

# Monitoring and rehabilitation of the environment

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The increasing economic activity of the humankind may cause a hazard of irreversible environmental changes in some regions on the Earth. One billion tons of fossil fuel is burnt annually, hundreds of tons of nitrogen oxides, soot, ash, and dust are being emitted to the atmosphere. Soil and water are polluted with oil products (several millions of tons), mineral fertilizers and pesticides, mercury, lead, and nuclear wastes. Uncontrollable environmental changes pose threats for living organisms.

*Ecological Dictionary 2000, p. 531*

The Third International Symposium on Monitoring and Rehabilitation of Environment, that was held at the Institute of Optical Monitoring (IOM) SB RAS on July 10–12, 2000, was dedicated to discussion of results obtained by Russian scientists, as well as by scientists from NIS and foreign countries, when studying a wide range of problems concerning anthropogenic environmental pollution. In estimating an anthropogenic influence of industrial emissions, sewage water, and waste on the quality of the environment, hydrometeorological regimes in different physico-geographical regions have been taken into account. Considerable attention was paid to the influence of atmospheric air pollution on inhabitants' health and role of the quality of drinking water in morbidity. New efficient methods were also discussed for estimation of the influence of technogenic environmental pollution on the health of population.

Discussion of problems concerning both minimization of the influence of anthropogenic factors on the population health and rehabilitation of polluted environmental components is of great interest from the viewpoint of practical applications. The Symposium has gathered 121 participants, from different countries including: Netherlands, France, Belarus, Kazakhstan, and Uzbekistan, as well as from different big cities throughout Russia, like Moscow, St. Petersburg, Ulan-Ude, Novosibirsk, Surgut, Yakutsk, Krasnoyarsk, Bratsk, Nizhni Novgorod, Gorno-Altai, and Barnaul. Proceedings edited by Corresponding Member of RAS M.V. Kabanov and Doctor of Technical Sciences N.P. Soldatkin had been prepared and issued by the beginning of the Symposium. They include 134 short abstracts with the total number of pages of 205. This Symposium was supported by Russian Foundation for Basic Research (Grant No. 02005–74040), Commercial Bank Dvizhenie, and by IOM SB RAS.

Leading scientists and specialists presented 64 oral reports at five sessions that have shown generalized investigation results and their application to various researches and practical fields. These sessions are the following: Methods and physico-technical basis for environmental monitoring; Methods and tools for monitoring of air quality and industrial waste; Methods and tools for monitoring of water and soil, electromagnetic fields and radiation; Effect of climate-ecological and ecosystem changes on the population health; Progressive technologies for environmental rehabilitation. The main and basic topics at the Symposium were *medium, human being, and health*.

Corresponding Member of RAS M.V. Kabanov, developing the concept of "monitoring" in scientific investigations, noted in his report that in recent years statistical analysis of long series of the net instrumented observations has revealed some taxonomic and temporal regularities, in particular for Siberia. These regularities allow one to specify some conceptual monitoring principles and to formulate conclusions on the strategy of investigations of modern natural and climate changes.

In a number of regions, modern natural and climate changes occur at increased rates and relate to the important factors of their sustainable development. Therefore, it is necessary to mobilize scientific and technical achievements and material resources for solving problems on quantitative assessment of the anthropogenic impact and for long-term forecasting of the changes observed.

Regional evolution trajectories made for some parameters of natural and climatic systems differ essentially from each other and from trajectories of the global changes observed. Therefore, in the key regions it is necessary to create centers of comprehensive monitoring that will unite specified (hydrometeorological,

actinometric, atmospheric electricity, ecological, etc.) monitoring networks.

Traditional monitoring of the natural and climate systems, including technogenic ones, as well as the instruments providing such monitoring is necessary but not sufficient for monitoring of an evolution of natural and climate systems. This brings up the urgency of developing new instruments and monitoring technologies accounting for modern scientific and technical tasks. This problem was also discussed in the report on the methods of monitoring the quality of natural water presented by *S.L. Shvartsev*.

Now specialists modernize and create new instruments using both optical and acoustic radiation taking into account requirements for a list of the parameters to be measured and spatiotemporal mode of field observations. With the geoinformation technologies, the results have been obtained on technical realization of both remote recording and reading information from stationary and mobile sensors related to geographical coordinates.

Particular attention at the Symposium has been paid to the problems in analytical and numerical simulation (reports by *V.V. Penenko, Yu.M. Polishchuk, etc.*). Solutions of these problems determine the final stage of monitoring. One of the most valuable achievements in this field is the development of analytical and calculation models for radiation processes in the Earth's atmosphere that cut essentially observation series even on the one-day scale when monitoring climate and ecological changes. Methods for optical monitoring of natural and anthropogenic gases have also been developed. The results have been presented on the development of parametric IR laser frequency converters intended for remote monitoring of the atmosphere (report by *Yu.M. Andreev, P.P. Geiko, et al.*).

Influence of landscape (forests, bogs, water) on the state of the atmosphere was elucidated in the reports by *M.N. Alekseev, I.I. Ippolitov, A.I. Komarov, E.V. Domrachev, V.I. Khamarin, etc.*

A number of reports were devoted to estimation of impact of oil and gas production on the state of the atmosphere and underlying surface. The problems on remote detection of leakage of oil products and prevention accidents have been considered. The methods have been suggested for both determining pollution by oil products and elimination of their leakage (reports by *V.D. Kuzmichev, I.I. Plyusnin, A.P. Zoskin, I.I. Prusakova, etc.*).

Comparative analysis has shown that chemical pollutants are the most dangerous for the environment because they manifest themselves at large distances from the sources. Elaborating upon this concept, a number of authors (*Yu.M. Polishchuk, etc.*) has developed special software (under GIS medium)

intended for computer experiments on assessment of the impact of atmospheric pollution on the landscape components. The results obtained show that the technique proposed allows one, based on accounting for dynamics of oil and gas production, their qualitative parameters (for instance, sulfur content), and changes of amount of oil gas burning, to estimate time changes of ecological load depending on the pollution level and natural complex type.

At the Symposium, considerable attention was paid to lidar and acoustic methods of investigation (reports by *G.G. Shchukin, V.V. Bryukhanova, A.A. Tikhomirov, K.T. Protasov, etc.*). It was proved that these methods are promising.

An urgency of the problem on impact of the environmental pollution (role of water quality in morbidity, methods of estimation an integral pollution, influence of ecosystem and social changes) on the population health was discussed in the presentations by specialists in medicine (*L.P. Volkotrub etc.*).

Ecology-dependent diseases of thyroid gland attracted the greatest interest of the audience. The basic reasons for iodine-losing diseases have been analyzed. Preventive measures have been determined and the problems of early diagnostics have been touched on.

In conclusion, it should be noted that this forum of specialists working in various research fields allowed us to assess the current state of these problems, as well as to organize an exchange of opinions and to discuss the investigation results obtained both in Russia and abroad in the fields of methodology and instrument-making. The decision of the Symposium recommends the regional ecological services to pay proper attention to extending works on monitoring and rehabilitation of environment, as well as to assist in performance of large-scale comprehensive experiments that unite efforts of different organizations from Russia and NIS with the participation of foreign specialists. Useful recommendations concerning integration of investigations of Russian scientists and scientists from European Union in the field of studying modern natural and climate changes in Eurasia were given in the invited presentation by Dr. *Jan Linders* (Netherlands). These problems have also been discussed with other foreign scientists.

Symposium noted that at present this field of investigations is provided with the Russian research staff quite satisfactorily. As for scientific instrumentation, it was noted in the proceedings that now the works are being carried out vigorously on creation of unique instrumentation for investigations (device intended for diagnostics of car roads and transport, automated gas analyzer, precipitation collector, etc.). The development of new devices is at such a level that allows us to get certificates and put them in a commercial production.