Radioecology in Perspective

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In 2006, a book on the problems of radioecology was published by the Russian Academy of Agricultural Sciences and the All-Russia Research Institute of Agricultural Radioecology. This book represents a collection of papers written by Academician of the Russian Academy of Agricultural Sciences and the Ukrainian Academy of Agrarian Sciences, Doctor of Biology, Honored Scientist of the Russian Federation, Winner of State prizes of the USSR and the Russian Federation, Professor R.M. Aleksakhin. Its publication was timed to the 70th anniversary of the birth of Aleksakhin and devoted to the memory of his teacher, Academician of the All-Union Academy of Agricultural Sciences Vsevolod Mavrikievich Klechkovskii.

Aleksakhin has headed the All-Russia Research Institute of Agricultural Radioecology since 1989. He came to this institute in 1975 as a senior researcher. Before 1975, he worked in the Laboratory of Forestry of the All-Union Academy of Sciences. This laboratory was headed by Academician V.N. Sukachev and, then, by Prof. A.A. Molchanov. The first study into the problems of radioecology was performed by Aleksakhin in this laboratory and was devoted to the environmental consequences of the radioactive catastrophe in Kyshtym.

The papers collected in the book acquaint the reader with the scientific career of its author and his significant contribution to general ecology and, particularly, radioecology. Aleksakhin is the author of more than 700 scientific works. Seventy of them were selected for the book (to match the number of years lived by the author).

The book opens with a paper devoted to the effect of lime trees on soil properties. This is an entirely ecological study performed by Aleksakhin under the supervision of a well-known soil scientist, Prof. N.P. Remezov. It is marked by a clear formulation of the problem, an original approach to the complex spatial pattern of forest ecosystems, and thorough experimental work. Remezov helped Aleksakhin to develop a truly ecological approach to study objects. These features have become typical of the further scientific works by Aleksakhin.

A number of papers are devoted to the distribution of radionuclides in forest soils and in forest biogecenoses; the problems of radioactive contamination of food chains in forest ecosystems are also considered. Active work in this field enabled Aleksakhin, together with F.A. Tikhomirov and N.V. Kulikov, to formulate strategic problems of forest radioecology in a paper that was first published in 1970. The challenge of forest radioecology is to study interactions between radionuclides and the components of forest cenoses. This strategic goal involves the study of two problems: (a) the turnover of radionuclides in forest biogecenoses and (b) the biogeocenotic consequences of the radioactive contamination of forest ecosystems. The authors stressed the importance of studying various ecosystem interactions for the proper assessment of the distribution and activity of radionuclides. They also emphasized that soil serves as a protective barrier for radioactive radiation.

The systems approach to study objects is typical of Aleksakhin’s works. He applies various parameters to characterize the impact of radioactive contamination on the biosphere, including changes in the cytogenetic properties of plants, the activity of migration of radionuclides in biogecenoses and soils, the activity of gamma radiation, the uptake of radionuclides by crops, the use of ferrocene-containing preparations in animal husbandry, etc. This list attests to the deep analysis of the problems of radioecology and the wide scope of scientific interests of Aleksakhin.

Aleksakhin was actively involved in the study of the environmental consequences of the Chernobyl nuclear power plant accident. Many papers included in the book are devoted to this tragic event. In contrast to other researchers that took part in this study, Aleksakhin was prepared for it owing to his rich experience gained in the area of the Kyshtym radioactive fallout in the Urals. He clearly formulated the goals of particular studies and understood the importance of their results.

In 1985, Aleksakhin and Tikhomirov published a paper devoted to the advances in radioecology in the past decades in relation to the development of nuclear power engineering. They stressed the great scientific and practical importance of the study of migration of radionuclides in natural media in the context of the disposal of radioactive wastes. They also attracted attention to the biological effects of low doses of radiation.

The development of a general theory of the resistance of biotic objects to radioactivity was considered one of the major challenges of radiobiology and radioecology.

The papers devoted to the problems of crop growing in the areas contaminated by the Chernobyl-derived fallout are of particular interest. Thirteen papers (out of 70) included in the book are in English, as they were originally published abroad. This attests to the international recognition of the works by Aleksakhin and his colleagues among scientists dealing with the problems of radioecology in different parts of the world.

One important fact deserves special mention. Aleksakhin found that soddy-podzolic soils contain some amounts of exchangeable sodium. Normally, exchangeable sodium is not analyzed in the case of soils of humid regions; it is generally believed that it cannot be present in them. The data obtained by Aleksakhin expand our knowledge of the role of cation exchange in the biogeoecenotic processes and point to the possibility of participation of monovalent radioactive elements in the creation of a permanent radioactive field in soils of humid regions.

A paper in which the consequences of radioactive contamination of different ecosystems and soils are analyzed is of particular importance in relation to the potential use of such territories for agricultural purposes in the future.

According to Aleksakhin, the great progress of radioecology was facilitated by the use of radioactive labels in ecosystem studies and by the use of data on concentrations of various isotopes in natural objects as indicators of the character of natural processes and the state of biogeoecenosises.

Aleksakhin stresses that soils and bottom sediments are the main depositories of radionuclides after accidental fallout.

He argues that different organisms in an ecosystem receive different doses of radiation under conditions of the same level of radioactivity. Thus, the doses received by natural biota may be one to three orders of magnitude higher as compared with the doses received by humans. The heterogeneity of the redistribution of radionuclides in ecosystems should be taken into account. The challenge of radioecology is to harmonize our estimates of the effect of radiation on biota and humans. At present, this problem is considered from the viewpoints of the anthropocentric and ecocentric concepts.

The Chernobyl catastrophe provoked a distrust of nuclear energy; Aleksakhin argues that the modern development of nuclear power engineering makes it possible to ensure accident-free functioning of nuclear power plants. The activity of humans has reached the stage when most living organisms may be killed by poisonous chemicals or by biological contamination; soil degradation also endangers the development of civilization. However, this does not mean that all the branches of human economic activity should stop functioning and that humans have to return back to the Stone Age. On the contrary, the growth of our knowledge about various processes related to the productive activity of humans, the rise of our technological culture, and the improvement of consumption should lead to a more secure world, including the security of life on the planet.

As noted above, the book under review is devoted to V.M. Klechkovskii; there are pages on which the reader will find unknown information about this outstanding scientist. The role of Klechkovskii in the development of radioecology remains poorly known because of the secrecy of his works. At present, the veil of secrecy can be removed, and Aleksakhin pays due tribute to his teacher.

The book also contains a paper devoted to the role of Academicians I.V. Kurchatov and A.P. Aleksandrov in the development of radioecological investigations.

Aleksakhin remembers the name of Minister of the Atomic Industry E.P. Slavskii, who was the organizer of the first experimental research station on the territory of the Mayak nuclear plant. The Institute of Agricultural Radioecology was organized on the basis of this station and the Biophysical Laboratory created by Klechkovskii in Timiryazev Agricultural Academy. Often, the creation of the nuclear industry in the Soviet Union is associated with the name of L.P. Beria, who was a curator of the atomic project. However, the role of E.P. Slavskii in the organization of the nuclear industry was much more significant. Slavskii understood the importance of research organizations. Owing to him, the biologists N.V. Timofeev-Resovskii and N.P. Dubinin, who were labeled by Soviet officials as opponents of the “progressive Michurin biology,” got a chance to continue their work in the field of radioecology. In fact, the term radioecology appeared in the United States and in the Soviet Union simultaneously in 1956. However, the results of radioecological investigations remained virtually unknown to the public. The scientists who devoted their talent to the problems of radioecological security are less known than the scientists who created the nuclear bomb, a dreadful menace to humankind. The veil of secrecy around these works was very dense; many advances in radioecology are unknown not only to the broad circle of readers but also to the relatively narrow circle of professional ecologists. In this context, the book by Aleksakhin cannot but attract the attention of researchers specializing in ecology, soil science, botany, crop science, and zoology; it will help them to incorporate the advances of radioecology into the practice of their theoretical and applied studies.

Most of the papers included in the book were prepared by Aleksakhin together with coauthors. The broad scope of the problems considered in these papers is very impressive. The list of coauthors includes the names of many well-known scientists, such as F.A. Tikhomirov, V.M. Prokhorov, S.V. Fesenko, V.F. Gol’tsev, D.A. Spirin, B.A. Prister, N.I. Sanzharova, and others.

The publication of this book is an important event in ecology and radioecology. It is a valuable source of ref-