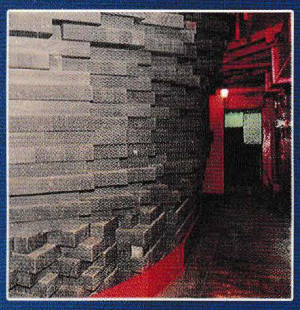
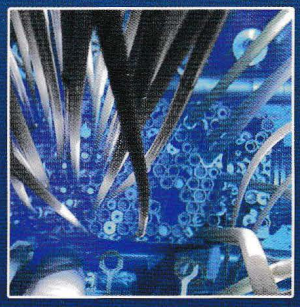
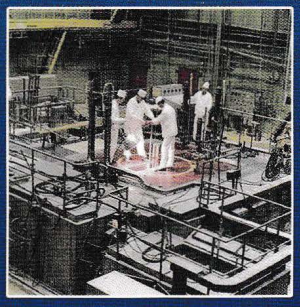
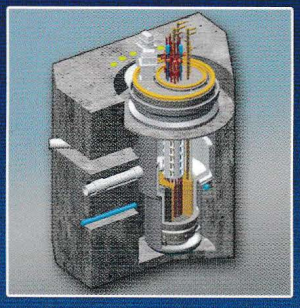






# NUCLEAR RESEARCH FACILITIES IN RUSSIA



# NUCLEAR RESEARCH FACILITIES IN RUSSIA

Edited by N.V. Arkhangelsky, I.T. Tretiyakov, V.N. Fedulin

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Since December 2, 1942, when E. Fermi and his colleagues achieved the first controlled chain reaction in the CP-1 reactor, research facilities have played an important role in many branches of science and technology. Despite their long history, research reactors have not lost their attraction as powerful neutron sources for scientists and engineers and will remain in demand for various applications through many years to come.

The first Russian research reactor was brought into action by I.V. Kurchatov and his fellow workers on December 25, 1946. Since then, a large number of research reactors of various configurations and experimental purposes have been built in the country, many of which are still in operation. The ingenious – and often unique – design of these reactors brought world-wide recognition to the Russian school of research reactor engineering.

Beginning with the first Geneva Conference on Peaceful Uses of Atomic Energy, held in August 1955, extensive information on Russian research reactors has been published. However, it has never been attempted to draw in one publication an overall picture of their characteristics and status regardless of the departmental affiliation and specific research applications.

Russian research reactors have been increasingly shaping up as an integral part of the global experimental capabilities.

Hopefully, this book can make a befitting contribution to integration of Russian engineers and scientists into the world's scientific community and can provide useful information to all readers interested in the subject of Russian research reactors.

ISBN 978-5-98706-061-2

The establishing and progress of nuclear science and engineering would have been impossible without strong experimental capabilities, where a special place belongs to nuclear research facilities.

Their contribution to research in nuclear reactor physics, to development of materials for fission and fusion reactors, and to fundamental science, will not be overestimated.

A whole branch emerging to produce surplus-neutron radioisotopes for medical and industrial purposes as well as other applied activities necessitating intensive neutron radiation, owe their origin to research reactors.

Development of nuclear research facilities, assurance of their safe operation and their efficient experimental uses have always had a high priority in the activities of the State Corporation "Rosatom" and will undoubtedly remain in the center of attention in the future.

The history of research reactors is almost seven decades long, but today this line of nuclear science and engineering is gaining second wind. The world is awaking to the fact that research reactors of a new generation are indispensable for progress in nuclear science and industry, and a number of leading countries have already built new powerful research reactors, or are going to do so in the next few years.

The future of nuclear power will depend on development of fast neutron reactors, and Russia, which has a lead in this area, should and will have a research fast reactor of a new generation with capabilities fit for unique studies in the 21st century.

This book has garnered information about all nuclear facilities of Russia. It can provide answers to the questions not only on the parameters of such facilities, but also about their experimental capabilities and prospects for development.

We hope that this information will be important and useful to designers and operators of nuclear research facilities as well as to specialists whose various activities rely on neutron radiation.

*Deputy General Director – Director of the Innovation Management Unit of the State Corporation "Rosatom", member of the Board of the State Corporation "Rosatom", Doctor of Technical Sciences, Professor*
**VYACHESLAV PERSHUKOV**

Dear reader,

This book, which may be of interest to nuclear specialists and managers of all levels, is basically an encyclopedia of domestic nuclear research reactors. It is shown in the Introduction to the book that Russia has a world lead in terms of the number of such facilities. This result, provided for by scientists and engineers in the first decades of the nuclear sector development, was later underpinned by the experience and knowledge of specialists in the operating organizations.

Symbolically enough, this book is going to be published in the year of the 60th anniversary celebrated by NIKIET – the institute known to have participated in creation of many research reactors with user parameters unprecedented in Russia and beyond. This effort was carried out in collaboration with other organizations, of which many have contributed to this publication.

It would be unwise though to "rest on our laurels", fully content with the past achievements. Sentiments at NIKIET, and in the sector as a whole, tend otherwise, as may be seen from the information on new developments found in Chapters 4 and 5. Today's world with its high competition confronts us with many challenges, such as the need for:

– renovation (upgrading) of the research reactor fleet which is growing outdated;

– its optimization to fulfill the current and future objectives;

– reentry into the world market of research reactors.

These challenges can be dealt with by design of new facilities giving due consideration to the current regulatory requirements – including reduction of the research reactor fuel enrichment – and using novel engineering tools (e.g. 3D and 6D design technologies).

It is such approaches that NIKIET has been bringing into its practice, making sure that they are consistent with the ever-growing experience of design studies, installation of research facilities, and their field supervision.

An attentive reader will find confirmation of the above statement in this publication which, I feel certain, may become a desk companion for an experimenting scientist or a designer, for a field engineer or a professor, for a young specialist or a student.

*Director – General Designer*
*of OJSC "NIKIET",*
*Corresponding Member of*
*the Russian Academy of Sciences*
**YU.G. DRAGUNOV**

Quick-paced progress of nuclear power engineering and industry is impossible without versatile and efficient experimental capabilities offered by reactor and out-of-pile facilities. Some of them are available at the Research Institute of Atomic Reactors (NIIAR) with its fleet of research reactors (including the unique high-flux SM reactor commissioned in 1961); a nuclear power plant prototype – VK-50 facility with a boiling water reactor (1964); a large material test reactor (MIR, 1966) with a wide spectrum of test loop devices; a nuclear power plant prototype with a fast sodium-cooled reactor BOR-60 (1969); and pool-type RBT-6 and RBT-10 reactors. The research reactors of NIIAR provide the required conditions for successful testing materials of the nuclear industry and trying out nuclear technologies. The scientific and engineering results attained by the highly qualified staff of the Institute have contributed to the collective knowledge and expertise of Russian nuclear science and industry. The reliable and safe operation of nuclear research facilities and the important scientific and technical achievements of NIIAR, along with other organizations of Rosatom and Russia at large, have won well-deserved international recognition in the context of global atomic energy use for peaceful purposes. The innovative trend of NIIAR activities has brought its involvement in the present-day nuclear applications, such as radiation medicine (commercial production of various radioisotopes), closed nuclear fuel cycle (fuel fabrication, tests and radiochemical reprocessing for fast reactors), nuclear energy technologies of a new generation (planned construction of a multipurpose fast neutron research reactor, MBIR, with foundation of an international center for shared use of this facility and construction of a pilot power unit with a heavy metal-cooled reactor, SVBR-100), etc. By working along these breakthrough lines to fulfill the long-term plans of nuclear power development, NIIAR is growing into a major experimental reactor technology center of the State Corporation "Rosatom".

*NIIAR Director*
**V.M. TROYANOV**

10.05.2012