	52,5	171	94,7
(20) металлургия	138	104,6	152	72,3	79,1	129	93,0
(21) химия	187	137,8	198	81,5	86,2	229	81,7
(22) пищевая	128	116,7	140	47,7	52,4	140	91,5
(23) комунальное хозяйство	142	141,5	400	0,08	0,20	153	92,8
(24) машиностроение	230	168,0	290	50,9	64,1	215	107,0
(25) угольная	172	106,9	257	43,1	64,6	120	143,4
(26) легкая	203	227,0	175	46,9	40,5	195	104,1
(27) транспорт	151	164,1	117	27,2	21,1	132	114,4
(28) строительство	217	144,0	705	13,0	42,3	163	132,5
(29) прочие	136	156,5	76	25,2	14,1	140	97,1

Key:

1. Regions and branches of industry
2. Total water consumption
3. Consumption of fresh water
4. Consumption of recycled water
5. Percentage of demand satisfied by recycled water
6. Growth rate of industrial production
7. Changes in proportional water consumption norms
8. Throughout the republic as a whole
9. By regions
10. Donbass
11. Cis-Dnepr
12. Southern
13. Left Bank
14. Right Bank
15. Volyn'
16. Podoliya
17. Cis-Carpathian
18. By industrial branches
19. Power engineering
20. Metallurgy
21. Chemicals
22. Food industry
23. Public utilities
24. Machine building
25. Coal industry
26. Light industry
27. Transportation
28. Construction
29. Others

The economic impact of water conservation measures in the Ukrainian SSR was evaluated by means of the reports of state water inspectorates and data on economic development in the republic, published in statistical yearbooks for 1966-1973. In accordance with the methods chosen for this purpose,[2] comparative calculations were made of the economic impact of water conservation measures in 1966 and 1973.

The data for comparing the impact in different regions of the republic and the main branches of industry are presented in Table 1.

During these years, most of the increase in water consumption was covered through the introduction of systems for recycling the water supply. The percentage of the total demand for water which was satisfied through the organization of recycling systems increased in all of the main branches of industry in the republic.

From the regional standpoint, however, the picture was somewhat different. The greatest increase in water consumption was seen in the Podoliya, Volyn' and Right Bank regions, but the percentage of demand satisfied by recycled water only increased in Volyn', while there was a sharp drop in these percentages in the Podoliya and Right Bank regions. In general, there was an increase in proportional water consumption norms in the Donbass, the Right Bank Region, Volyn' and Podoliya and in the following branches of industry--machine building, the coal industry, light industry, transportation and construction.

Consequently, in reference to the more efficient use of water, the republic still has unused reserves, even though the technical and economic indicators of water management rose significantly during 1966-1973 as a whole. The highest percentage of demand satisfied by recycled water at present may be found in the cis-Carpathian Region, and then in Volyn', even though water consumption norms rose by 127 percent in this region. In the Donbass, despite the significant increase in the use of recycled water, proportional water consumption norms rose by 5.5 percent. In the cis-Dnepr, Southern and cis-Carpathian regions, an increase in the percentage of demand satisfied by recycled water was accompanied by a drop in water consumption norms.

Therefore, in the case of the republic as a whole, the possible impact from the reduction of water consumption norms per unit of product is much less than the impact which could be obtained from the stricter control of water used. The greatest increase in the use of fresh water in the Right Bank and Podoliya regions was mainly due to the start-up of large thermal power stations, where the water supply is still being transmitted through a direct-flow system. The use of recycling systems at these facilities will reduce the amount of fresh water used and the expenses related to its conveyance and purification. The maintenance of proportional water consumption

2. L. G. Chernega and N. Ye. Kudenko, "Assessment of the Economic Impact of Water Conservation Measures," EKONOMIKA SOVETSKOY UKRAINY, No 8, 1972.

norms in the Donbass, the Right Bank, Volyn' and Podoliya and in machine building, transportation, light industry and the coal industry on the 1967 level with the conservation level that was achieved in 1973 in other regions and branches of the republic economy would reduce fresh water consumption by 38 percent. These hidden reserves amount to 38 percent while the actual amount of reduction in fresh water consumption in 1973, as compared to 1966, was only 6 percent.

The economic impact of the present reduction in the use of fresh water as a result of the greater use of recycled water can be determined from the following data: Fresh water consumption in the Donbass can only be increased by means of its conveyance from other regions--in this case, from the Dnepr through the Dnepr-Donbass Canal; in the cis-Dnepr Region the significant rise in the use of recycled water has been to the advantage of Krivoy Rog, to which fresh water is conveyed through the Dnepr-Krivoy Rog Canal; in the Southern Region, most of the demand for fresh water is satisfied by means of the North Crimean Canal. Within the near future, most of the Left Bank's demand for water will also be satisfied through the Dnepr-Donbass Canal which is now being built; plans envisage a powerful pipeline branching off from this canal to satisfy the growing demand for water in the Khar'kov industrial region.

It is only in the Right-Bank, Podoliya, Volyn' and cis-Carpathian regions that existing water resources now cover the growing demand for water without its transfer from other regions. But these regions only accounted for 15.5 and 21.6 percent of total water consumption in the republic in 1966 and 1973 respectively, and 11.1 and 28.1 percent of fresh water consumption. Therefore, in order to determine the economic impact of the organization of recycling systems, it would be completely natural to compare their technical and economic indicators not to the indicators of direct-flow systems, but to the technical and economic indicators of the transportation of water from other regions. According to our calculations, this could save the Ukraine up to 60 rubles in capital investments and 5 rubles in operational expenditures for every thousand cubic meters of water used in recycling systems each year.

In terms of averaged expenditures, the economic impact would be 12.2 rubles per thousand cubic meters of water, that is, 648 million rubles in the Donbass, 396 million in the cis-Dnepr Region, 56 million in the Left Bank Region and 1.1 billion rubles in the Ukraine as a whole. This is much higher than annual expenditures on the entire system of water management in the republic, which include the expenses of operating water supply systems and the expenditures on the drainage and sanitization of sewage.

The process of determining the economic impact of measures involving the drainage and sanitization of sewage has its own peculiar features. The fact is that, while the impact of using certain measures connected with the water supply is manifested directly at the facility where the water is used, since the technical and economic indicators of basic production processes

depend on the conditions governing the conveyance and purification of water, the picture is somewhat different in regard to the drainage and sanitization of sewage.

These expenses give rise to additional expenditures on basic production, but their impact is not manifested within the boundaries of the specific facility. The deterioration of the quality of water at levels lower than the water used by the given consumer does not affect his technical and economic indicators, although it can cause great harm to other consumers. This is why the economic impact of measures to organize the drainage and sanitization of sewage can only be determined with consideration for the interests of all consumers in the given region and, in some cases, even beyond the boundaries of this region.

In order to determine the economic impact of measures to sanitize sewage, the initial data presented in Table 2 were used.

From these data we can see that the amount of sewage dumped as a whole throughout the republic increased by 15 percent, while proportional norms (calculated per unit of product) decreased by 31.6 percent, the amount of purified sewage dumped rose by 41.1 percent, and proportional norms dropped by 16 percent; the absolute amount of unpurified sewage dumped decreased by 19.2 percent, while proportional norms decreased by 51.9 percent. The rate of purification, in terms of trapped pollutants, amounted to 65.2 percent in 1966, and by 1972 the figure had already reached 77 percent.

At present, the highest rate of purification can be seen in the Left Bank Region (85 percent), the Donbass (819 percent), the cis-Dnepr Region (80.2 percent) and Podoliya (78.7 percent). The situation is somewhat worse in the Southern Region (52 percent) and the cis-Carpathian Region (67 percent).

In the case of industrial branches, proportional dumping norms rose only in transportation, light industry and other branches not mentioned in the list.

The same information can be used, however, as the basis for the conclusion that the reserves for removing pollutants by means of the purification methods used most widely at the present time will be exhausted within the near future. Published data and CEMA recommendations[3] indicate that the use of traditional methods for the removal of pollutants can ensure indicators of 30-98 percent in regard to the degree of purification of suspended elements and 10-99 percent in regard to biochemical oxygen demand (BOD) (Table 3).

3. A. P. Levin, V. P. Prokof'yev and A. P. Demin, "Procedures for Determining the Impact of Water Conservation Measures," VODNYYE RESURSY, No 3, 1974; CEMA and All-Union Scientific Research Institute of Water Supply, Sewer Systems, Hydraulic Engineering Structures and Engineering Hydrology, "General Norms for Water Use and Sewage Quality per Unit of Product for Various Industrial Branches," Stroyizdat, Moscow, 1973.

Table 2

Basic Indicators of Sewage Sanitization in Ukrainian SSR in Relation to 1966 (%)

(1) Районы и отрасли промышленности	Сброс сточных вод (2)		Очистка сточных вод (5)		Сброс неочищенных сточных вод (7)		Снятие загрязнений на очистных сооружениях (9)	
	(3) всего	удельный сброс сточных вод (4)	(3) всего	удельная норма очищенных вод (6)	(3) всего	удельная норма (8)	1966 г.	1973 г.
(10) По республике	115,0	63,4	141,1	84,0	80,0	48,1	65,2	77,0
(11) в том числе по районам:								
(12) Донбасс	73,1	50,9	112,2	77,9	42,7	29,6	75,6	81,9
(13) Приднепровье	111,5	67,5	149,9	90,7	71,6	43,5	62,8	80,2
(14) Южный	162,0	93,5	143,9	83,1	204,5	118,0	57,4	52,0
(15) Левобережье	97,7	94,5	182,6	102,5	63,1	35,6	64,2	85,5
(16) Правобережье	459,0	240,0	194,5	101,9	52,3	27,4	60,2	80,7
(17) Волынь	144,0	80,0	166,6	92,6	129,0	71,6	69,4	80,7
(18) Подолия	736,0	381,0	133,7	69,1	60,0	31,1	67,0	78,7
(19) Прикарпатье	82,4	41,4	251,6	126,3	56,6	29,4	46,8	67,0
(20) в том числе по отраслям промышленности:								
(21) энергетика	108,7	63,4	141,1	82,6	100,0	58,5	85,5	86,6
(22) металлургия	112,0	86,6	107,1	83,0	49,6	38,5	70,2	79,7
(23) химия	153,0	66,8	233,0	101,8	160,6	70,1	69,3	74,5
(24) пищевая	122,9	87,6	134,4	95,8	66,1	47,4	72,2	83,0
(25) коммунальное хозяйство	135,4	88,3	169,5	110,9	76,4	50,0	46,8	61,6
(26) машиностроение	157,0	73,0	179,2	83,4	153,4	71,5	79,5	79,6
(27) угольная	117,7	98,0	116,7	97,1	31,8	26,5	55,8	63,1
(28) легкая	248,0	127,0	307,0	157,0	120,0	61,5	60,7	65,8
(29) транспорт	167,3	127,0	134,8	102,0	153,1	116,0	52,0	52,6
(30) строительство	133,3	81,9	182,3	112,5	112,5	69,0	67,7	68,5
(31) прочие	204,0	154,0	353,0	267,0	252,0	182,0	67,8	77,9

Key:

1. Regions and branches of industry
2. Amount of sewage dumped
3. Total
4. Proportional dumping
5. Amount of sewage purified
6. Proportional sanitization norm
7. Amount of unpurified sewage dumped
8. Proportional norm
9. Amount of pollutants removed in purification process
10. Throughout the republic
11. By regions
12. Donbass
13. Cis-Dnepr
14. Southern
15. Left Bank
16. Right Bank
17. Volyn'
18. Podoliya
19. Cis-Carpathian
20. By industrial branches
21. Power engineering
22. Metallurgy
23. Chemicals
24. Food industry
25. Public utilities
26. Machine building
27. Coal industry
28. Light industry
29. Transportation
30. Construction
31. Others

Table 3

Basic Methods Used To Purify Production Sewage
(Purification Rate Indicated in %)

Production Unit	Mechanical		Physicochemical		Biochemical		Chemical	
	suspended elements	BOD	suspended elements	BOD	suspended elements	BOD	suspended elements	BOD
Food industry	50-60	30	--	--	95-98	95-99	--	--
Light industry	40-70	30	80-90	50	90-95	95	80	85
Processing of animal husbandry products	60	30	--	--	95	98	80	85
Wood processing	60	10	90	60	90	90	90	95
Production of artificial rubber and chemical fibers	60	35	90	75	95	98	90	95
Ferrous and nonferrous metallurgy	90	20	90	40	--	--	90	95
Basic chemicals	30	10	80	30	80	50	80	60
Oil extraction, oil refining and petrochemicals	50	10	90	60	90	95	80	85
Proportional capital investments (1 ruble per 1,000 cubic meters)	50-150		500-1,500		200-450		300-1,800	
Overhead costs (1 ruble per 1,000 cubic meters)	10-20		100-800		100-150		80-700	

When we compare the indicators in tables 2 and 3, it is easy to see that the maximum rate of the removal of pollutants by means of existing purification methods has almost been reached in the Ukraine as a whole and in each individual economic region and industrial branch.

As a rule, a rise in the level of sanitization requires a considerable rise in capital and operational expenditures. This fact has been analyzed in great detail in literature and we can therefore limit our discussion to a comparison of the technical and economic indicators of the repurification of sewage to the possible amounts of sewage that can be dumped into reservoirs on the condition that the self-purification properties of the water be used to the maximum. When these calculations are adjusted to apply to a larger scale, the ratio of the given quantity of sewage to the drainage from another region should not be higher than 1:5, while the ratio of this sewage to the run-off from other regions should not be higher than 1:10, since the run-off has already been partially polluted by the sewage of the regions from which it has come. On the basis of this, we can determine the possible volume of sewage that can be dumped into reservoirs in accordance with established laws protecting the quality of water in regions of the Ukraine. If we then compare the expenditures required to remove an equivalent quantity of pollutants from the sewage in special purification units, we can determine the economic impact of the self-purification properties of reservoirs. The initial data for this kind of computation are presented in Table 4.

From the data in Table 4, we can see that the potential for self-purification in reservoirs in the Donbass has been exceeded by the amount of sewage dumped (by 57 percent in 1966 and by 8.5 percent in 1973). In the cis-Dnepr region, it was exceeded by 5 percent in 1966, but some reserves still exist in the other regions. These data indicate that the purification of sewage is essential in all regions of the republic without exception, since the average volume of sewage dumped into purification installations in 1973, without allowances for the degree to which pollutants were removed, exceeded the possible amounts in every case.

Table 4

Indicators of the Use of Open Reservoirs in the Ukrainian SSR as Receptacles for Sewage

(1) Районы	(2) Сток рек (км³ в год)		(5) Возможный объем сброса приведенных стоков (км³)	(6) Фактический приведенный объем сброса сточных вод (км³ в год)			
	местный (3)	транзитный (4)		без учета очистки (7)		с учетом очистки (8)	
				1966 г.	1973 г.	1966 г.	1973 г.
(9) Донбасс	6,4	2,5	1,53	9,86	9,16	2,40	1,66
(10) Приднепровье	2,1	40,0	4,42	12,83	13,85	4,64	2,50
(11) Южный	1,0	43,0	4,50	5,48	9,10	2,33	3,83
(12) Левобережье	7,1	32,9	4,71	3,52	27,00	0,92	1,05
(13) Правобережье	3,6	37,4	4,46	5,18	9,50	2,06	1,84
(14) Волынь	6,3	4,0	1,66	1,58	2,44	0,48	0.47
(15) Подолия	4,0	4,0	1,20	1,41	3,00	0,46	0,64
(16) Прикарпатье	10,0	—	2,00	3,04	5,00	1,61	1,65
(17) УССР	40,5	24,6	24,48	42,90	59,00	14,90	13,60

[Key on following page]

Key:

1. Regions
2. River run-off (cubic kilometers per year)
3. Local
4. Transit
5. Possible amount of dumping (cubic kilometers)
6. Actual amount of sewage dumped (cubic kilometers per year)
7. Without allowances for purification
8. With allowances for purification
9. Donbass
10. Cis-Dnepr
11. Southern
12. Left Bank
13. Right Bank
14. Volyn'
15. Podoliya
16. Cis-Carpathian
17. Ukrainian SSR

We must remember that the dumping of sewage within permissible limits does not leave any reserves for expanded reproduction, since new facilities will not have the opportunity to use the reservoirs as receptacles for sewage and, for this reason, the complete use of water resources in this way will run counter to the interests of continued national economic development.

The economic impact of the operations of purification installations is determined by means of the reduction in the expenditures of those using the given reservoir minus the expenses of purification (see Table 5).

Table 5

Economic Impact of Operations of Units for the Purification of Sewage in the Ukraine (millions of rubles per year)

(1) Районы	1966 г.	1968 г.	1970 г.	1972 г.	1973 г.
(2) Донбасс	1050	1190	1300	1420	1484
(3) Приднепровье	230	293	370	454	460
(4) Южный	22	32	50	73	75
(5) Левобережье	103	186	340	540	568
(6) Правобережье	84	135	220	334	369
(7) Волынь	16	23	30	40	44
(8) Подолия	18	26	40	57	59
(9) Прикарпатье	57	75	100	126	141
(10) Всего	1580	1960	2450	3040	3200

Key:

1. Regions
2. Donbass
3. Cis-Dnepr
4. Southern
5. Left Bank
6. Right Bank
7. Volyn'
8. Podoliya
9. Cis-Carpathian
10. Total

It is interesting to determine the economic impact of the self-purification properties of reservoirs in comparison to expenditures on the repurification

of the same quantities of sewage in purification units. The final results of these computations are presented in Table 6.

Table 6

Economic Impact of Self-Purification of Water in Open Reservoirs (millions of rubles per year)

(1) Районы	1966 г.	1968 г.	1970 г.	1972 г.	1973 г.
(2) Донбасс	810	885	846	790	775
(3) Приднепровье	1760	1667	1700	1736	1761
(4) Южный	439	456	505	593	625
(5) Левобережье	407	440	448	415	420
(6) Правобережье	590	598	650	698	720
(7) Волынь	127	141	169	188	205
(8) Подолия	99	128	157	173	190
(9) Прикарпатье	288	325	375	408	420
(10) Всего	4520	4620	4850	5005	5120

Key:

1. Regions
2. Donbass
3. Cis-Dnepr
4. Southern
5. Left Bank
6. Right Bank
7. Volyn'
8. Podoliya
9. Cis-Carpathian
10. Total

From these data we can see that the use of the self-purification properties of reservoirs for the sanitization of sewage ensures fairly high indicators of economic efficiency (in comparison to the repurification of sewage after other methods have been used to remove pollutants from the sewage).

This fact causes many researchers to suggest the wider use of this method for the sanitization of sewage instead of the construction of cumbersome and not always efficient installations for the repurification of sewage. A great deal of reference has been made to this, particularly in foreign literature.[5] Reference is primarily made to the greater efficiency of the "natural" purification of water in reservoirs and the lower expenditures on the use of this method in comparison to the use of artificial purification units. Many methods have been worked out to artificially augment the self-purification property of reservoirs and channels. In some cases, the "natural" method is even contrasted to the "artificial" method of water purification.

In our opinion, the choice of a specific method for guarding water resources against pollution must be made primarily on the basis of all of the ways in which the water will be put to use in each specific case and on the basis of

5. "Economics," reviewed by F. E. McJunkin, JOURNAL OF THE WATER POLLUTION CONTROL FEDERATION, June 1969, vol 41, No 6; "Economics," reviewed by W. Whipple, JOURNAL OF THE WATER POLLUTION CONTROL FEDERATION, June 1970, vol 42, No 6; "Annual Literature Review," JOURNAL OF THE WATER POLLUTION CONTROL FEDERATION, June 1971, No T-6.

local conditions of water consumption. This problem cannot be solved without a preliminary technical and economic evaluation of all of the technically possible options.

In the USSR, the problem of protecting water resources is being investigated comprehensively. The implementation of the total group of water conservation measures will involve the planting and expansion of protective forest strips on the banks of reservoirs, the creation of special sanitary zones around reservoirs, a ban on the dumping of unpurified or insufficiently purified sewage into reservoirs and the construction of special hydraulic engineering installations for the purpose of augmenting the self-purification potential of reservoirs, on the one hand (measures carried out directly at reservoirs) and, on the other, the introduction of recycled water supply systems, the transfer to a new technology in the systems used for cooling equipment in industry, the collection and recycling of water for irrigation in agriculture, the use of biologically purified water as a recycled water supply for industrial enterprises and irrigated fields, the enlargement of the capacities of purification installations at local facilities (shop and plantwide) for the sanitization of sewage, the introduction of new technological processes for the purification of water and the utilization of valuable substances in sewage, etc. Besides this, an automated control system is to be set up for controlling and regulating the quality of water, first in individual sources of water, and then for all bodies of water in general.

The introduction of the planned group of water conservation measures will produce a savings in the national economy through the reduction of proportional water expenditure norms and a drop in the cost of sewage purification.

A comparison of the data of our calculations shows that the amount saved in the Ukrainian SSR in 1973, in comparison to the 1966 level, through the reduction of proportional water expenditure norms was 1.1 billion rubles, with another savings of 1.62 billion through the higher degree of purification of sewage in the purification units of industrial and municipal enterprises and 600 million rubles through the better use of the self-purification properties of reservoirs; this was a total savings of 3.32 billion rubles.

These data show that the greatest attention in recent years has been paid to a rise in the purification rate, then the reduction of proportional water consumption norms and, finally, the use of the self-purification properties of reservoirs.

An analysis of the total change in the technical and economic indicators of the development of water management in the Ukrainian SSR, which is already one of the most highly developed regions--not only in our nation, but in the entire world--can answer many of the questions arising in connection with the setting of new water conservation normatives, the development and implementation of new methods and equipment for the purification of sewage, the improvement of industrial technology, etc.

Besides this, similar computations can be made to assess long-range plans for water conservation, which will aid in the selection of the most effective measures.

The criterion used to measure the effect of expenditures on the purification of sewage in the absolute sense of the term might be the national economic gains from the prevention of losses due to the pollution of reservoirs (the change in the composition of water in reservoirs). This has not met with any fundamental objections from economists or technologists working in the field of sewage purification. But it has been objected to by sanitary inspection agencies and some scientific establishments engaged in the study of environmental protection as a whole.

We can explain this by means of the following example. The dumping of sewage by a large chemical enterprise into a river which is intensively used in the national economy (such as the Northern Donets in the Donbass) will immediately affect the closest users of this water, who will either have to increase their expenditures on the purification of the water or find other sources of water. If this enterprise is located in East Siberia or the Far East on a river that does not serve any other industrial water users downstream, however, the dumping will not have the same consequences. But this does not mean that the dumping will cause less noticeable harm to the environment and the national economy. The fact that the region has not been adequately studied makes it impossible to make any precise forecasts about the changes which might occur in the ecology of the body of water, particularly the effect on the development of the fishing industry. It would be difficult to predict the future effect of these changes, even though it is clear that this type of harm cannot be computed in terms of cost at the present time.

For this reason, two views are expressed in regard to this matter:

One group advocates the establishment of the maximum permissible concentration (MPC) for various conditions polluting the composition of the water in reservoirs. The MPC criteria are set on the basis of the way in which the reservoir is to be put to use--as a fishing spot, a source of drinking water or technical water supply, a location for mass recreation or a national park;

The other group advocates restrictions on the maximum permissible discharge (MPD), that is, the limitation of the dumping of sewage, regardless of the location of the reservoir and the way in which it is to be put to use.

In the first case, the prevention of losses in the national economy is given priority over environmental protection, while the protection of all bodies of water from pollution is the primary consideration in the second case.

If we examine these proposals from the standpoint of general national economic interests, we must first consider two facts: The cost of installations for the purification of industrial and household sewage has already reached 10-15 percent of the total productive capital of industrial enterprises and

public utilities. If MPD requirements must be observed, the cost of purification units will reach (according to estimates) 40-45 percent of the value of fixed productive capital. Some idea of the size of these additional expenditures can be gained from the indicators presented in Table 6. The setting of MPD criteria instead of MPC requirements will require the expenditure of these funds on the repurification of sewage rather than on the development of other branches of the national economy. The adoption of this kind of criterion will virtually signify the need to stop the construction of all industrial enterprises and other facilities for a period of approximately 3 years and to allocate all existing resources for the construction of purification installations.

It is obvious that this kind of delay in the construction of new industrial facilities and public utilities would be impossible, even though the present situation, which frequently leads to the increasing pollution of reservoirs and, consequently, greater losses in the national economy, also cannot be allowed to remain unchanged. There is one solution--the gradual restriction of the dumping of sewage into open reservoirs, first in regions of the most intensive economic development, where the situation is the most threatening, and then in other regions, depending on their degree of economic development.

The degree to which the dumping of sewage should be restricted can be determined by means of computing the amount of average run-off and drainage from local and transit rivers for each year or 5 years on the basis of the planned rates of economic development in new regions and the ways in which open reservoirs are to be put to use: as fishing spots, as sources of household and drinking water, etc. The details should be worked out by specialists from all concerned organizations, but the main thing is that there can be no unconditional choice of a single method for controlling and protecting the quality of water by means of MPC or MPD criteria. Both methods must be combined on economic grounds, depending on specific local conditions.

8588
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ENVIRONMENTAL PROTECTION AT HEALTH RESORTS

Kiev EKONOMIKA SOVETSKOY UKRAINY in Russian No 6, Jun 76 pp 59-63

[Article by A. Zhivitskiy (Odessa): "The Environmental Problems of Using the Southern Economic Region as a Health Resort Territory"]

[Text] Concern for the health of the Soviet individual and for the need to improve his material welfare is one of the most important matters with which the state is occupied. The principles formulated by V. I. Lenin during the first years of Soviet power in regard to the organization of medical treatment and recreation for the workers are successfully being developed and implemented. Sanitorium and health resort services have become a strong industry in our nation, within the system of which around 9 million individuals are treated each year at sanatoriums, rest homes, boarding houses and health resort polyclinics and more than 25 million individuals make use of various forms of organized recreation.[1]

The intensive development and protection of the nation's health resort resources and the protection of the environment in health resorts and treatment areas are playing an important part in the continued development of the resort industry. The southern economic region, because of its combination of health resort resources and therapeutic factors (sunny weather, a combination of steppe and sea air currents, a warm sea, wide beaches and an abundance of therapeutic salt water and valley mud), is one of the best resort regions in the nation. For example, the temperature of the water is much higher here and the length of the bathing season is much longer than at the seaside resorts of the Baltic region and the Far East, the beaches are wider and swimming is safer than on the famed Black Sea Coast of the Caucasus and the region is one of the leaders in the world in terms of the quantity and quality of its therapeutic mud.

The therapeutic resources of the region explain its growing popularity. While in 1970 the total number of vacationers here amounted to 3 million,[2] the total number of individuals receiving treatment or taking their vacations here, according to our calculations, had exceeded 8 million in 1975. Around 1.8 million individuals received treatment and took their vacations within the sanatorium and health resort network of the region in 1973.[3]

We must remember that, according to the data of the sociological study, 80 percent of all vacationers prefer to make use of organized forms of recreation. Consequently, as a health resort for the use of people throughout the nation, the region is now only satisfying 28 percent of the demand of the vacationers.

The region has considerable reserves for the required continued development of the network of sanatoriums and health resorts. At present, only 200 kilometers of the 1,700 kilometers along the coastline of the Azov and Black seas have been adequately developed for the establishment of health resorts, primarily within the boundaries of greater Yalta, greater Odessa and Yevpatoriya, while the remaining 88 percent of the coastline, with the exception of isolated small groups of health resorts, is still "virgin land." The coast of the Azov Sea and the northwestern part of the Black Sea are particularly underdeveloped. For example, in the second of these, an area of less than 15 percent of its 500 kilometers has been developed adequately for treatment and recreation facilities, including around 50 kilometers of the Odessa coastline, where more than 300,000 individuals are treated at sanatoriums and health resorts each year, and the 15 kilometers of the narrow Karolino-Bugaz-Zatok strip, where around 600,000 persons spend their summer vacations either at 200 vacation facilities or in unorganized forms of recreation.

Special mention should be made of the valuable experience accumulated by the Zatok Village Soviet of Workers' Deputies of Belgorod-Dnestrovskiy Rayon in Odesskaya Oblast. A fairly strong resort industry has been organized here within a relatively short period of time on a small stretch of recently deserted coastline. This experience could be successfully applied to the rest of the undeveloped areas of the resort and treatment zones where the absence of the necessary financial means, materials, powerful construction organizations and so forth are now making it impossible to realize the great plans for the large-scale development of resort areas.

The expenses of the Zatok Village Soviet on providing the resort territory of the Karolino-Bugaz-Zatok coastal strip with all of the conveniences have amounted to around 400,000 rubles a year. Most of the funds for this have been raised by the soviet by implementing the proper premises of the order of the Ukrainian SSR Ministry of Municipal Services of 13 May 1970 and the instructions "On Covering the Expenses Involved in the Provision of Municipal Services to Areas of Temporary Use." This is the second year that recreation facilities have allocated 2.5 rubles per square meter of their territory each for the provision of municipal services to the health resort (landscaping, water mains, electricity, etc.). This means that each hectare of land provides the soviet with 25,000 rubles, an amount which could not be obtained, for example, from the agricultural development of this infertile sandy wasteland.

In other coastal regions, this system is not being used as yet, even though the number of persons traveling to the seacoast for unorganized vacations

is increasing with each year and local ispolkoms are suffering a shortage of funds for financing the rendering of health resort services to the workers and the provision of municipal services to coastal territories. At the same time, it is precisely because of the inadequacy of municipal services that the number of persons taking unorganized vacations on the coast is being reduced by means of administrative measures in some locations, while the establishment of temporary facilities for organized recreation is not being permitted because of the plans for the capital construction of future large health resort complexes along the coast.

Obviously, the time has come to make adjustments in the plans and the dates for the development of the coastal wasteland, as well as in the forms this development will take; the KiyevNIIgradostroitel'stvo and Giprograd project planning institutes must draw up detailed plans for all health resorts and treatment facilities in the region. Trade-union health resort management councils could then, in accordance with these plans, organize the coordination of the means of various organizations in the nation, which might desire to take part in the capital construction of health resorts or, in some locations, the temporary development of the coastline for resorts, and carry out all of the work involved in the provision of these areas with municipal services, following the example of the Karolino-Bugaz-Zatok Resort.

The oblispolkoms of the southern economic region should, for example, organize administrations for the provision of resort areas with municipal services; these economically accountable administrations would have the power to arrange for the cooperative use of departmental resources, since the rayispolkoms of this area do not have the staff or funds for this kind of work.

Special mention should be made of the problem of ensuring the improved use of natural resources in resort areas, particularly in regard to the protection of therapeutic resources, which represent the essential basis for the planned intensive development of the resort industry in the region.

The size of the coastal resort network and the possibilities for its development are determined by project planning organizations mainly on the basis of the existing amounts of therapeutic resources (beaches, therapeutic mud, mineral water, etc.). But it is just as important to consider the other types of natural resources in the area. The shortage of fresh water in this arid zone is of particular importance in the development of the resort industry. Maximum reserves of surface and underground water in the southern economic region are only 1 cubic kilometer a year. The proportional amount of local run-off is 0.01 million cubic meters per square kilometer of dry land, which is 11.7 times less than in the Soviet cis-Black Sea region (not counting the Dunay River)[4] and 16.5 times less than the average for the Black Sea Basin as a whole.

The southern economic region is already experiencing a water shortage which is equal to 4 cubic kilometers per year,[5] which will increase with the

continued development of irrigation systems. It will be a problem to provide the resort industry with the necessary quantity of water, since around 30 percent of the local run-off is not sufficiently purified when it reaches the region's reservoirs.[6] The water shortage is resulting in the intensive use of surface water, which frequently exceeds the amount of operational reserves, and this causes a sharp drop in the water level and raises the mineral content of the water in several coastal locations(the south of Odesskaya Oblast, the western Crimean bank and others).

There are ways of artificially supplementing surface waters by means of gully and ravine run-off, as well as the leakage and drainage from canals and irrigation systems. This water can be dumped into the North-Sivash artesian reservoir, which will prevent a harmful rise in the water level in irrigated areas.[7] Considering the planned growth of the resort network in the cis-Black Sea region of the USSR to a size accomodating 1.5 million persons and the limited nature of water resources, an efficient system of priorities should be established in regard to the region's main consumers of water resources. Priority in supplies of fresh water should be given to the most promising branches requiring a unique environment, including the resort industry and agriculture. The needs of other branches using water (industry, power engineering and others) should be planned for on the basis of the desalinization and utilization of the unlimited resources of sea water from the Azov and Black seas.

The intensive collection of water from the large rivers in the region--the Dnepr and the Dnestr--where it can account for 50 percent of the river flow during the summer, has led to the progressive salinization of the lower parts of the rivers in the Dnestrovskiy and Dnepro-Bugskiy estuaries. This is threatening the water supply of large cities and health resorts--Odessa, Nikolayeva, Kherson, the Karolino-Bugaz Resort and others. In order to prevent this salinization, it would be expedient to install special water-obstruction channels in the Tsaregrad and Kinbourne straits, which will stop the salinization of the depth of these rivers even in those cases when the water intake reaches 50 percent of the river flow. Protective measures must be instituted throughout a considerable portion of the seacoast, which has been subjected to intensive distortion by storm waves and currents. In the northwest cis-Black Sea region alone, around half of the coastline has been subjected to intensive abrasion, which will require increased capital investments in the development of health resorts. The growing scales of poorly organized sand dredging operations in the shelf zone must be stopped; in 1973, the amount of sand dredged in the Black Sea Basin reached 18.1 million tons. The scope of dredging operations is becoming particularly great on the Odessa, Dnestr, Churyum and Bakal banks, which are of great value in the protection of the coastline and its natural resources. For example, only 4 percent of 3 million tons of construction gravel used in Odesskaya Oblast came from the mainland.[8]

These dredging operations are seriously increasing the speed of the abrasion of the cliffs, which, for example, reaches an average of 6 meters a year on

the west bank of the Crimean Peninsula, with a maximum of 11-15 meters a year. Cliffs are eroding at the same rate in the regions of the settlement of Avrora east of the Bakal Spit, the village of Severnoye west of the Bakal Spit at Cape Yevpatoriy and south of Kyzyl-Yar Island.[9]

It will be necessary to reconsider the locations for sand dredging operations on the coastal shelf and the possibility of using the surplus sand from shipping channels for construction purposes, since this work must be done on a strip exceeding 1,100 kilometers in length in the USSR. For example, in the Zhdanov channel alone, the excess drift amounts to 2 million cubic meters a year and, in the case of the Kerch-Yenikal channel to 0.6 million cubic meters a year.[10] The soil excavated during dredging operations involved in the construction of new ports and piers can also be used for this. The amount of soil excavated during the construction of the Grigor'yev Port alone amounted to more than 3 million cubic meters.[11] According to hydraulic engineering experts, the excavation of soil near beaches will subsequently reduce the size of these beaches. For this reason, it will be necessary to consider the possibility of compensating for these environmentally dangerous sand dredging operations by means of the dumping of neutral production waste in these locations, such as, for example, the slag and sludge of metallurgical, aluminum and other plants.

An important role in the protection of the valuable therapeutic properties of the sea water in the coastal zone is played by the coastal aquatic areas, which are distinguished by the great density of their biomass. By converting the products of the decomposition of organic substances, they remove pollutants from the sea, absorb the carbon dioxide in the water and enrich it with oxygen. These aquatic complexes perform the particularly useful function of augmenting the self-purification properties of water in places where the sea has been polluted by sewage from Odessa, Il'ichevsk, Nikolayev, Kherson and Feodosiy and the petroleum products of maritime transport. The sanitization of the marine environment will require the quicker introduction of off-shore sewage dumping by large cities in the hydrosulfide waters of the Black Sea and augmentation of the reserves and composition of the most effective hydrobiontics--water purifiers; the reserves of these have been dramatically reduced in several areas of the Odessa coastline as a result of anti-creep hydraulic engineering work.

In connection with the rise in unorganized recreation along the coastline, it will be necessary to increase the number of national parks and natural preserves, since the coastal aquatic complexes in natural preserves are most able to perform the function of natural filters for removing pollutants from the water.[12]

Economic activity is having an increasing effect on the possibility of developing the coastal area as a health resort region, which requires that more intensive measures be taken to protect the therapeutic resources of this area. For example, an increase in the drilling of artesian wells frequently results in the exposure and, sometimes, the pollution of

mineral water resources; in some cases this is the result of the filtration of surface pollutants. On the northwestern bank of the Crimean Peninsula, therapeutic sulfide waters have been widely used for irrigation purposes. The valuable therapeutic territory of Moynak Island must be guarded against shoaling. The disruption of the natural balance on Saki Island has distilled the natural brine here with fresh water and has deteriorated the quality of the therapeutic mud, the reserves of which exceed 13 million cubic meters.[13]

Protective measures must also be taken in the Kuyal'nitskiy and Khadzibeyskiy limans, which contain the largest reserves of therapeutic mud in the USSR--150 million cubic meters; this mud represents the world standard for quality.[14] As a result of many years of the dumping of Odessa sewage in the Khadzhibeyskiy Liman, the water here is losing its saline content and is becoming polluted, while the therapeutic mud has been subjected to adulteration and deterioration. The dumping of sewage into the liman must be completely stopped so that its unique therapeutic properties can be restored as fully as possible.

Consideration must also be given to the problem of protecting the therapeutic resources of this area in connection with the plans for transmitting water through the Dunay-Dnepr Canal. The plan to desalinize the large Sasyk Liman and to make it a reservoir for irrigation will result in the loss of considerable reserves of therapeutic mud, the quality of which, according to the data of the Odessa Scientific Research Institute of Health Resorts and Physiotherapy, is not surpassed by the quality of the mud in the Kuyal'nitskiy Liman. Several therapeutic mud baths are already operating with the use of mud from the Sasyk Liman and other therapeutic limans in the Dunay-Dnepr interfluve, and the regional plan for the Odessa health resort region envisages the creation of a large network of resorts which will accomodate 1 million individuals each year.

The loss of these valuable health resort resources can lead to a drastic reduction in therapeutic facilities, without which it will be impossible to plan for the development of the resort industry. This is why all natural areas of physiotherapeutic value in the region should be regarded as natural sanctuaries, which will mainly (even in the future) be put to use as health resorts, while other forms of economic activity will only be permitted on the condition that they will not harm the valuable physiotherapeutic properties of these areas. The logic behind this approach may be found in the irreplaceability of these resources, their small reserves and their indispensable role in the effective restoration of the nation's main treasure--its labor resources. This is why the therapeutic factor must also be one of the determining factors in the choice of methods for the development of facilities which will be comprehensively used in the national economy. This applies to the Dnestr and Dnepro-Bug limans, which are widely used in water supply, fishing and shipping.[15] They are also used by the resort industry (alternative bathing in the sea and in the fresh-water liman and the increasing development of the beaches for treatment and recreation).

The plan for transferring water from the Dunay envisages the damming of these limans for the purpose of turning them into reservoirs. This could lead to the flooding and erosion of the Karolino-Bugaz and Kinbourne spits, which are of great statewide physiotherapeutic value. The construction of dams could result in the "blooming" of the water and the accumulation of drainage from river basins, which would deteriorate sanitary conditions along the seacoast. This is why the question of protecting therapeutic resources must be taken into consideration in this plan.

Protective measures must also be taken to guard something which is considered to be a free "gift" from nature--fresh air--particularly in some parts of Odessa, Kherson, Nikolayev, Simferopol', Yalta, Belgorod-Dnestrov and other cities. The plans for moving a group of sanatoriums out of Odessa must be replaced or accompanied by the larger-scale moving of enterprises polluting the environment out of the city. It is particularly inexpedient to situate new enterprises along the coast if these require large quantities of water as part of their production process or if their production is characterized by toxic waste products and other negative effects on the environment. Nonetheless, despite the statewide value of the coast as a resort area and the shortage of water resources, several plans have already been drawn up for the situation of production units here which will use large quantities of water (enterprises of the chemical industry and metallurgy, power engineering facilities, etc.). The choice of this location is explained by the advantages of proximity to the source of raw materials and the place where the products will be sold. In this case, however, little consideration has been given to the potential danger of harming resort areas with the waste products of these production units as a result of even the temporary pollution of the air and water. These plans frequently disregard the vast experience in environmental pollution by existing enterprises, which, in terms of the scales of their production, can not even compare to the enterprises being planned.

In recent years, the problem of environmental protection has evoked increasing concern in various industrially developed nations of the world. In this connection, the Japanese experience in the protection of resort areas is of definite interest. Here the process of urbanization increased internal tourism to 440 million individuals a year (in the USSR, the figure was 125 million individuals in 1972). Due to the increased demand of the inhabitants of cities with populations of millions for vacations in natural surroundings, restrictions were imposed on the further industrialization of the valuable resort region of the Nagano Prefecture; attention was concentrated on the development of the tourist industry and public recreation facilities, with consideration for the convenient location of this region and its valuable therapeutic resources (lakes, hot mineral springs, etc.). The dramatically growing tourist industry provides the prefecture with 8 percent of its total revenues. This experiment in the substantiated restriction of the further industrialization of resort areas can be recommended in part for particularly valuable parts of the resort zone of the southern economic region's coastline.

The more efficient development and preservation of health resort resources for future generations could be promoted by the compilation and implementation of a comprehensive plan for the utilization and protection of the therapeutic resources of health resorts and treatment areas. The absence of this kind of plan, particularly in the Odessa resort region, made the dumping of Odessa sewage in the Khadzhibeyskiy Liman possible. In addition to this, the compilation of this kind of plan could result in a change of plans regarding the modification of natural conditions in the Sasyk Liman, the situation of new production units along the coast, etc. This is why the compilation of this kind of plan is not only of theoretical significance, but also of purely practical value, since it will aid in the future development of the resort industry.

In turn, the continued growth of the resort industry will have a positive effect on the state of the economy of the region. In particular, the development of the resort industry will considerably improve the employment rate and will increase population density, which, in some coastal areas, is the lowest in the region and in the republic--16 individuals per square kilometer.[16] In view of the fact that the average annual rate of increase in revenues from the resort industry and tourism in the world during 1950-1970 was 11 percent, which exceeds the rate of increase in revenues from the highly profitable field of international exports by almost one-fourth, we can predict the considerable activization of productive forces in the region as a result of the planned intensive development of the resort industry, including the internal tourist trade.

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8588
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ENVIRONMENTAL PROTECTION VS. INDUSTRIAL PRODUCTION

Kiev EKONOMIKA SOVETSKOY UKRAINY in Russian No 6, Jun 76 pp 63-66

[Article by Zh. Paliyenko, candidate of economic sciences, and I. Golovach: "The Problem of Protecting the Environment Under Conditions of Concentrated National Production"]

[Text] The 25th CPSU Congress adopted a decision "to develop and implement environmental protection measures and promote the intelligent utilization and reproduction of natural resources."

The problem of environmental protection has now become particularly urgent and is attracting the attention of specialists in various branches of the national economy, as well as the attention of many scientists. This is connected primarily with the great volumes of industrial production, the large quantities of natural resources involved in national economic circulation and the need to prevent losses during the processing of these resources and the considerable harm suffered by the national economy as a result of the pollution of the environment by the harmful wastes of industrial production. This is why, as V. V. Shcherbitskiy pointed out in his speech at the plenum of the Central Committee of the Ukrainian Communist Party on 16 May 1974, the protection of nature is not only of national economic importance, but also of enormous social and indoctrinational significance.

In the Soviet Union, questions of environmental protection are being given a great deal of attention--considerable resources are being allocated for this purpose and the systems, equipment and methods for the purification of the gases formed during the production of certain commodities are constantly being improved. In the Ukrainian SSR alone, capital investments in the construction of dust and gas catchers amounted to 104.9 million rubles during 1968-1973. During these 6 years, new installations were developed and existing units were remodeled; they are not only capable of trapping the harmful contaminants contained in the gases of enterprises, but also of utilizing them for the needs of the national economy. While in 1968 there were 859 sources of pollution in the republic which were completely or partially supplied with dust and gas catchers, by 1973 there were already 1,121. Plans have been made to provide all industrial enterprises in the Ukraine

with the necessary equipment for the purification of their dust and gas waste during the next few years. Despite the considerable amount of work which has been done to prevent atmospheric pollution, however, many problems remain unsolved. These include the low efficiency level of existing dust and gas catchers and the lack of methods and equipment for trapping certain types of harmful substances.

The resolution of the general problem of sanitizing the environment is also complicated by the lack of scientific grounds for comparing the expense of purifying gases discharged into the atmosphere to the impact of the reduction of harmful discharge on the national economy; there is also a lack of information about the effects of scientific and technical progress in physical production on the efficiency of methods for protecting the atmosphere, about the management of production under the conditions of the growing demand for a clean atmosphere, etc.

Now that scientific and technical progress represents the main factor determining the development of national production, the problem of environmental protection must be solved immediately; otherwise, the efficiency level of measures will be extremely low.

As we know, the most important trends in the development of national production are now the improvement of production equipment and technology, the concentration of production, the specialization and combination of production units and the creation of territorial production complexes. Improvements in the territorial organization of production, in turn, give rise to certain specific features which must be taken into consideration when decisions are being made on environmental protection measures. These features are most apparent in the process of the concentration of production.

The concentration of production aids in raising the level of labor productivity and reducing capital and operational expenditures per unit of manufactured product. This can have a significant economic impact. At the same time, enlarging the capacities for the production of a certain commodity in a specific district, economic region or populated point can also lead to negative consequences in connection with an increase in the quantity of harmful substances formed during the production process. This makes it necessary to determine the optimal capacity of enterprises polluting the environment with identical waste products. The resolution of this problem will aid in preventing the above-norm pollution of the atmosphere in a specific territory.

We should emphasize the fact that the presence of dust and gas catchers with a fairly high level of efficiency does not always guarantee the observance of clean-air requirements.

Modern equipment and units for the removal of certain types of harmful contaminants from enterprise gases can guarantee a fairly high level of efficiency-- for example, a rate of 95-96 percent in the case of dust removal.

At the same time, the removal of SO_2, NO_2 and other compounds is still on a low technical and economic level.

In general, the quantity of a single harmful substance (K) discharged into the atmosphere is governed by:

$$K = \left(1 - \frac{\eta}{100}\right) M \cdot t\,(\text{T}), \tag{1}$$

where η signifies the efficiency level of purification equipment (in percentage values), M signifies the quantity of the harmful substance formed during period (T) and t signifies duration.

It is completely understandable that, even if η is fairly high, the quantity of the harmful substance formed during the production process (M) can reach such proportions under the conditions of a high degree of production concentration that the indicator K will exceed the maximum permissible norm for the specific geographic location.

Therefore, when we analyze the total effect of the harmful wastes of a specific enterprise on the environment, we can conclude that the degree of pollution will depend on the capacity of the source of the harmful wastes, the efficiency of purification equipment and the size of the polluted territory. And if we take the maximum permissible concentration of harmful substances in the atmosphere of a specific location to be the limit, the total quantity of a specific substance or compound for several sources (i) can be conditionally expressed in the form of the following equation (period t = 1):

$$\sum_i^n K_i = \sum_i^n \left(1 - \frac{\eta_i}{100}\right) \cdot M_i \leqslant \frac{1}{2} P_\kappa \sum_i^n S_i \cdot H_i + Q, \tag{2}$$

where P_k signifies the maximum permissible concentration of a single type of harmful contaminant in the atmosphere (milligrams per cubic meter), S_i signifies the territory over which the harmful wastes will be spread (square meters), H_i signifies the height of the source (meters) and Q signifies the quantity of the harmful substance assimilated by organisms, plants and surface precipitation (T).

In this equation, the most variable element represents the quantity of gases formed during the production process. If the efficiency level of dust and gas catchers can reach 96-97 percent, the quantity of these gases will be quite small. That is, 3-4 percent of the harmful substance discharged into the atmosphere after the purification of gases can constitute an amount exceeding the maximum permissible concentration of the given substance. This envisages the existence of a certain "total critical capacity" of the sources of atmospheric pollution, in which case the quantity of the harmful substances discharged into the atmosphere cannot be reduced by means of other, more variable parameters--a rise in the efficiency level of purification equipment or an increase in the height of flues.

It should be noted that Formula 2 excludes the possibility of the emergence of individual areas which differ considerably in terms of their degree of pollution under the influence of specific geomorphological or meteorological conditions within the boundaries of a certain geographic territory. If this should be the case, separate calculations must be made for each individual area.

The determination of the "total critical" capacity of sources of pollution is of great national economic significance, since environmental protection is closely related to the rates of production growth, the distribution of productive forces in the future and the improvement of the present territorial organization of productive forces.

If we assume that all of the gases formed during the production process must be purified, the reserves for increasing the capacities of sources of pollution (R) can be determined in the following way:

$$R = \sum_{i}^{n} \left[\frac{1}{2} P_{\kappa} S_i H_i + Q - \left(1 - \frac{\eta_i}{100}\right) M_i \right]. \qquad (3)$$

In regard to the existence of reserves for the development of production which will be accompanied by the discharge of harmful compounds and substances, individual regions or populated points can be characterized by one of the following three possibilities: R<0; R=0; R>0. It is obvious that, if R>0, there are reserves for increasing production capacities. These reserves can be quantitatively assessed by means of the parameters included in Formula 3.

In the case of R=0, enterprises have reached their "total critical" capacity in terms of the quantity of the certain type of harmful compounds. Consequently, an increase in production volumes will either not be accompanied by an increase in the quantity of harmful substances formed during the production process or will be characterized by a rise in the efficiency level of purification equipment to such a degree that R=0 will still be the case even when production development occurs. Both cases require the consideration of economic matters, since the improvement of production equipment and technology and the development of equipment and units for the purification of industrial gases will require considerable funds. This is why it is essential that these expenses be assessed and that the expediency of investments be determined. If the impact derived from an increase in production volumes will not cover the expenses of preventing atmospheric pollution, it will be inexpedient to increase production capacities.

If R<0, the "total critical" capacity of enterprises, in terms of the quantity of harmful substances discharged into the environment, has been exceeded. It is obvious that the pollution of the environment in certain geographic locations will exceed the maximum permissible norm. This is why our main objective must consist in a reduction in the total quantity of the harmful wastes of enterprises by means of changes in technology, a rise in the efficiency level of purification equipment and the reduction of production

volumes. It should be pointed out that, even though environmental protection measures require considerable capital and operational expenditures, they are essential in all cases, since the technical and economic indicators of production will only be objective when R>0. In other words, optimal production development must envisage the complete exclusion of the possibility of environmental pollution.

In analyzing Formula 3, we can see that the presence of reserves for production development primarily depends on indicator Q. That is, the greater the quantity of a certain harmful substance assimilated by organisms, plants and surface precipitation, the greater the restriction on harmful wastes will be. In cases when harmful contaminants are constantly present in the atmsophere:

$$R^1 = \sum_i^n \left[Q_i - \left(1 - \frac{\eta_i}{100}\right) M_i \right], \qquad (4)$$

where R^1 signifies the quantitative assessment of reserves for an increase in production capacities when the maximum permissible concentration of harmful substances in the atmosphere has been reached.

In our opinion, it is completely possible to control the purity of the atmosphere primarily through improvements in production management. This is of exceptionally great significance in the compilation of forecasts for the development of individual cities and industrial production as a whole, as well as for systematic control over the state of the environment.

This is confirmed by the positive experience in the development and distribution of productive forces with consideration for environmental sanitization requirements. In particular, a rise in the efficiency level of dust and gas catchers at metallurgical plants in Zhdanov, in conjunction with other factors, contributed toward the further development of production. Similar examples may be found in other branches of industry as well--for example, the chemical industry.

Therefore, the further development and improvement of the territorial organization of production will require the timely and thorough analysis of changes in the environment, particularly the degree of atmospheric pollution. The level of production concentration and its efficiency in industrially developed cities and entire regions are limited to some extent by the need to observe clean-air requirements.

The economic impact of a certain variant plan for production development must be determined on the basis of existing reserves and from the standpoint of the need to protect the environment.

Assessment of the prospects for the development of national production and the distribution of productive forces will require the compilation of a list of the reserves for this development in each populated point in the republic.

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POLLUTION BLAMED FOR INCREASING INCIDENCE OF ILLNESS

Athens TO VIMA in Greek 10 Jun 77 p 10

/Text/ In an announcement it issued on the occasion of tomorrow's observance of the World Day for the Protection of the Environment, the Democratic Center Union /EDIK/ points out that the issue of environmental protection in Greece has reached tremendous dimensions because in essence there is no legislation designed to protect the environment and the health of the Greek people from all sorts of profit mongering and from the state's indifference.

More specifically, the statement underlines the considerable responsibility of the present government so far for not taking any effective steps to protect the environment although there is a relevant constitutional provision for it.

EDEK included in its statement a special report from the party's "Committee on Environment and Quality of Life" which says in part: The pollution and infestation have increased to such a dangerous degree that in addition to the dead seas (Saronikos and Thermaikos) we had on a large scale the first cases of illness affecting large segments of the population.

It is further stated that confidential reports to the government show the following: Epidemiological studies in Salonica indicate that we often have symptoms attributable to atmospheric pollution. In the center of Athens, the average levels of sulfuric dioxide are almost twice as high as the maximum safe levels proposed by the World Health Organization. The average pollution level for nitrogen dioxide in the Athens area is high compared to that of other world cities. Pollution from smoke is also high with a high point every morning between 0600-0900 hours. Pollution from floating small particles in the Athens atmosphere is also one of the highest in the world, reaching 190 milligrams per cubic meter (Zurich 130, Paris 49, etc.). The WHO also proposes an annual average level of 40 milligrams per cubic meter. Every report shows that in the last few years the problem of water pollution in Greece has become particularly acute. The situation in the gulfs of Saronikos, Thermaikos, Pagasitikos, etc., is bad. The same applies to a number of rivers. The committee report concludes with the following:

"EDIK, as a responsible political party assessing all data and recognizing the extent of this problem in our country, calls for the immediate adoption of all necessary measures. As a vanguard party EDIK will wage the battle for the protection of the Greek environment and the achievement of quality of life for all Greeks without discrimination, especially for those who work and live under miserable, unhealthy conditions. It is time to put an end to private irresponsibility and state indifference."

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ENVIRONMENT RESTRICTS BUILDING CONSTRUCTION

Athens TO VIMA in Greek 15 Jun 77 p 1

/Article by A. K. Alexandropoulos/

/Text/ The construction of skyscrapers in Athens is banned from now on. It will be allowed only in the suburbs, especially those in the north (Amarousion, Pevki, Khalandri, Vrilissia, Melissia, etc.) for a limited height not to exceed 75 meters and exclusively for offices, hotels and hospitals--never more for private residences. Banned also is the construction of high-rise buildings in all suburbs along the Saronikos coast from Varkiza to Elevsis in order not to obstruct the view of the sea. The same strict rules for the construction of high-rise buildings will apply to all urban centers in the country.

Deputy Minister of Public Works Kharis Rendis confirmed the TO VIMA report yesterday stating that this is indeed a decision by the government designed to avert dangerous complications in the human environment of densely populated areas such as Athens.

Replying to a question as to whether this decision is the outcome of a responsible regulatory plan determining the zones for high-rise buildings in conjunction with the land use throughout the Attiki basis, the traffic networks and the desired population densities, etc., he said:

"The decision is reasonable. A study showed that it is not proper to construct skyscrapers in densely populated areas."

The zones of the northern suburbs where the construction of high-rise buildings will be permitted will be determined by a five-member committee which was set up by Rendis on the 8th of this month. The committee includes Polytechnic School City Planning Professor Ath. Aravandinos, Technical Chamber vice president architect N. Kalogeras, and under-ministry directors Ag. Rogon, Ryssianos and Kaiti Dousi.

According to the ministerial decision, the committee is expected to "determine areas in the northern suburbs of the capital where the construction of high-rise buildings will be permitted." The committee must complete its task within 15 days.

Deputy Rendis underlined the advantages of high-rise buildings (better use of height, greater sunlight, etc.) but then he said that such buildings also present disadvantages as shown so far in countries where skyscrapers have been constructed in large numbers. These disadvantages are both functional and psychological. For this reason, he concluded, skyscrapers must be constructed only in areas where they will disturb the environment as little as possible.

The skyscrapers were transplanted to Athens from America and Europe during the dictatorship in the context of the "housing modernization" of Greek society. This was done under Emergency Law 395/68 "on the height of structures and the system of free construction."

Following the end of the dictatorship it was decided to suspend the granting of permits for skyscrapers pending final determination of the matter.

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FACTORY TO CLOSE UNTIL POLLUTION PROBLEM SOLVED

Athens TO VIMA in Greek 17 Jun 77 p 5

/Text/ Minister of Industry and Energy K. Konofagos said yesterday that the Thessaliki Co. strawcellulose factory will be ordered to suspend its operation unless it completes by the end of June 1977 the construction of installations for processing its refuse which constitutes the major source of pollution for the Pineios River. He added that the extension asked by the company will not be granted. Referring, on the other hand, to the overall question of environmental protection, Konofagos said:

Overall Measures

The pollution of the /Attiki/ basin by industrial wastes will soon come under complete control according to a plan which was drafted by the ministry and has been under implementation for some time. He specifically underlined that the survey of all industries in Attiki has been completed. The industries were placed in two categories--those of high and those of medium or tolerable pollution, in conjunction with the size of installations (horse power) in each case.

At the same time, he has received from most enterprises and is evaluating the responses to the questionnaires sent to them by the ministry a few months ago with regard to the measures they have taken or the installations they have under construction to prevent pollution.

The next step is the study by the appropriate directorate of the ministry of the effectiveness of existing or constructed installations for processing refuse and of the control over their proper functioning.

With regard to the latter, Konofagos said that there are frequent occasions when for one reason or another the existing anti-pollution installations of the factories operate ineffectively or interrupt operations periodically.

In conclusion Konofagos said that the ministry has discontinued for some time the granting of permits for establishing in Attiki high or medium pollution industries in the context of a comprehensive proposal submitted to the Economic Committee for its approval.

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BRIEFS

POWER PLANT POLLUTION--In response to a question by New Democracy /Party/ Deputies N. Kaltetziotis and A. Mikhas, Minister of Industry K. Konofagos stated yesterday in the Chamber of Deputies that the issue of pollution of the atmosphere by the Megalopolis thermoelectric plant will be examined at a meeting to be held at the Ministry of Industry with the participation of ministry and Public Power Corporation /DEI/ officials, the Arkadia deputies from all parties, and Professor Valkanas of the Polytechnical School. Replying to a question by Democratic Center Union Deputies V. Pendaris and V. Dendidakis, Konofagos said that a phthorium-collecting device capable of retaining 99 percent of emitted phthorium is being installed in Pesine. A written reply by the minister to a question by Panhellenic Socialist Movement Deputies A. Kaklamanis and I. Skoulikaris states that the Ministry of Industry has rejected the application of an interested company for establishing a section for the construction of metal ships in the area of the Avlis coast. /Text/ /Athens TO VIMA in Greek 11 Jun 77 p 10/ 7520

END

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