STATE SCIENTIFIC CENTER –
RESEARCH INSTITUTE OF ATOMIC REACTORS

AN ENTERPRISE OF ROSATOM STATE ATOMIC ENERGY CORPORATION

A MAN OF LABOR

ANNUAL REPORT 2014

Human life is not eternal but science and knowledge cross the thresholds of the centuries

Igor V. Kurchatov

JOINT STOCK COMPANY

**"STATE SCIENTIFIC CENTER –
RESEARCH INSTITUTE OF ATOMIC REACTORS"**

A MAN OF LABOR

ANNUAL REPORT of JSC "SSC RIAR" for the year of 2014

Approved by the Annual General Meeting of Stockholders
of JSC "SSC RIAR" (Protocol #37 as of June 30, 2015).

Pre-approved by the Resolution of Board of Directors
of JSC "SSC RIAR" (Protocol #292 as of May 28, 2015).

Director of JSC "Science and Innovations",
Managing Director of JSC "SSC RIAR"  Alexander A. Tuzov

Dimitrovgrad
2015

UDC 621.039=161.1

JSC "SSC RIAR" Annual Report 2014 [Electronic resource]: – E-text data (11.2MB) – **Dimitrovgrad: JSC "SSC RIAR", 2015.** – 220 pages – 1 RAM disk (CD-ROM); 12 cm. – System requirements: Pentium III or better; 512MB RAM; 32MB of available hard disk space; Windows 95/98/XP/7/8; Adobe Acrobat Reader; CD-ROM, 2x or higher; mouse. – Heading from the title screen.

The Report covers the key financial, economic and production results of JSC "SSC RIAR" activities for the year of 2014 as well as the results of the sustainability-related activities (economic, ecological and social impact on the world around us); the Report also contains medium- and long-term plans and intentions which are prognostic and may differ from the actual ones. The Report has been issued on a voluntary basis and is addressed to a wide audience.

ISBN 978-5-94831-141-8

Joint Stock Company
“State Scientific Center –
Research Institute of Atomic Reactors”

Mailing address: Dimitrovgrad-10, Ulyanovsk region, 433510, Russian Federation
Phone: +7 (84-235) 3-27-27
Fax: +7 (84-235) 3-58-59
Official website: http://www.niiar.ru
E-mail: niiar@niiar.ru

CONTACT DETAILS

Vladimir V. Kalygin,
JSC “SSC RIAR”, Deputy Director for Science and Innovations,
Deputy Chairperson of the Committee for Public Annual Reporting
E-mail: kalygin@niiar.ru

Irina M. Smirnova,
JSC “SSC RIAR”, Head of the Division for Science and Engineering Research,
Secretary of the Committee for Public Annual Reporting
E-mail: imsmirnova@niiar.ru

Galina L. Pavlova,
JSC “SSC RIAR”, Head of the Internal and External Communications Office,
Spokesperson
E-mail: sos@niiar.ru

CONTENTS

OVERVIEW

High-level expertise
and scrupulous responsibility
in achieving the set goals are
a business card of RIAR specialists

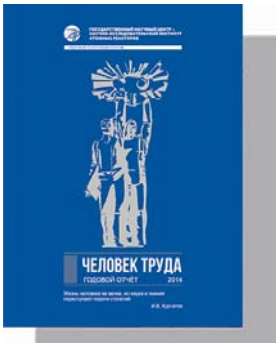
Alexander S. POKROVSKII,
Reactor Materials Testing Complex,
Head of Laboratory, PhD in Physics and Mathematics,
in 2014 awarded a First-Class Medal
of the Order of Merit for the Motherland

INFORMATION ABOUT REPORT AND ITS ISSUING

REPORT DESCRIPTION

The present Report is the fourth integrated report that covers the key financial, economic and production results of the Joint Stock Company “State Scientific Center – Research Institute of Atomic Reactors” (JSC “SSC RIAR”, Company, Institute) performance over the calendar year.

The Report also presents the results of the sustainability-related activities and management approaches allowing results to be achieved and performance to be enhanced in accordance with the strategic objectives of ROSATOM State Atomic Energy Corporation. The Report combines both a common annual report of the Company and a sustainability report.



The key objectives of the Report 2014 are as follows:

- to represent JSC “SSC RIAR” as a dynamic innovative enterprise of ROSATOM;
- to disclose the information about JSC “SSC RIAR” sustainable development;
- to improve the quality of stakeholder engagement.

The Report is addressed to a wide audience of stakeholders, it has been translated into English and it is available on the JSC “SSC RIAR” website (http://www.niiar.ru).

The previous annual report was issued in 2014.

REPORT OUTLINE

The Report covers the whole scope of the JSC “SSC RIAR” activities from January 1 to December 31, 2014 and discloses the information about the Company to the maximum extent, state and commercial secrets being kept. The Report presents the dynamics of the key indicators for a three-year period, plans for 2015, medium- and long-term purposes as well as the information about the strategic objectives and activities to create a basis for long-term sustainable development. No significant changes have been introduced in the envelopment, outline and methods in terms of measuring data and calculations compared to the previous reporting period.

STANDARDS AND REGULATORY DOCUMENTS

The Report has been issued in compliance with the following regulatory documents:

International standards and guidelines:

- AA1000 series standards (Institute of Social and Ethical AccountAbility);
- GRI Sustainability Reporting Guidelines (GRI, version G3.1);
- International Integrated Reporting Standard (International <IR> Framework).

Laws and regulations of the Russian Federation in corporate and financial reporting:

- Federal Law of the Russian Federation No. 208-FZ "On Joint Stock Companies" dated December 26, 1995;
- Law of the Russian Federation No. 5485-1 "On State Secrets" dated July 21, 1993;
- Federal Law of the Russian Federation No. 98-FZ "On Commercial Secrets" dated July 29, 2004;
- Federal Law of the Russian Federation No. 402-FZ "On Accounting" dated December 06, 2011;
- Federal Law of the Russian Federation No. 149-FZ "On Information, Information Technologies and Protection of Information" dated July 27, 2006;
- Order of the Federal Financial Markets Service No. 11-46/pz-n "On Approval of Provisions on Information Disclosure by Registrable Security Issues Bodies" dated October 04, 2011;
- Order of the Federal Commission on Securities Market No. 421/r "Recommendations on Application of the Corporate Code of Conduct" dated April 04, 2002;
- Order of the Federal Commission for on Securities Market No. 03-849/r "Methodological Recommendations on the Scope and the Form of Representing Data on Compliance with the Corporate Code of Conduct in Annual Reports Issued by Joint Stock Companies" dated April 30, 2003.

Regulatory documents of ROSATOM State Atomic Energy Corporation:

- the Public Reporting Policy of ROSATOM;
- the Public Annual Reporting Standard of ROSATOM and its enterprises.

Regulatory documents of JSC "SSC RIAR" in public reporting:

- Provision on the JSC "SSC RIAR" Stakeholder Commission in Public Reporting;
- Provision on the JSC "SSC RIAR" Committee for Public Annual Reporting;
- Standard of Enterprise STO 086-202-2014 "The Quality Management System of JSC "SSC RIAR". The Annual Report Issuing Procedure".

PRIORITY TOPICS OF THE REPORT

Events occurred in JSC “SSC RIAR” within the reporting period and their impact on the development strategy, efficiency and effectiveness of the JSC “SSC RIAR” performance were reviewed in order to select the priority topics of the Report. All groups of stakeholders were greatly involved in direct discussions and survey. As a result, two priority topics of the Report have been selected:

- Involvement of JSC “SSC RIAR” in the priority projects of ROSATOM and resolving the issues of federal significance;
- A Man of Labor.

The key information about covering the priority topics is given in Chapter 3 “Annual Results” and Chapter 4 “Sustainable Development Activities” as well as in other Chapters of the Report as the information related to the effectiveness aspects of the priority topics.

REPORT ISSUING

Prior to issuing this Report, the JSC “SSC RIAR” activities over 2014 as well as the public reporting system and the previous Report issuing quality were reviewed.

At the first stage of Report issuing a survey was conducted among stakeholders and Administration. Here and elsewhere “Administration” means senior management of JSC “SSC RIAR” and its subdivisions. Based on the survey data Report the priority topics and information contents were selected, a stakeholder ranging chart was generated, and proposals on public annual reporting were considered. Concurrently, the best world’s practices in public reporting and annual reports of nuclear enterprises were reviewed.

At the second stage the survey data were analyzed, the methodical baseline was updated, and a Report concept was drafted (see Section 5.3 “Stakeholder Engagement in Report Issuing”, Chapter 5 “Enhancement of the Public Reporting System and Stakeholder Engagement”).

Results and recommendations on public reporting made by ROSATOM and JSC “SSC RIAR” and wishes voiced by stakeholders were taken into consideration in developing the Report concept. The Report concept and assignment of responsibility between JSC “SSC RIAR” subdivisions in provision of information, i.e. public reporting indicators, the statement of work and the Report issuing corporate schedule were approved by Order # 64/20-P of JSC “SSC RIAR” Director as of January 19, 2015.

At the third stage of Report issuing the information was collected from the RIAR subdivisions, dialogues were conducted with stakeholders, the Report was drafted, and the Report draft was publicly verified. Also the statements on the public verification of the Report of the internal audit and the Stakeholder Commission were obtained. The final revision of the Report was approved by the Board of Directors and General Meeting of Stockholders.

DIFFERENCES BETWEEN THE ANNUAL REPORT 2013 AND THE ANNUAL REPORT 2014

The main differences between the Annual Report 2013 and the Annual Report 2014 are as follows:

- two new priority topics have been added;
- 57 GRI indicators have been covered (version G3.1) compared to 32 indicators covered in the Annual Report 2013;
- comments of the JSC "SSC RIAR" top management have been introduced on the key topics of the Report;
- stakeholder engagement has been further developed: the Stakeholder Commission in Public Reporting has been established in JSC "SSC RIAR". It is successfully operating;
- the public reporting system has been improved: Standard of Enterprise STO 086-202-2014 "The Quality Management System of JSC "SSC RIAR". The Annual Report Issuing Procedure" has been issued.

In issuing the Report, more attention was focused on dialogues with stakeholders related to the Report priority topics and on information quality improvement.

The emphasis was laid on the Report design. The Report contains information headpieces about the most hard-working and skillful employees of JSC "SSC RIAR" under the priority topic "A Man of Labor". The Report parameters and promotion methods were as well improved.

The Report concept was discussed in the form of a survey.

STAKEHOLDER ENGAGEMENT

In issuing this Report a principle of stakeholder engagement was implemented in accordance with *the Public Reporting Policy of ROSATOM.* The following stakeholders are the target audience of the Report:

- ROSATOM;
- JSC "Science and Innovations";
- Partners (customers, vendors, subcontractors);
- International partners;
- Personnel and Administration of JSC "SSC RIAR";
- Federal, regional and local authorities;
- Public organizations;
- Educational institutions of different level;
- Population of the presence regions;
- Mass media.

In the course of Report issuing surveys including those on discussion of the Annual Report 2014 concept, two dialogues and public consultations were conducted. More detailed information about stakeholder engagement is given in Chapter 5 "Enhancement of the Public Reporting System and Stakeholder Engagement".

VERIFICATION OF INFORMATION

Following the Resolution of the ROSATOM Operations Committee as of December 16, 2013, an independent audit of the Report cannot be conducted. However, information disclosure in the Report complies with level B (self-declaration).

The members of the Public Annual Reporting Committee of JSC “SSC RIAR” were involved in all the key milestones of Report issuing. One of the main objectives of the Committee is the assessment of accuracy and completeness of the disclosed information.

The accuracy of the information published in the Report is confirmed by as follows:

- Statement of the audit commission;
- Annual financial reporting audit by the FBK Company, which is an independent auditing company;
- Statement of the Internal Audit Division of JSC “SSC RIAR”;
- Public verification statement.

The statement of the audit commission is given in Appendix 7 of this Report. The auditor’s statement on the verification of financial reporting is provided in Appendix 6. The Report was audited by the Internal Audit Division of JSC “SSC RIAR” (Appendix 8); it was publicly verified in accordance with the AA1000AS Standard. The statement on the public verification is given in Chapter 5 “Enhancement of the Public Reporting System and Stakeholder Engagement”.

STATEMENT ON LIABILITY LIMIT FOR PUBLISHING PROGNOSTICATIVE INFORMATION

The Report contains prognostication statements regarding future events or financial indices of JSC “SSC RIAR”.

The following verbiage is used for such prognostication statements: *to plan, to expect, to suppose, to assume, to estimate, to intend, will, possibly, probably, may*, etc.

There are many factors, including general economic conditions, competitive environment, activity-related risks, change of situation in the nuclear power industry, which may cause a significant difference between the real events and prognostication statements made by JSC “SSC RIAR”.

Therefore, the actual activity results to be presented in the forthcoming reports may differ from the prognostication ones provided in this Report. JSC “SSC RIAR” does not represent or warrant that the activity results as well as any indicators and events specified in prognostication statements will be achieved or will occur.

Additional relevant information about JSC “SSC RIAR” activities is available at the official website (http://www.niiar.ru).

KEY PERFORMANCE INDICATORS

Indicator	Actual				Predicted
	2011	2012	2013	2014	2015
Sales proceeding, mn RUB	3 120.9	4 458.8	5 882.9	3 700.9	3 995.0
Net asset, mn RUB	3 995.7	6 482.6	8 277.4	9 263.7	13 861.4
Labor efficiency, thousand RUB/man	661	928.1	1 335.1	928.6	1 090
Insource (added value), %	42.9	31.4	34.7	45.5	54.7
Average headcounts, persons	4 839	4 882	4 430	4 018	3 675
Average monthly salary, thousand RUB/month	19.1	24.1	30.1	32.1	35.6
Social expenditures, thousand RUB	30 655	54 364	78 941	84 200	86 895

APPEAL OF DIRECTORS

Dear friends and colleagues!

JSC “SSC RIAR” is an important element of the Russian nuclear project. It is widely considered to be one of the most remarkable and recognized scientific and research institutions in the Russian nuclear power industry.

Today, thanks largely to well-coordinated and conscientious work of its specialists JSC “SSC RIAR” is the leading experimental and expert center, and one of the best physics and nuclear power institutes in Russia. RIAR performs its scientific and research activities in accordance with the priority development trends of ROSATOM.

I believe that smooth work of its specialists will enable JSC “SSC RIAR” to resolve successfully the set objectives.

ALEXEI V. DUB

Director General of JSC “Science and Innovations”, the Managing Company of JSC “SSC RIAR”

Dear Ladies and Gentlemen!

This Report covers the JSC “SSC RIAR” activities for the year of 2014.
Our Institute is still the largest experimental site in the Russian nuclear power industry.
It has six operating nuclear research reactors, unique materials testing and radiochemical laboratories. Here a wide range of research and process activities is conducted targeted at the development of the nuclear power industry, its safety and efficiency. RIAR is one of the major radioisotope producers.
We are continually expanding international cooperation: the scope of work with international customers has increased by several times within two years. We hope this trend will continue in the future.

The priority tasks of JSC “SSC RIAR” were, are and will be to enhance continually the experimental facilities and provide their safe operation. In 2014, as a result of a whole range of performed activities, we obtained an approval to prolong the BOR-60 reactor operational lifetime up to 2020. We keep on upgrading the reactor materials science facilities, and of course, working towards completing number one task, i.e. construction of the MBIR reactor. Its construction will begin next year.

This reporting year we have launched a highly important social project on housing construction intended for young specialists and honored employees of the Institute.
As a result, more than one hundred and eighty apartments will be owned by RIAR specialists.

JSC “SSC RIAR” keeps up with rapid development of the Russian nuclear power industry. And undoubtedly this is contribution of all RIAR employees, each of them.

SERGEY V. PAVLOV

Director of JSC “Science and Innovations”,
Managing Director of JSC “SSC RIAR”
from October 2012 till April 2015.

KEY EVENTS

March

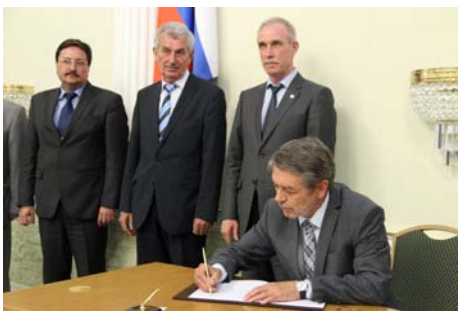
The Conference on New Materials for Innovative Development of Nuclear Power Engineering was held dedicated to the 50th anniversary of the JSC “SSC RIAR” Reactor Materials Testing Complex. The experimental data obtained by the material scientists of JSC “SSC RIAR” were introduced in reference books on material properties used by reactor materials science specialists.

The first batch of forty fuel assemblies containing vibropac mixed uranium-plutonium (MOX) fuel was sent from JSC “SSC RIAR” to the town of Zarechny. This fuel is intended for the initial loading of the BN-800 hybrid core.

The Project on Construction of a Multipurpose Fast Research Reactor (MBIR) was approved by the RF Main State Expert Review Board (Glavgosekspertiza). The project is being implemented under the Federal Target Program “Next Generation Nuclear Power Technologies for 2010–2015 up to 2020”. The Headquarters of the State Expert Review Board issued a favorable opinion on the project documentation and engineering survey results.

April

Public hearings were held where the documentation related to the assessment of environmental impact in terms of constructing a multipurpose fast research reactor at the RIAR site was discussed. The documentation was approved by the members of the public of Dimitrovgrad.



May

An agreement was signed on JSC “SSC RIAR” engagement in the scientific and educational innovative consortium of higher educational institutions and scientific organizations of Ulyanovsk region established in order to develop collaboration of higher educational institutions and scientific organizations in research and innovative projects.

The International Conference on Safety of Nuclear Research Facilities was held. A wide range of issues was discussed related to nuclear research reactor operation experience, safety of spent nuclear fuel management, refurbishment of the operating reactors, their life extension and decommissioning.

A license was obtained to construct buildings and installations of the Polyfunctional Radiochemical Complex designed for conducting research and testing methods of the fast reactor closed nuclear fuel cycle.

An approval was obtained from ROSATOM for construction of the MBIR reactor.

July

A license issued by the Federal Environmental, Industrial and Nuclear Supervision Service was obtained for siting the MBIR reactor.

August

For the first time in Russia a nuclear research reactor was decommissioned. The Federal Environmental, Industrial and Nuclear Supervision Service removed RBT-10/1 from the list of the supervised nuclear facilities.

September

The Federal Service for Supervision of Nature Resources approved the statement of the State Environmental Expertise Commission on the documents related to the feasibility of the MBIR reactor construction license.

The Youth Forum “Energy of Generations” was organized by JSC “SSC RIAR” and a Dimitrovgrad branch of NRNU MEPhI. Over a hundred students and young specialists of ROSATOM and innovation leaders from eight Russian regions attended the event.

JSC “SSC RIAR” was successfully audited for compliance of the quality management system with National Military Standard GOST RW 0015-002-2012 “System of Military Equipment Development and Launching into Manufacture. The Quality Management System. General Requirements” confirming the validity of the earlier issued Certificate of Conformity.

October

The target inspection was completed on checking the credibility of information contained in the documents related to the feasibility of the MBIR construction license submitted by JSC “SSC RIAR” to Rostechnadzor. The Commission of the Volzhsky Interregional Territorial Department for Nuclear and Radiation Safety Supervision of the Federal Environmental, Industrial and Nuclear Supervision Service of Russia confirmed the credibility of the submitted information.

SC “SSC RIAR” signed an agreement with the Governor and the Head of Government of Ulyanovsk region Sergey Morozov on the necessity and interest in implementation of the housing development project under Housing Program “Akademgorodok” (Academy Town) to attract and keep recent graduates and highly-qualified specialists in JSC “SSC RIAR”. The project is implemented with support of Deputy Director General and Director of the Innovation Management Unit of ROSATOM Vyacheslav A. Pershukov.

JSC “SSC RIAR” was successfully audited for conformity of the quality management system with the requirements of the international and national standards ISO 9001:2008 and GOST ISO 9001-2011, thus confirming the validity of the earlier issued Certificates of Conformity.

November

Ten specialists of JSC “SSC RIAR” became the winners of the annual regional event “2014 Engineer of the Year”.

December

JSC “SSC RIAR” obtained a license on BOR-60 reactor operation till December 31, 2019.

JSC “SSC RIAR” became one of the thirty-six enterprises of Russia to be put on the Federal Register in 2014, i.e. a list of financially viable and investment-favorable organizations that use the latest material and social technologies in their activity and have high recognition and guaranteed reliability in the relations with the state-level organizations and business partners.

AWARDS RECEIVED BY JSC “SSC RIAR”

The Gold Medal
“Russia’s Top 100 Organizations.
Ecology and Eco-Management”, which is a sign
of acknowledgement of RIAR achievements
in environmental protection and safety.

Director of JSC “SSC RIAR” Sergey V. Pavlov was
awarded by a Badge of Honor “2014 Ecologist”.
This is one of the most prestigious awards
in the Ecology confirming the status
of the environmentally responsible enterprise.

Following the results of the nationwide rating
of the Russian Federation enterprises in foreign
economic activity JSC “SSC RIAR” entered Top 50
list in five groups of products and won the highest
awards in three groups of products.
RIAR received the international certificate
and the gold medal “2014 Importer of the Year”.

Awardee of the event “Russian Quality Leader”,
which is the evidence of high-quality products
and services, successful functioning of the quality
management system based on involvement
of all RIAR personnel in the activities on product
quality improvement, making and keeping contact
with all stakeholders, alignment of their interests
in quality with RIAR interests.

Grand prix (a Gold Medal)
"2014 Most Efficient Organization".

The International Center of Investment Consulting (ZAO "MTsIK", Moscow) confirmed that JSC "SSC RIAR" performs its activity in compliance with the regulations of the current Russian law. JSC "SSC RIAR" releases competitive products (work, services) and makes use of the latest material and social technologies. JSC "SSC RIAR" is the leader of process development.

Awards in public annual reporting

The Annual Report 2013 entered Top-10 Annual Public Reports at the VI Public Annual Reporting competition held by ROSATOM and took the third place award in the category "Best Public Reporting System".

The Annual Report 2013 entered the leading group represented by 68 organizations and took the 34th place in the resulting rating of the corporate transparency study among the largest Russian companies conducted by the Russian Regional Network of Integrated Reporting as well as the 4th place in the category "Systematic Approach to the Public Reporting Processes".

In total, 721 companies joined the study.

In the reporting period JSC "SSC RIAR" specialists received the following awards:

- Nuclear power industry awards – 315 employees;
- Federal and regional awards – 42 employees;
- Town awards – 112 employees;
- JSC "SSC RIAR" awards – 943 employees;
- Governmental awards – 8 employees.

1

GENERAL INFORMATION

An interesting and promising job
along with fair wage in many ways
determines the life of a scientist

Igor Yu. ZHEMKOV,
Research Reactor Complex,
Head of Laboratory,
the winner of the Competition
“2014 ROSATOM's Person of the Year”,
awarded a Third-Class Badge of Merit for the Nuclear Industry

1.1. GENERAL INFORMATION ABOUT JSC “SSC RIAR”

Table 1.1 provides the main requisites of JSC “SSC RIAR”.

Table 1.1

JSC “SSC RIAR” main requisites

Full name	
in Russian	Акционерное общество «Государственный научный центр – Научно-исследовательский институт атомных реакторов»
in English	Joint Stock Company “State Scientific Center – Research Institute of Atomic Reactors”
Short name	
in Russian	АО «ГНЦ НИИАР»
in English	JSC “SSC RIAR”
Location and mailing address	
Dimitrovgrad-10, Ulyanovsk region, 433510, Russian Federation	
Contacts	
E-mail	niiar@niiar.ru
Website	http://www.niiar.ru
Phone	+7 (84-235) 3-27-27
Fax	+7 (84-235) 3-58-59

REGISTRAR

Joint Stock Company “R.O.S.T. Registrar” was approved as a Registrar of JSC “SSC RIAR” in accordance with Resolution No.4 of the Board of Directors of JSC “SSC RIAR” as of December 30, 2008. This Company is a professional participant of the securities market that carries out its activities on the basis of License No. 10-000-1-00264 as of December 03, 2002 issued by the Federal Commission on Securities Market of the Russian Federation.

Registrar’s requisites:

OGRN 1027739216757.
TIN 7726030449.
Short name: JSC “R.O.S.T. Registrar”.
Address: 18/13 Stromynka St., 107996, Moscow.

Phone/Fax: +7 (495) 771-73-36; +7 (495) 771-73-34.
E-mail: rost@rrost.ru

The date since when the Registrar has maintained the register of issuer’s inscribed stock: January 11, 2009.

INFORMATION ABOUT STOCKHOLDERS

Key information about stockholders is given in Table 1.2.

Table 1.2

Key information about JSC "SSC RIAR" stockholders

Stockholders	Legal/ mailing address	Number of shares		Share in the charter capital, %	
		by December 31, 2013	by December 31, 2014	by December 31, 2013	by December 31, 2014
Joint Stock Company "Atomic Energy Power Corporation"	24 Bolshaya Ordynka St., 119017, Moscow	6 320 505 675	6 320 505 675	90.1448	64.7367
Russian Federation represented by ROSATOM State Atomic Energy Corporation	24 Bolshaya Ordynka St., 119017, Moscow	691 000 000	12 200 000	9.8552	0.1250
ROSATOM State Atomic Energy Corporation	24 Bolshaya Ordynka St., 119017, Moscow	0	3 430 700 000	0	35.1384

SUBSIDIARY COMPANIES AND JOINT VENTURES

Information about subsidiary companies and joint ventures of Joint Stock Company "SSC RIAR" is presented in Table 1.3.

Table 1.3

Subsidiary companies and joint ventures of JSC "SSC RIAR"

Company	Purpose of activities
RIAR - GENERATION Ltd.	Generation and supply of energy: electricity, heat, steam, hot water, drinking and general-use water, water discharge
Belorussian-Russian Joint Stock Company "Isotope Technologies"	Production, storage, receipt, usage, transportation of radioactive materials and products; design engineering, fabrication, assembling, adjustment, failure assessment, operation, repair and maintenance of radioisotope-based devices and facilities
Chinese-Russian Joint Venture "Beijing CIAE – RIAR Radioisotope Technology Co. Ltd."	Production of Cf-252 neutron sources and other sources, their integration in devices and equipment, selling at the territory of the People's Republic of China, promotion of Cf-252 sources and other sources for their use in the industry of the People's Republic of China, rendering services for consumers

1.2. BACKGROUND

The origin of Research Institute of Atomic Reactors dates back to March 1956 when it was decided to build a pilot plant in the town of Melekess, Ulyanovsk region to provide R&D support for the development of a wide range of nuclear reactors for the nuclear industry according to a Decree of the USSR Council of Ministers. By the time the Decree was issued, a unique high-flux research reactor with super high neutron flux density had been nearly developed. The development work was led by Academician Igor V. Kurchatov. Under his initiative, it was decided to locate at a new pilot plant a reactor with a large research complex to perform work in the field of reactor materials science, solid-state physics, nuclear physics, accumulation of remote transuranium elements and radiochemistry. In 1959 in accordance with the Decree of the USSR Council of Ministers Research Institute of Atomic Reactors was established at the base of research and test reactors, facilities and labs under construction.

Figure 1.1 represents schematically the history of the Institute development. More detailed information is provided in the JSC “SSC RIAR” Annual Report 2013.

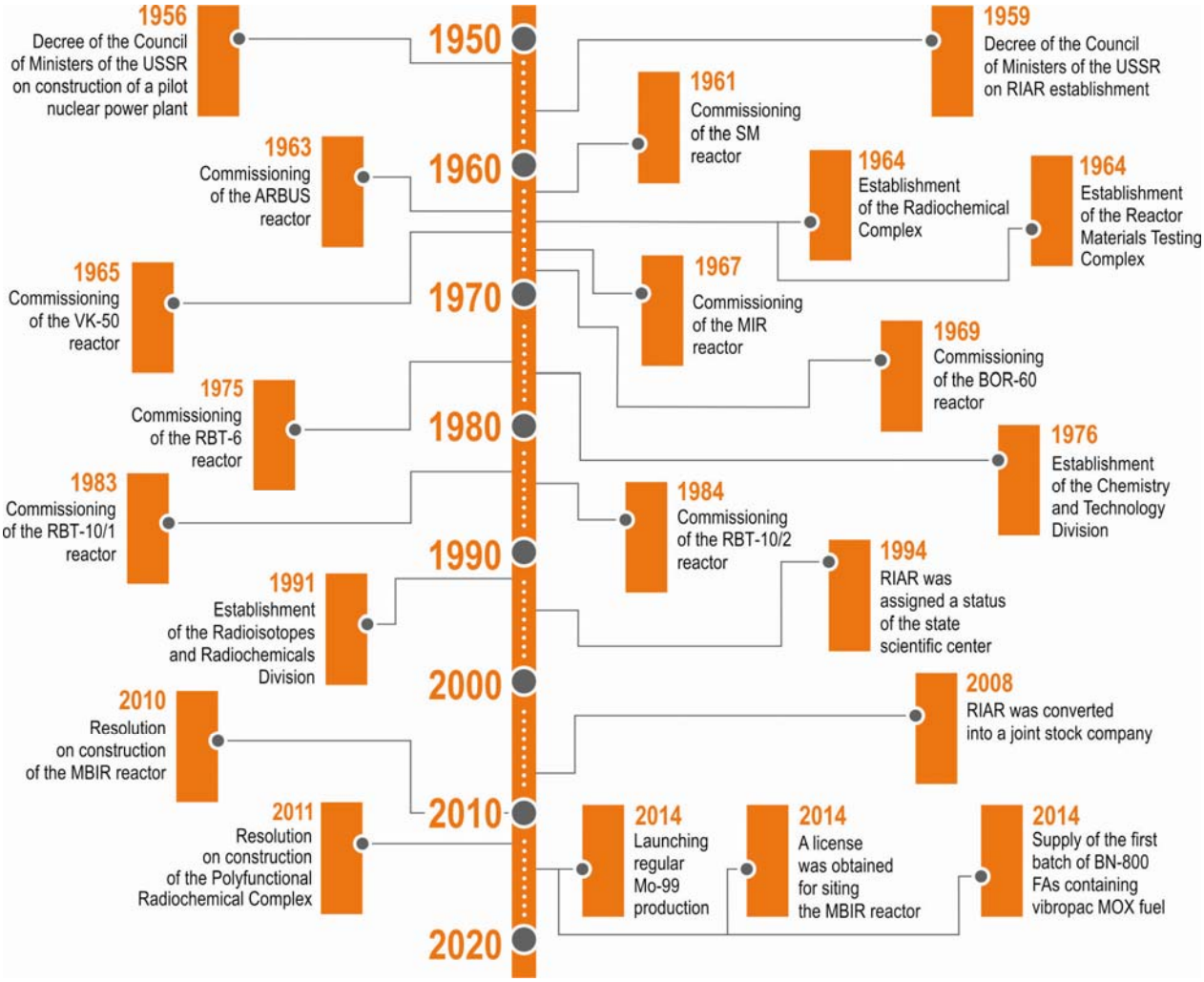


Figure 1.1. The history of JSC “SSC RIAR” development

Since its establishment and so far, RIAR is the biggest Russia's research site. Its experimental capabilities provide investigations in the following trends:

- nuclear reactor physics, engineering, irradiation techniques and safety;
- reactor materials science and methods for testing materials and components of nuclear power facilities;
- radiochemistry and fuel cycles of nuclear power engineering;
- radioisotopes and radiochemicals.

1.3. ORGANIZATIONAL STRUCTURE

The organizational structure of JSC “SSC RIAR” (Figure 1.2.) was approved by the Resolution of the Board of Directors of JSC “SSC RIAR” (Protocol #161 as of December 30, 2013) and put in force by the Decree of Director #64/389-P as of May 05, 2014.

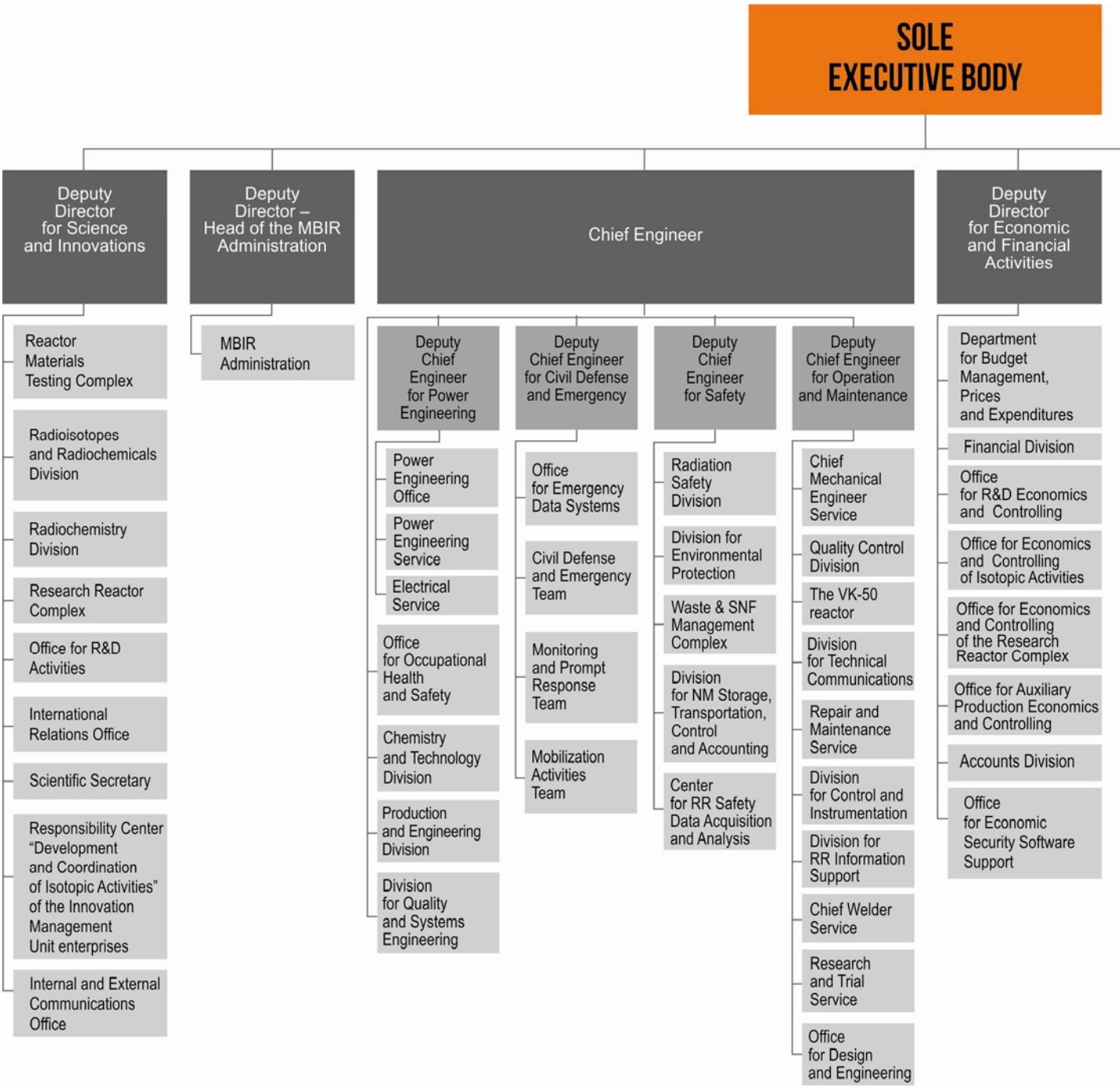
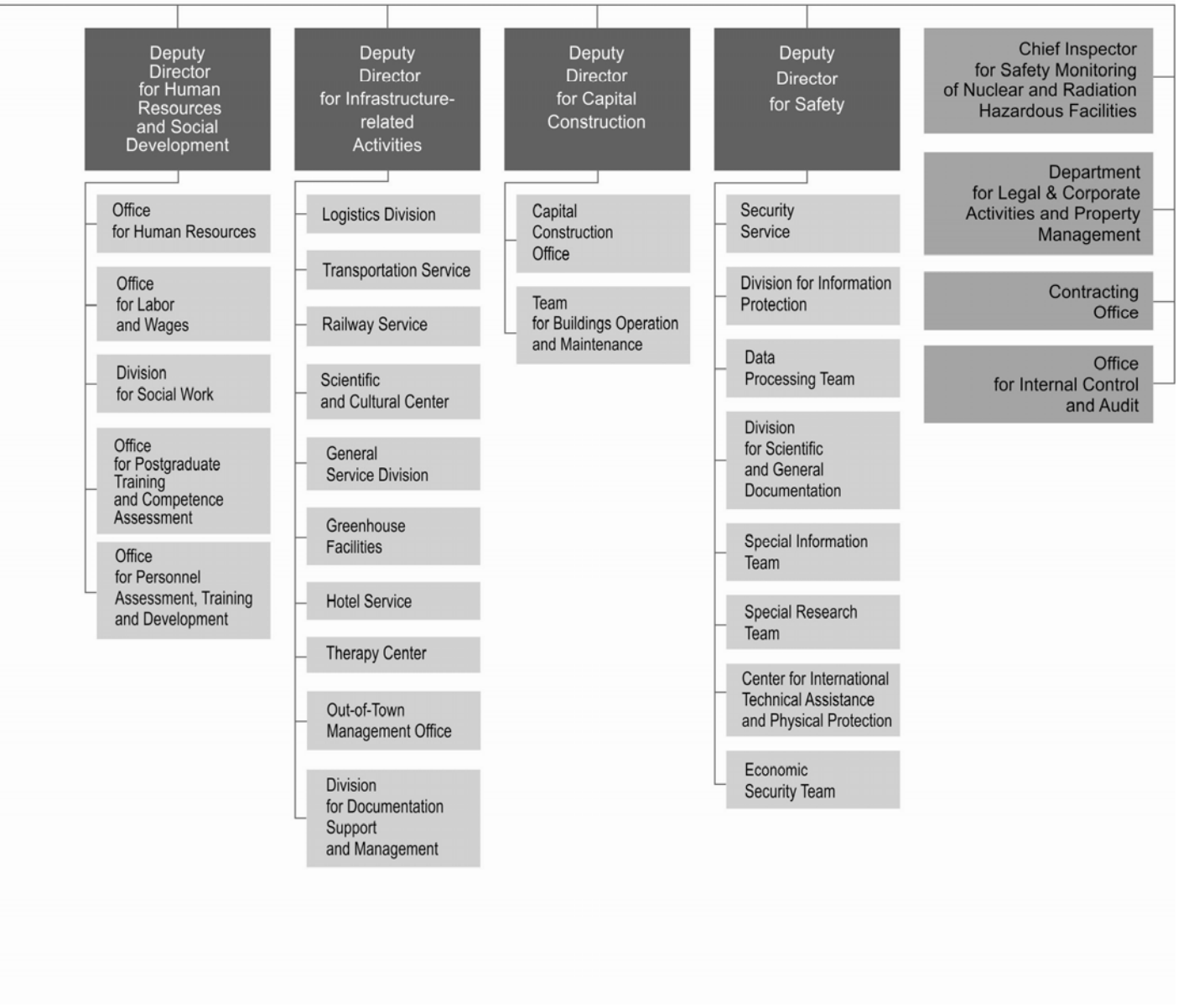


Figure 1.2. Organizational structure of JSC “SSC RIAR”

Full names of RIAR subdivisions mentioned in the organizational structure are given in Appendix 12 ‘Subdivisions of JSC “SSC RIAR”’.



1.4. KEY COMPETENCIES. PRODUCTS AND RENDERED SERVICES

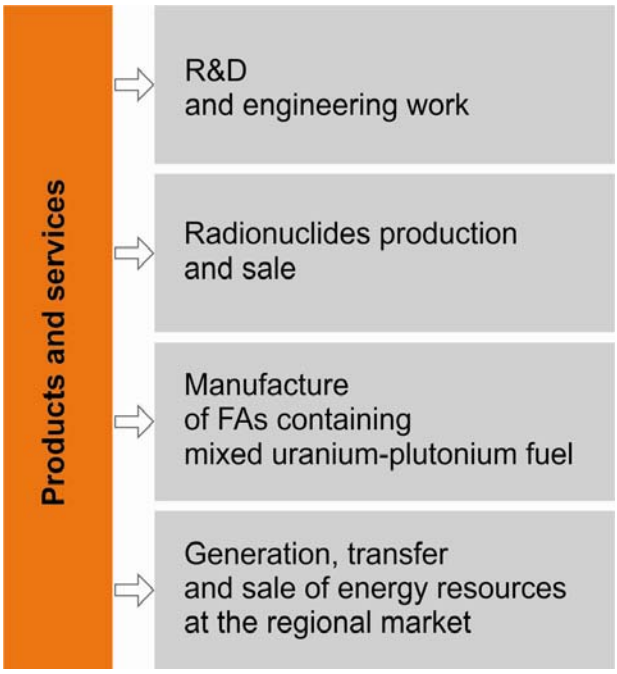


Figure 1.3. Key types of RIAR products and rendered services

Key competencies of JSC "SSC RIAR" have been developed during its whole history. The unique experimental site of JSC "SSC RIAR" includes six research reactors, materials testing and radiochemical complexes, radioisotope production and FA manufacture facilities, auxiliary production and services, and highly-qualified specialists. All these enable resolving complicated scientific, R&D and process issues faced by the nuclear power engineering today focusing on achievement of the strategic objectives of ROSATOM.

Hi-tech and knowledge-intensive products and services are in demand both at the domestic and international markets. JSC "SSC RIAR" products can be divided into four types (Figure 1.3).

SCIENTIFIC, R&D AND ENGINEERING WORK

Nuclear reactor physics, engineering and safety

The reactors of JSC "SSC RIAR" make it possible to test materials and fuel both from the existing and innovative nuclear reactors of different types: VVERs, thermal neutron reactors including BWRs and PWRs, fast reactors including heavy metal-cooled, gas-cooled reactors, etc. (see Section 3.3. "Results of the Key Activities", Chapter 3 "Annual Results").

RIAR reactors are among the world's best reactors in terms of their state, parameters and performance indicators that allow a wide range of tests to be performed in the following key trends:

- in-pile testing of performance behavior of fuel, materials and nuclear engineering products;
- scientific and experimental feasibility of advanced engineering solutions with reference to nuclear reactor fuel, absorbing elements and structural materials;

- development of methods and engineering equipment to test materials and nuclear engineering items under different operating and accidental conditions in the reactors and hot cells;
- development and testing of engineering equipment to monitor condition of nuclear power facilities for their safe operation;
- development of techniques, launching production and accumulation of radioisotope products for scientific, technical and medical applications, and radiation-modified materials.

Reactor materials science and methods to test materials and components of nuclear power facilities

JSC "SSC RIAR" has one of the world's largest materials science centers – the Materials Testing Complex. It is intended for resolving scientific and engineering tasks of reactor materials science. The experimental site allows testing of irradiated items and materials with the activity of up to 1.9×10^{16} Bq (see Section 3.3. "Results of the Key Activities", Chapter 3 "Annual Results"). All forty-six hot cells of the Materials Testing Complex are equipped with special-purpose automatic or remote process and testing equipment. Two hot cells are intended for FAs from VVER-440, VVER-1000 and BN. They are 7.5 m long, 4.0 m wide and 7.2 m high.

Modern equipment and developed methods allow obtaining a wide range of experimental data describing the impact of irradiation on changes in material behavior: elemental and phase composition, micro- and macro-structure, mechanical and physical properties.

Compared to other similar labs, the Materials Testing Complex is unique for testing of full-scale FAs of all reactor types existing in Russia. In addition, availability of several research reactors of different types at one site enables performing a full cycle of irradiation tests and post-irradiation examinations (PIE).

The Materials Testing Complex carries out the following research:

- testing of FAs, fuel elements, control rods, fuel, absorbing and structural compositions of the different-purpose reactor cores as well as other materials and power engineering products before and after they are irradiated;
- examination of fuel elements and their fragments after they are irradiated in irradiation rigs under the conditions simulating stationary, transient and accident modes to show the feasibility of reliable and safe operation;

- materials science supervision over the reactors of JSC “SSC RIAR”;
- investigations in support of long-term storage of spent nuclear fuel (SNF), development of SNF, materials and products management methods;
- investigations in irradiation damage physics;
- development of methods and equipment for PIEs;
- development and manufacture of irradiation rigs, absorbing compositions and products, control and safety system components, accumulation targets and other nuclear engineering items.

Radiochemistry and nuclear fuel cycles (NFC)

The Radiochemical Complex of JSC “SSC RIAR” is the only experimental site in Europe that allows testing of reprocessing methods related to different spent nuclear fuel types (mixed nitride fuel, metallic fuel, fuel containing minor actinides, high-burnup fuel and MOX fuel), resolving the tasks of the closed nuclear fuel cycle of the fast and thermal neutron reactors, obtaining experimental data on physical and chemical processes applied in reprocessing of irradiated materials and spent nuclear fuel, their fractioning, fuel refabrication and recovery of released fission products.

The Radiochemical Complex is involved in the following activities:

- R&D in testing and mastering new processes and technologies of the nuclear fuel cycle including irradiated nuclear fuel reprocessing and radioactive waste management, development and improvement of special-purpose equipment;
- R&D in studying and mastering new processes and process technologies with reference to advanced nuclear fuels;
- development of analysis methods and analytical support of processes applied in the Radiochemistry Division of JSC “SSC RIAR”.

MANUFACTURE AND SALE OF RADIOISOTOPE PRODUCTS

JSC “SSC RIAR” develops and produces a wide range of radioisotopes and ionization sources for scientific, industrial and medical applications. Being a producer of radioisotopes, RIAR holds a significant competitive position among other members of the market due to availability of the high-flux SM reactor at its site that enables accumulation of radioisotopes with high specific activity, which is impossible in other reactors, or which requires a rather extended period of irradiation making it economically unreasonable.

MANUFACTURE OF FUEL ASSEMBLIES CONTAINING MIXED URANIUM-PLUTONIUM FUEL

JSC “SSC RIAR” has a unique manufacturing complex where a full cycle of mixed uranium-plutonium oxide fuel fabrication is implemented: from initial plutonium dioxide to a readymade FA. After the complex has been refurbished, its production capacity makes up over a hundred FAs per year. Sixty of them are FAs with vibropac fuel and forty FAs contain pellet MOX fuel. In addition to FA manufacture, non-aqueous SNF reprocessing methods are tested, granulated fuel is fabricated, vibropac fuel elements are manufactured, and closed fuel cycle processes along with transmutation including minor actinides are tested.

GENERATION, TRANSMISSION AND SALE OF ENERGY RESOURCES AT THE LOCAL MARKET

JSC “SSC RIAR” supplies resources and renders services in generation and transmission of electric power, process water and energy resources. Since April 1, 2013 a part of power-related assets has been under the management of the subsidiary and affiliate company JSC “RIAR – Generation” which is a resource supply company in the following activities:

- electricity generation (thermal power station);
- generation and transmission of thermal power and steam as well as hot water supply;
- generation and transmission of general-use water;
- drainage.

Generated electricity is supplied to regional utilities companies.

More detailed information related to RIAR achievements in 2014 is provided in Chapter 3 “Annual Results”.

1.5. POSITION OF JSC “SSC RIAR” IN THE RUSSIAN NUCLEAR INDUSTRY

Figure 1.4 shows the position of Joint Stock Company “State Scientific Center – Research Institute of Atomic Reactors” in the ROSATOM structure.

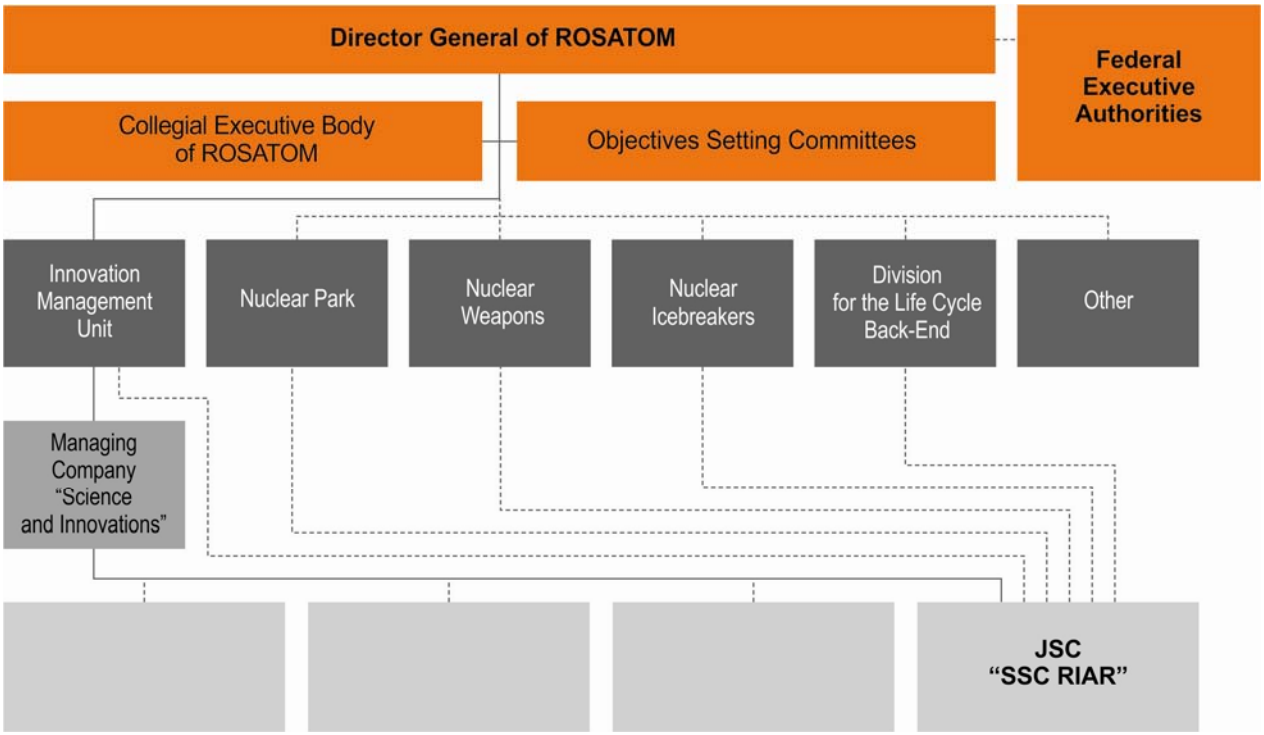


Figure 1.4. JSC “SSC RIAR” position in the ROSATOM structure

JSC “SSC RIAR” IS THE EXPERIMENTAL SITE OF THE RUSSIAN NUCLEAR POWER INDUSTRY

Joint Stock Company “SSC RIAR” is the center of ROSATOM in rendering knowledge-intensive high-tech services in order to conduct a wide range of irradiation tests and post-irradiation examinations to ensure long-term sustainable development of the Russian nuclear power industry. It is the center of key competencies in the development and manufacture of high-tech innovative products that are in demand in different industrial branches.

The experimental capabilities of JSC “SSC RIAR” determine its expected contribution in the achievement of the ROSATOM strategic objectives in the following trends:

- development of technologies for the NFC closure based on the fast nuclear reactors (manufacture of advanced fuels, reprocessing of irradiated materials and spent nuclear fuel, their fractioning, fuel refabrication and recovery of released fission products);
- research and engineering support in extending nuclear engineering applications (new structural materials, space power engineering, radioisotopes);
- scientific and technical feasibility of engineering solutions focused on enhancement of performance and safety of the operating VVER fuel (increase in power, capacity factor, efficiency, fuel burnup, operational lifetime, licensing overseas);
- implementation of State Defense Order;
- development of the experimental research and process facilities (construction, refurbishment, technical re-equipment);
- development of the engineering infrastructure in terms of nuclear and radiation safety, spent nuclear fuel and radioactive waste management, physical protection from ionizing radiation (methods development, decommissioning, transportation for reprocessing, area rehabilitation).

1.6. MISSION, STRATEGY AND PROSPECTS

THE MISSION OF JSC "SSC RIAR" IS AS FOLLOWS:

- **to render knowledge-intensive high-tech services on demonstrating the experimental feasibility of the operating and advanced nuclear reactor core materials and components,**
- **to develop nuclear fuel cycle innovative technologies,**
- **to accumulate radioisotopes in the reactor**

The most in-demand competencies of JSC "SSC RIAR" determined its main purpose (mission). The mission determines the strategic view of the Institute: RIAR shall have scientific and technological potential, human resources and capabilities that provide successful solutions to all the tasks set by the government and nuclear power industry. To resolve the most urgent issues of the Russian and world's nuclear power engineering and medicine the strategy shall envisage a range of trends important in terms of long-term development and referred to the strategic objectives and tasks of ROSATOM such as:

- developing scientific, research, experimental and technological capabilities;
- ensuring the required safety level at all RIAR nuclear facilities;
- implementing efficient management methods and processes;
- creating working conditions attractive for highly-qualified specialists of all ages;
- long-term scheduled manpower and equipment loading with orders to conduct R&D activities under Russian and foreign innovative projects and scientific programs.

The RIAR technology strategy comes out of the first two trends of its strategic development. It focuses on meeting the ROSATOM strategic objectives and targets at creating scientific and technical potential for the development of a RIAR-based international innovative scientific and technological center. To achieve this objective it is necessary to take the following steps:

- to upgrade the existing experimental research facilities and create new ones that can resolve today's tasks related to the development of the nuclear power industry and other applied and basic sciences;
- to expand the capabilities of the Radiochemical Complex for testing of the closed nuclear fuel cycle processes;
- to broaden the capabilities and improve the efficiency of radioisotope-related activities;
- to update and develop the engineering infrastructure in terms of nuclear and radiation safety, spent nuclear fuel and radioactive waste management, physical protection from ionizing radiation to ensure safe, efficient and continuous operation of the whole scientific and experimental structure.

To implement the technology strategy it is necessary to solve several accompanying tasks related to efficient management of the enterprise and its resources, i.e.:

- to improve the quality of managing single projects and the enterprise as a whole by developing the enterprise process management system within the framework of the quality management system and introducing the latest information management systems;
- to manage efficiently the intangible assets in the form of the intellectual property and its rights as well as knowledge and expertise of the employees;

- to develop flexible human resource policies in order to attract the targeted number of highly-qualified employees for the project implementation;
- to build such relationships with the partners and consumers that provide the scheduled loading of the main resources at the enterprise.

Table 1.4 shows a list of projects and programs focused on resolving the specified tasks in order to achieve the specific objectives.

Table 1.4

Strategic objectives of JSC "SSC RIAR" development

No.	Objective	Projects and programs targeted at objective achievement	Implementation period	Description of the key result
1.	Technical refurbishment of the fast neutron reactor BOR-60 (60 MW thermal output) to prolong its operational lifetime up to commissioning of the MBIR reactor	Technical refurbishment of the fast neutron reactor of 60 MW thermal output	2011–2020	Technical refurbishment and improvement of the BOR-60 research reactor to prolong its operational lifetime up to 2020, replacement of the obsolete equipment
2.	Construction of a multipurpose fast research reactor to replace the existing research reactors that have reached the end of their serviceable lifetime	Construction of a multipurpose fast research reactor (MBIR)	2010–2019	Construction of the MBIR reactor and a range of systems, components and irradiation rigs designed for the use of neutrons and ionizing sources in research
3.	Construction of the Polyfunctional Radiochemical Research Complex – a prototype of the Gen IV reactors spent nuclear fuel reprocessing module	Construction of the Polyfunctional Radiochemical Research Complex	2010–2017	Construction of the Polyfunctional Radiochemical Research Complex to conduct the feasibility study of the nuclear fuel cycle closure methods
4.	Development and experimental feasibility of single process stages and equipment of the unified process layout for reprocessing compact fuel to be used in the industrial on-site module intended for fast reactor SNF reprocessing	Development and feasibility of process and engineering design solutions for the industrial on-site module intended for fast reactor SNF reprocessing	2010–2020	Creation and implementation of the unified process layout intended for the compact nuclear fuel reprocessing module
5.	Refurbishing production of cobalt-60, iodine-131, strontium-89, yttrium-90, californium-252 and other transplutonium elements; extending the range of radioisotope products	Integrated refurbishment and development of radioisotope production at RIAR in order to develop nuclear medicine and radiation technologies	2013–2015	1. Commissioning of new radioisotope production facilities. 2. Development of new and upgrading the existing processes. 3. Increase in the scope and profitability of radioisotope production due to increased performance capacity of the operating (upgraded) lines.

No.	Objective	Projects and programs targeted at objective achievement	Implementation period	Description of the key result
				4. Results of R&D and engineering activities focused on upgrading and development of new processes, improvement of quality and competitiveness of radioisotope products. 5. Preservation and development of the key competencies in reactor-produced radioisotopes
6.	Development of a high-tech LEU-based ^{99}Mo production process	Development of a LEU-based ^{99}Mo production process	2013–2015	The ^{99}Mo production method based on low-enriched uranium (uranium enriched up to 20 % ^{235}U) including new methods of target fabrication, reactor-based ^{99}Mo accumulation, and updated process of irradiation target reprocessing
7.	Creation of the MBIR-based International Research Center	Creation of the MBIR-based International Research Center	Being developed	Creation of the International Research Center with large-scale research programs contributing to the constant loading of RIAR testing equipment and personnel
8.	Creation of a system that enables preservation and transfer of knowledge and key processes	Creation of the knowledge management system	2012–2017	The system of knowledge and key process preservation and transfer includes as follows: – the organizational structure comprising professionals trained in compliance with the uniform rules who solve the tasks in accordance with these rules; – regulatory documents describing methods, means, principles and ways of practical activity arrangement

The results of the year 2014, i.e., the reporting year contribution to strategy implementation and plans for 2015 and medium-term prospective are presented in Chapter 3 “Annual Results”.

For more details about the knowledge management system see Section 2.10 “Knowledge Management”, Chapter 2 “Corporate governance”.

1.7. BUSINESS MODEL

A business model is a schematic representation of the company's activity system reflecting capital utilization and product manufacture. The business model describes schematically the existing value creation process.

The business model of RIAR (Figure 1.5) is a "business-to-business" (B2B) model in terms of information and economic interaction with the market, i.e., RIAR activities are focused on gaining the benefit from service rendering and product sale to other companies. The model object is a product or service, and the subjects are companies that interact in the market field.

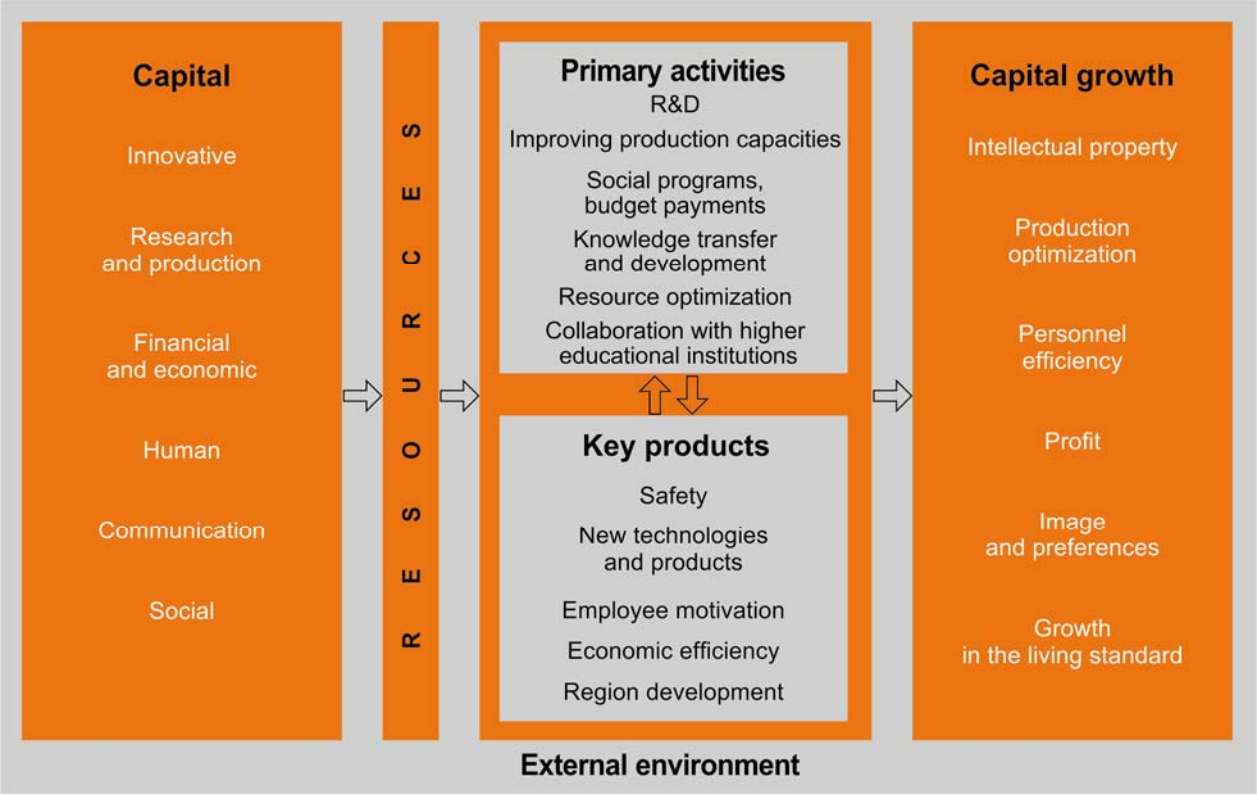


Figure 1.5. JSC "SSC RIAR" business model

The target audience of JSC "SSC RIAR" is the enterprises of ROSATOM (JSC "TVEL" ; JSC "Rosenergoatom Concern"; JSC "VNIINM"; JSC " Afrikantov OKBM "; JSC "NIKIET"; JSC "OKB 'Gidropress'"; JSC "Novosibirsk Chemical Concentrates Plant"; Kurchatov Institute; JSC "IRM"), Russian and foreign companies (AREVA (France), TerraPower (USA) as well as Japanese and Korean companies) that buy products and services for their own activity, production or reprocessing. This is what determines the marketing strategy of RIAR.

In addition to State Defense Order, the RIAR marketing policy is focused on the most efficient usage of (non-mass) communication channels such as scientific and technical marketing at the specific markets:

- R&D and engineering activities in nuclear reactor physics and engineering, safety, reactor materials science and methods of testing nuclear reactor materials and components, radiochemistry and nuclear fuel cycle;

- Radioisotope products (both end-use products and products for further reprocessing);
- MOX FAs (U-Pu);
- Electricity and its supply.

For more detailed information about rendered services and products see Section 1.4 “Key Competencies. Products and Rendered Services”.

Table 1.5 provides a list of utilized capital, its description and modification during the value creation process.

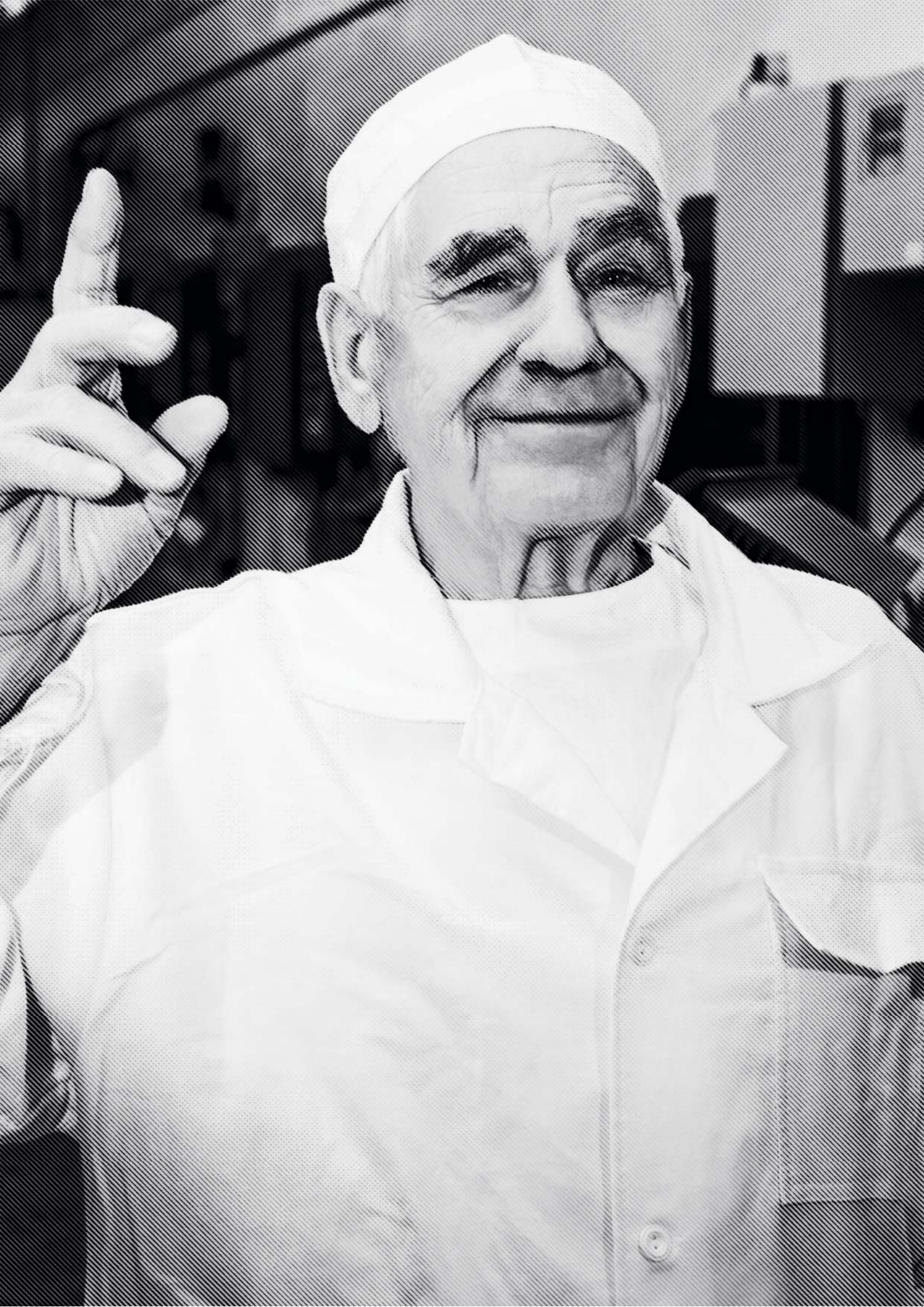
Table 1.5

JSC “SSC RIAR” capital and its transformation during the value creation process

Capital	Description	Resources	Applications	Modification
Scientific and production	Intellectual property, production capacities, equipment, production processes	Scientific and production infrastructure, innovations, ideas and developments	R&D and engineering work, production capacity improvement, process optimization, quality and performance enhancement	Intellectual property, optimization of scientific and production infrastructure and processes, technical re-equipment, programs of performance enhancement, new technologies, products and services
Human	Human resources: staffing, staff efficiency including experience, competencies, qualification and motivation	Human resources and social relationships	Social programs, knowledge transfer and preservation, employee motivation, advanced training	High employee efficiency, high level of employee motivation and engagement
Financial and economic	Economic efficiency	Financial resources	Optimization of financial flows, economic efficiency	Profit, financial reserves, investment programs, dividends, tax payments to budgets of different level
Communication	Agreements of collaboration and alliances, stock of orders, company brand and image, internal communications	Network of partners	Collaboration with Russian and foreign customers and partners, collaboration with higher educational institutions, new market development, brand positioning	New markets and extending the stock of orders, regular customers-partners, joint projects, impact of internal communications on human capital assets, company image enhancement and risk mitigation
Innovative	Intellectual property including patents, know-how, scientific and engineering achievements, new technologies	Ideas and developments, scientific and experimental expertise	Patents, facility construction and refurbishment, product cost reduction and product characteristic improvement	Intellectual property, new technologies
Social	Living standard	–	Employment, social projects and payments to the budget	Business activity development in the presence region

The JSC “SSC RIAR” activities depend on many internal and external factors. They are closely interrelated with stakeholders.

Financial capital increment enables JSC “SSC RIAR” to conduct the current activities and invest in new and in-demand projects, refurbish production, scientific and research facilities and expertise. The availability of high-tech production facilities, modern equipment and materials (production capital) is one of the key conditions in making efficient business.



2
CORPORATE MANAGEMENT

It is very important for the head in charge to foresee the final objective as well as for the subordinate employees to understand it when it occurs you are encouraged to go to work and work hard being aware of your usefulness

Anatoly I. PASTUKHOV,
Shift Supervisor of Chemical & Technological Division,
awarded with the badge of Merit
"For Merits to the Nuclear Power Industry" of the 3rd grade

2.1. MEMBERS AND STRUCTURE OF THE GOVERNANCE BODIES

According to the Charter, JSC “SSC RIAR” has the following governing boards:

- General Shareholders Meeting;
- Board of Directors;
- Sole Executive Body.

Figure 2.1 provides a schematic representation of the governance bodies for JSC “SSC RIAR”.

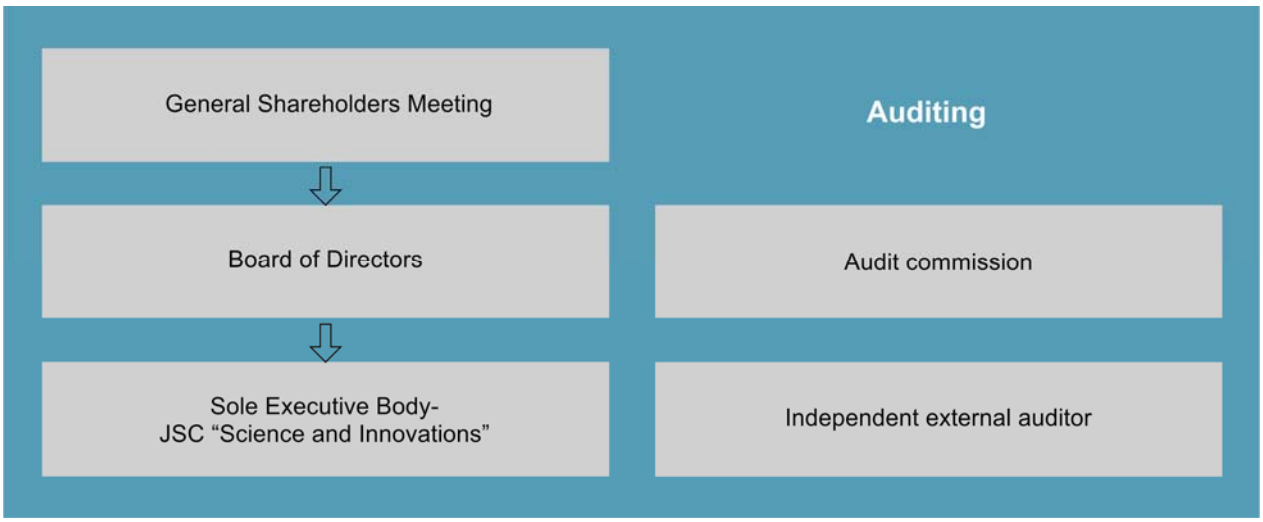


Figure 2.1. Schematic representation of corporate governance for JSC “SSC RIAR”.

The audit commission is a controlling body that exercises control over financial and economic activities of the Institute. The supreme governance body is the General Shareholders Meeting.

The Charter of JSC “SSC RIAR” as well as the Federal Law of the Russian Federation as of December 26, 1995 No.208-FZ “On Joint Stock Companies” specify the powers, the procedure for convocation and holding of the General Shareholders Meeting. In 2014 fifteen General Shareholders Meetings were held: one annual Shareholders Meeting and fourteen extraordinary Shareholders Meetings. The Board of Directors is a collegial managing body that provides overall management of the Joint Stock Company’s business, including strategic planning and development, exercises control over financial and economic activities and the Sole Executive Body. The Board of Directors occupies a central place in the system of corporate management. The number of members of the Board of Directors is specified in the Charter of JSC “SSC RIAR”. Table 2.1 provides some data on the Board of Directors which are disaggregated by age and sex.

Table 2.1

Disaggregated data on the age and sex of the Board of Directors

Age	Members of the Board of Directors		
	Men	Women	In total
Aged 30 and under	0	0	0
Aged 31 and through the age of 50	0	1	1
Aged 51 and over	4	0	4
Total	4	1	5

The Board of Directors of JSC “SSC RIAR” acts in compliance with the scope of its competence stipulated by the Federal Law of the Russian Federation as of December 26, 1995 No. 208-FZ “On Joint Stock Companies”, the Charter of JSC “SSC RIAR” and *the Statute of the Board of Directors*. In 2014 ninety five meetings of the Board of Directors were held to discuss 298 topics.

The members of the Board of Directors were as follows from 17 October 2013 to 31 December 2014:

- Vyacheslav A. Pershukov;
- Sergey P. Kashlev;
- Nikolay A. Kondratiev;
- Sergey V. Pavlov;
- Natalya T. Uspenskaya.

Vyacheslav A. Pershukov was elected the Chairman of the above-listed Board of Directors.

The members of the Board of Directors for JSC “SSC RIAR” do not hold any shares in the Company and have not made any transactions with them during the period under report.

Nowadays the Joint Stock Company does not provide for any remuneration for members of the Board of Directors.

Following the decision of the General Shareholders Meeting (Protocol No.5 as of 1 December, 2011), the powers of the Sole Executive Body were delegated to the managing organization Joint Stock Company “Science and Innovations” (see Table 2.2).

Table 2.2

Information about the managing organization Joint Stock Company “Science and Innovations”

Parameter	Data
Full Name	Joint Stock Company “Science and Innovations”
Acronym	JSC “Science and Innovations”
Director General	Alexey V. Dub
Head Office and Legal Address	24 BOLSHAYA ORDYNKA St., Moscow, 119017 Russia
Primary State Registration Number	1117746621211
Individual Taxpayer Identification Number	7706760091
Industrial Enterprise Classification Code	770601001
Dates of: Incorporation Registration	 11 August 2011 11 August 2011

The Sole Executive Body of JSC “SSC RIAR” does not hold any shares in the Company and has not made any transactions with them during the period under report.

A collegial executive body was not formed at JSC “SSC RIAR” during the period under report.

2.2. CORPORATE GOVERNANCE SYSTEM

CORPORATE GOVERNANCE PRINCIPLES

The corporate governance principles of JSC "SSC RIAR" are as follows:

1. Protection of rights and legitimate interests for the sole shareholders: the rights of the shareholder are granted pursuant to the Federal Law of the Russian Federation as of December 26, 1995 No.208-FZ "On Joint Stock Companies" and the Charter of JSC "SSC RIAR", the procedure of information exchange between the Company and Shareholder is governed by the laws of the Russian Federation, Charter of the Company, industrial and internal documents of the Company.
2. The principle of good governance of the Board of Directors: the Board of Directors acts in good faith and in the interests of the Shareholder and the Company and ensures transparence of its activity against the Shareholder.
3. The principle of transparency and accuracy of disclosure: JSC "SSC RIAR" ensures timely disclosure of adequate information concerning its financial position, economic performance, including the results of its activities, ownership and management structures to its Shareholders and the Parties concerned; the information to be disclosed is subject to existing provisions of the Federal Law on the state and commercial secrecy.
4. The principle of legality and ethics: JSC "SSC RIAR" acts strictly in compliance with the applicable laws, generally accepted norms of corporate conduct, ROSATOM standards of conduct, the Charter and in accordance with its contractual commitments. The relationships between the Shareholder and the Board of Directors are based on mutual confidence, respect, accountability and control.

MAJOR LOCAL REGULATIONS PERTAINING TO CORPORATE MANAGEMENT

The major local regulations pertaining to the corporate management are as follows:

1. Charter of JSC "SSC RIAR";
2. Statute of the Board of Directors for JSC "SSC RIAR";
3. Standing Orders on the Audit Commission of JSC "SSC RIAR";
4. Regulation on the mandatory disclosure of information by JSC "SSC RIAR";
5. RF Federal Law as of December 26, 1995 No. 208-FZ "On Joint Stock Companies" (latest Revision as of December 28, 2013).

INFORMATION ON THE CONFORMITY OF THE COMPANY WITH THE PRINCIPLES AND RECOMMENDATIONS OF THE CORPORATE GOVERNANCE CODE

The Company has not formally adopted the Code of Corporate Governance or other similar document but JSC "SSC RIAR" provides every opportunity to Shareholders to participate in governing of the Company and to receive some information about the Company's activities under the Federal Law of the Russian Federation dated December 26, 1995

No. 208-FZ ”On Joint Stock Companies”, Federal Law of the Russian Federation dated April 22, 1996 No.39-FZ “On Securities market” No.39-FZ and statutory regulations of the Bank of Russia.

The Company is committed to do its business in conformity with the basic principles and recommendations of the Code of Corporate Governance that was recommended to be implemented by the letter of the Bank of Russia No.06-52/2463 as of April 10, 2014 “Concerning the Code of Corporate Governance”.

Some provisions of the *Corporate Governance Code* are applied by the Company with due consideration of legal status of ROSATOM State Atomic Energy Corporation that is stipulated with the laws and regulations of the Russian Federation providing for the concept of unity of governance for all the enterprises of nuclear industry. They are also specified in some local regulations pertaining to the corporate governance.

BIOGRAPHIC PROFILE OF THE BOARD OF DIRECTORS FOR JSC “SSC RIAR”

Date of birth: May 20, 1958

Academic background: higher, graduate from the Lomonosov Moscow State University (1980) majoring in “Mechanics”.

Places of employment and positions held over the last 5 years:

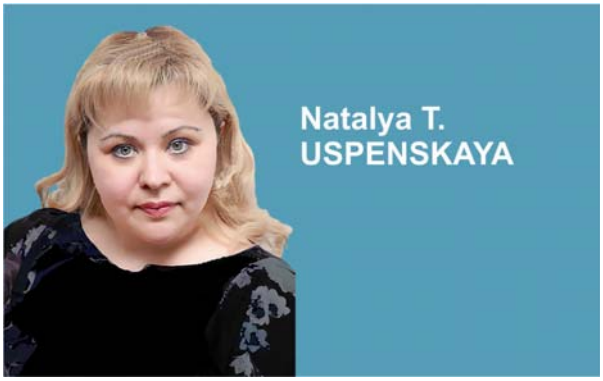
- Representative office of “Alltech Investments Limited” in the Russian Federation: the Senior Project Manager of Business Department from March, 2006 until January, 2011;
- “SN-Neftegas LLC”: Director General from April, 2008 until January, 2011; ROSATOM State Atomic Energy Corporation: First Deputy Director of the Directorate for Science and Engineering” from January 2011 until April 2011;
- Deputy Director General –Director of Directorate for Science and Engineering from April 2011 until June 2011;
- Deputy Director General – Director of the Block for Innovation Management from June 2011 up to the present time.

Date of birth: October 19, 1960

Academic background: higher, graduate from Tomsk Polytechnic Institute named after S. Kirov (1982) majoring in “Engineering Electronics”.

Places of employment and positions held over the last 5 years:

- “Oil Company Rosneft” LLC, Science and Technology Center: Director General from February, 2006 until November, 2011; ROSATOM State Atomic Energy Corporation: First Deputy Head of the Block for Innovation Management from August, 2011 until November, 2011;
- JSC “Science and Innovations”: Director General from November, 2011 until October, 2013; Executive Director from October, 2013 up to the present time.



Date of birth: April 21, 1977

Academic background: higher, graduate from All-Russian State Distance-Learning Institute of Finance and Economics (2000) majoring in “Finances and Credit”; Russian Academy of Entrepreneurship (2012) majoring in “lawyer”.

Places of employment and positions held over the last 5 years:

- JSC Registar R.O.S.T.: Head of the VIP-client Center Unit from 2010 until June 2012 ;
- JSC “Science and Innovations”: Advisor of the Department for Corporate Management and Judicial Support from July 2012 until August 2013; Project Manager for Legal and Corporate Administration from August, 2013 up to the present time; Head of Property Interests Department from November, 2014 up to the present time.

Date of birth: December 22, 1958

Academic background: higher, graduate from Moscow Engineering Physics Institute (1982) majoring in “Nuclear Power Plants and Facilities”.

Places of employment and positions held over the last 5 years:

- JSC “SSC RIAR”: Head (Director) of Materials Testing Complex from September, 2007 until January, 2010; Deputy Director for Post-irradiation Examination of NPP Fuel – Director of the Materials Testing Complex from January, 2010 until October, 2010; Deputy Director for Nuclear Fuel and Nuclear Core Components from October, 2010 until March, 2011; Head (Director) of the Materials Testing Complex from March, 2011 until October, 2012;
- JSC “Science and Innovations”: Director from October, 2012 until April, 2015.

Date of birth: February 23, 1960

Academic background: higher, graduate from Novosibirsk State University (1982) majoring in “Economic Cybernetics”.

Places of employment and positions held over the last 5 years:

- JSC “YUKOS EP” (Moscow): Vice President for Economics and Finance from May, 2007 until September, 2011;
- JSC “Science and Innovations”: Advisor from March, 2012 until January, 2013; Deputy Director General for Economics and Finance from January, 2013 up to the present time.

There are no independent directors in the Board of Directors in the meaning stipulated by the *Code of Corporate Governance* and recommended to be implemented by the letter of the Bank of Russia No.06-52/2463 as of April 10, 2014 “Concerning the Code of Corporate Governance”.

The board of Directors does not have any committees.

REPORTING OF THE BOARD OF DIRECTORS ON THE DEVELOPMENT OF PRIORITY BUSINESS DIRECTIONS

In 2014 ninety five absentia meetings of the Board of Directors were held (see Attachment 3 "Report of the Board of Directors on the results of business activities at JSC "SSC RIAR""). A level of personal attendance of the board of directors was 100 %.

Following the decision of the Board of Directors (Protocol No. 22 dated March 3, 2010), priority business trends of the Company were identified with the focus on fulfilling the needs of Physics and Power Engineering Block of ROSATOM State Atomic Energy Corporation:

- Engineering development of a multi-purpose fast test reactor;
- Technical retrofitting of fast test reactor with a thermal power output of 60MW;
- Development of technologies and launching into production of mixed oxide fuel for fast reactors;
- Advancement of non-aqueous technologies for spent nuclear fuel reprocessing.

Chapter 3 "Annual Results" provides an overview of outcomes for 2014 concerning the above listed trends of business activities.

DIVIDEND PAYOUT REPORT OF JSC "SSC RIAR"

Dividends were not attributed to the shares of JSC "SSC RIAR" and were not paid during the period under report as well as in 2012 and 2013.

CRITERIA FOR DETERMINATION AND AMOUNT OF REMUNERATION PAYABLE TO THE SOLE EXECUTIVE BODY

Following the decision of the General Shareholders Meeting (Protocol No. 5 as of 1 December, 2011), the powers of the Sole Executive Body were delegated to the managing organization Joint Stock Company "Science and Innovations". The criteria used for determination and the amount of remuneration payable to the Sole Executive Body are set forth in the *Agreement on delegation of authorities of the Sole Executive Body* No. 20 dated of December 2, 2012 and addendums to it.

In 2014 the cost of services rendered for exercising authorities of the Sole Executive Body was RUB 24142.942 thousand per month for the period from 1 January 2014 to 31 June 2014 as well as for the period of 1 July 2014 to 31 December 2014.

CHANGES IN THE SIZE, STRUCTURE OR OWNERSHIP DURING THE PERIOD UNDER REPORT

On the fourth of February the General Meeting of Shareholders resolved to increase the authorized capital of the Company (Protocol No. 24 dated of 4 February, 2014. The number of additionally issued shares made up 5 740 055 140 with a nominal value of RUB 1 (one ruble) and a total value of RUB 5 740 055 140. Payment terms and conditions of acquired securities are to be as follows: in the currency of the Russian Federation by bank transfer providing for the payment settling by setting off monetary claims to the Joint stock Company and/or other property (nonmonetary assets), including movable assets and issuance securities amongst the other things, immovable assets. On the 7th of August 2014 the Bank of Russia registered the additional securities issue report (the number of actually placed securities made up 4 323 675 000).

On the 9th of September 2014 the General Meeting of Shareholders at JSC “SSC RIAR” made a decision to increase the share capital of the Company (Protocol No.31 dated of September 9, 2014). The number of shares of additional issue made up 12 200 000 with a nominal value of RUB 1 (one ruble) and a total value of RUB 12 200 000. Payment terms and conditions of shares provide for payment with monetary funds in rubles and/or by setting off the monetary claims to the Joint Stock Company. The Board of Directors for Joint Stock Company (Protocol No. 240 dated of September 26, 2014) resolved to approve an additional issue of securities. It was registered by the Bank of Russia on the 16th of October 2014 under the State Registration No. 1-01-55411-E-006D. On the 29th of December 2014 the Bank of Russia registered the additional securities issue report.

The share capital of the Company amounts to RUB 9 751 205 675 (nine billion seven hundred fifty-one million two hundred and five thousand six hundred seventy-five) as of December 31, 2014.

The Company placed its ordinary registered shares with a nominal value of RUB 1 (one ruble) each in number of 9 751 205 675 (nine billion seven hundred fifty-one million two hundred and five thousand six hundred seventy-five) for a total amount of RUB 9 751 205 675 (nine billion seven hundred fifty-one million two hundred and five thousand six hundred seventy-five) of nominal value.

All the shares of the Company were issued in the non-documentary form.

PROJECTS AIMED AT IMPROVING COMMUNICATION BETWEEN MANAGEMENT AND EMPLOYEES

JSC “SSC RIAR” places great importance on the development of corporate culture and system and internal communication system.

JSC “SSC RIAR” has put in place a well-established communication system that provides live information about the events at the Institute and reflects the situation in the industry as a whole. The internal information and communication network of JSC “SSC RIAR” provides an entire information environment for all the employees. It offers not only timely and sound news from the nuclear industry sector but provides an access to the internal corporate information, single inquiry system, information blocks devoted to the RIAR’s departments and divisions and other information required. The Company’s management regularly informs the employees about plans for Institute development, accomplishments of the personnel in its entirety and of single staff members, any significant event in the Institute and promotes different ways of feedback with the employees.

Creation of a forum “Ploshchadka obsuzhdeniy” (Discussion Island) at the internal corporate web site is one of the ways demonstrating participation of individuals and groups in promoting the improvement of internal communication system. This forum does not only provide the mechanism for communication between the administration and the employees but promotes the feedback with the personnel in the form of proposals and responses resulting in optimization of the programs and process at the Institute. The internal corporate website has a section entitled “Vopros direktoru” (A question to Director). This section allows every employee who has an access to the internal network to ask a question of particular interest to the Director and get a detailed reply.

The Institute holds personnel attendance days in the presence of ROSATOM State Atomic Energy Corporation as well as within the Institute. These days provide for communication arrangements or devoted to information sharing and give employees a chance to talk directly with senior executives from JSC “SSC RIAR” and from the nuclear industry. The purpose is to share information on priorities, goals and objectives, focal projects in the nuclear industry and in the Institute. Altogether, in 2014, more than 90% of top managers and 80% of functional managers took part in such communication arrangements.

It has become a good tradition at the Institute to hold meetings of administration, a trade union and employees (for instance, to celebrate the Day of Institute Establishment and Science Day). Other information resources such as radio, Strana ROSATOM newspaper, industry-related bulletin boards, presentations made at different meetings and round table sessions, reports presented at research advisory boards, workshop meetings and conferences, corporate portal and digital dashboards are used to keep the personnel informed. The computer mail of the Institute is an efficient way of communication for the personnel thereby providing an opportunity for dialogue at different levels inside the Institute.

2.3. AUDITING OF FINANCIAL AND BUSINESS ACTIVITIES

Financial and business activities of JSC “SSC RIAR” are supervised by the Internal Audit Commission, independent auditor and Department for Internal Control and Audit.

AUDIT COMMISSION

The activities of Internal Audit Commission are governed by the *Regulations on the Internal Audit Commission* approved by resolution of the Sole Shareholder as of September 4, 2009. This document established the procedure that governs elections of the Audit Commission, its sessions and decision-making process, audits and involvement of experts and advisors as well as it stipulates rights and obligations of the Audit Commission members.

The annual General Shareholders’ Meeting of JSC “SSC RIAR” (Protocol No. 27 dated of June 30, 2014) elected the following members of the Audit Commission:

- Andrey Yu. Kladkov;
- Anna S. Selyuk;
- Igor A. Knyazkin

The members of the Internal Audit Commission do not hold any shares in the Company and have not made any transactions with them during the period under report.

INDEPENDENT AUDITOR

The internal control and auditing system is a combination of organizational arrangement, methods and procedures of audit and monitoring adopted by the management of economic entity as the mechanisms for consistent and efficient conduct of its business (process) and aimed at checking, elimination and prevention of significant errors and falsification of accounting data. The internal control and auditing system is one of the essential components of the risk management system related to business conduct.

The Department for Internal Control and Audit has been at JSC «SSC RIAR” since 2012 (see Chapter 2.5. Internal Control and auditing system at JSC “SSC RIAR”). Its major objective is to continue the constant enhancement of internal control and auditing system efficiency and reliability to facilitate improvement of the corporate governance system at the Institute in compliance with the laws of the Russian Federation, requirements of state supervisory agencies and international standards. The Department for Internal Control and Audit has one half of internationally certified specialists with the certificates issued by the Institute of Certified Financial Managers (Great Britain).

The Department for Internal Control and Audit supervises the public reporting process for compliance with the requirements applicable to the *Public Reporting Policy of ROSATOM State Atomic Energy Corporation* and of local regulatory documents of JSC “SSC RIAR” concerning the public reporting (see Attachment 8 “Report of the Department for Internal Control and Audit”).

2.4. KEY PERFORMANCE INDICATORS. APPRAISAL AND REMUNERATION OF PERSONNEL

CONCEPT OF KEY PERFORMANCE INDICATORS DEVELOPMENT

JSC “SSC RIAR” has been used the key performance indicators matrix since 2009. Its purpose is to convert the strategy of the Institute into a comprehensive set of its performance indicators specifying the basic parameters of the assessment and management system. A set of performance indicators forms the basis for strategy development and comprises quantitative and qualitative indicators to inform the employees about key success factors for the present and for the future. Putting forward anticipated results, the Institute sets a goal and creates conditions for its achievement. Shown in Figure 2.2 is a schematic representation of the key performance indicators setting (KPI).

Figure 2.2. Steps of key performance indicators setting

Governing principles of performance management:

1. Principle of recurrence: the key performance indicators are specified for a one-year term.
2. Principle of compliance to the SMART criteria and ambitiousness of objectives: the key performance indicators as any objective should meet all five criteria:

- Need to be specific or exact that is both the senior executive and the employee should share a common understanding of the objective;
- Need to be measurable that is the objective must be quantifiable or specified by the appropriate qualitative indicators;
- Need to be attainable that is the objective must be realistic but at the same time rather challenging too;
- Need to be consistent that is to promote consistency of strategic objectives and higher level objectives;
- Need to be time-bound.

At the beginning of the year the management team of the personnel management office at JSC “SSC RIAR” approved the key performance indicators matrix for the Director that had been worked out for a one-year term. It includes both financial and non-financial performance indicators. This matrix provides team-oriented, production and functional key performance indicators specified by appropriate departments at ROSATOM State Atomic Energy Corporation.

The key performance indicators were decomposed from the key performance indicators matrix of Director in the key performance indicators matrix of Directors for RIAR’s Departments and Divisions and thereby promoting and ensuring the fulfillment of key performance indicators for Director (senior officers).

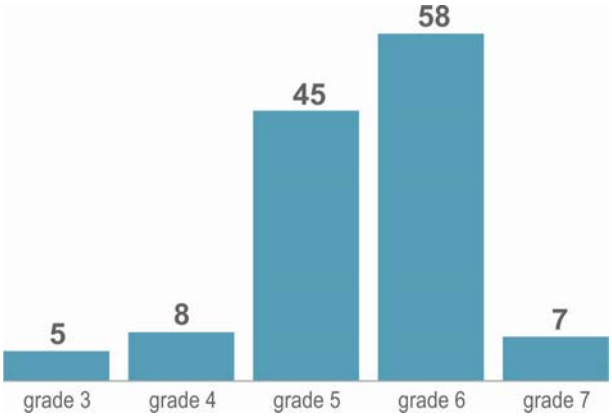


Figure 2.3. The number of key performance indicators matrices being developed in 2014 and disaggregated by years

In 2014 JSC "SSC RIAR" worked out one hundred twenty three (123) key performance indicators matrices with reference to six levels of management for the management personnel in RIAR's Departments and Divisions who has grades from the third to the seventh (Fig. 2.3).

The results of key performance indicators fulfillment in 2014 will be announced in II quarter in 2015.

The system of employees' incentive is based on the bonus system granting payment of bonuses following the fulfillment of key performance indicators. According to this system, each performance indicator is assigned with weight value in the total amount of bonuses.

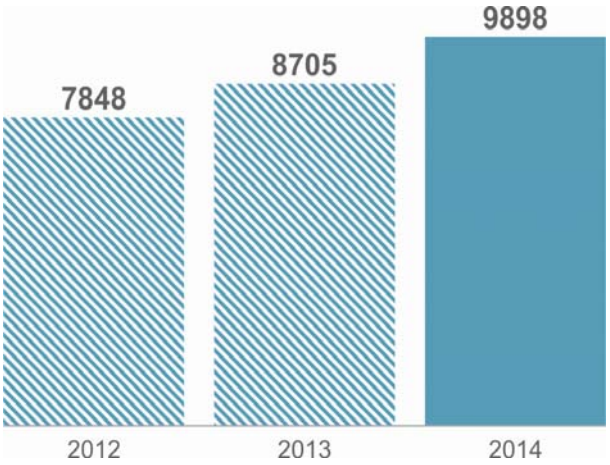


Figure 2.4. Increase of the minimum monthly wage paid to the JSC "SSC RIAR" employees in rubles

A total amount of bonuses is calculated based on the annual amount of salaries assigned to every position with a certain coefficient. The amount of bonuses payable to employees depends on the level (grade) of the position held by employee and can reach up to 150% provided that the key performance indicators are fulfilled at a high target level. Bonus payments are effected to employees following achievement of the lower level of indicators defined in the individual matrix of key performance indicators. The amount of bonuses granted to the employees can be increased if performance achievements are higher compared to the target level. Table 2.3 provides the dynamics of remuneration paid to the employees of JSC "SSC RIAR". Shown in Figure 2.4 is the increase in the minimum monthly wage on the annual scale basis.

Table 2.3

The amount of remuneration assigned to different employee categories (thousand rubles per month)

Occupational category	KPI on the annual scale basis		
	As it is		Forecast
	2013	2014	2015
Management personnel	55.0	58.0	64.4
Staff members of professional occupations	31.7	32.5	36.1
Workers	20.8	22.1	24.6

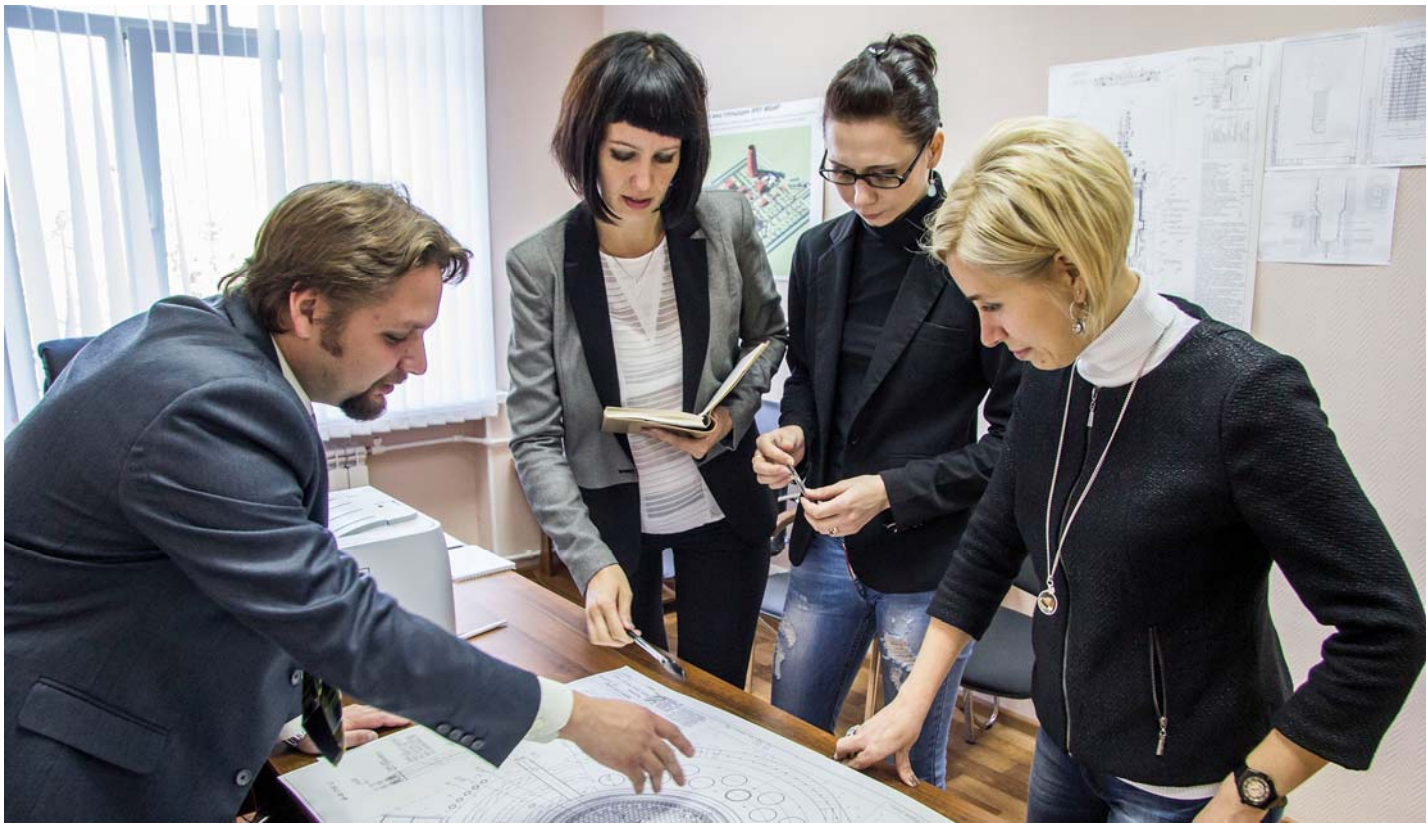
MOTIVATION OF TOP MANAGEMENT

A motivation system of top management and other management personnel is based on the *ROSATOM's Unified Standard Remuneration System.* Salaries of management personnel consist of a fixed salary and annual bonus payment that depends on fulfillment of key performance indicators.

Key performance indicators provide a basis for final decisions. They are based on the assessment of Institute's performance and targeted at pursuing strategic goals of the Company. The key performance indicators are developed to address the needs of the national policy in the field of nuclear energy use, considering the competitive principal of business running, strategy and development programs of JSC "SSC RIAR" and provide for economic, environmental, and social performance.

The key performance indicators are documented in the key performance indicators matrix of Director and decomposed into the key performance matrices of management personnel in the departments and divisions. The amount of bonus payment is relevant to personal achievements and is based on the actual achievement level of key performance indicators. Bonus payments are manly used as a reward: bonus payment is a fair compensation for personal achievements*. Regulations on remuneration in JSC "SSC RIAR"* reflect the relationship of the bonus amount and performance level towards achieving goals and objectives.

The implementation of the key performance indicators system led to enhanced individual responsibility of the senior executives for fulfillment of the Company's strategic targets owing to setting mutually agreed performance indicators and rewarding the employees for fulfillment of key performance indicators.



2.5. INTERNAL CONTROL AND AUDITING SYSTEM

The Department for Internal Control and Audit undertakes inspections as directed and ordered by the Sole Executive Body of JSC "SSC RIAR" as well as conducts its audit of business processes in addition to oversight procedures and in conformity with the plan of supervisory arrangements agreed with the ROSATOM State Atomic Energy Corporation.

In 2014 the staff members of the Department for Internal Control and Audit undertook thirteen inspections (in 2013 they conducted nine inspections). Six inspections out of thirteen were routine inspections but the other five inspections were undertaken for the needs of the ROSATOM State Atomic Energy Corporation. The remaining two inspections were undertaken under the instructions of senior executives. Following the conducted inspections, actions plans were worked out to address identified drawbacks under an obligation to prevent them in the future. Seven company's officials incurred disciplinary liability, one criminal proceeding was initiated, and thirteen assignments (instructions) were given.

In order to reduce the risks of the business processes, the Department for Control and Audit exercises control over implementation of the action plans intended for elimination of the identified drawbacks. When financial and business activities of subdivisions are audited, procurement and contract-related activities are checked on a mandatory basis including auditing of the purchasing activities and procurement procedures for their compliance with the *Procurement Standard* of the ROSATOM State Atomic Energy Corporation. Execution of purchase orders and delivery contracts is also checked (in 2014 sixty eight audits of procurement procedures were conducted). Particular attention is given to the procurement contracts concluded with the single supplier.

In 2014 twelve audits were conducted by external supervisory agencies against JSC "SSC RIAR". Among these Agencies were the Federal Oversight Service for Supervision over Natural Resources Management of the Ulyanovsk Region, Autonomous Non-Profit Institution "Institute for Testing and Certification of Armaments and Military Equipment", Certifying Association "Russian Register – Baltic Inspection Center", Ltd, Federal State Budgetary Institution "Special Office of the Federal Fire Safety # 87" under the Ministry of the Russian Federation for Civil Defense, Emergencies and Disaster Response, auditing companies FBK Consulting Ltd, and Nexia Pacioli Consulting LLC, Regional Evaluation Center, CJSC and ROSATOM State Atomic Energy Corporation.

Plans for 2015:

- Internal audit of the most essential business processes to monitor reliability and performance of the internal auditing system at JSC "SSC RIAR";
- Auditing of financial and business activities, procurement and contract-related activities in accordance with the approved plan of supervisory arrangements agreed with the ROSATOM State Atomic Energy Corporation as well as under the decision of the governing board, as directed and ordered by the Sole Executive Body of JSC "SSC RIAR";
- Further introduction of regulatory documents elaborated by the ROSATOM State Atomic Energy Corporation within the framework of the processes "Internal control and internal auditing" and "Auditing activities";
- Enhanced training of the staff employed in the Department for Internal Control and Audit, exchange of professional experience and expertise with the associated departments at the ROSATOM State Atomic Energy Corporation;
- Supervision over the public reporting process for compliance with the requirements applicable to the *Public Reporting Policy of ROSATOM State Atomic Energy Corporation* and of local regulatory documents of JSC "SSC RIAR" concerning the public reporting.

Percentage and total number of business units analyzed for the risks of corruption

Special work is done in accordance with the plan approved by the ROSATOM State Atomic Energy Corporation for combating corruption and fraud in the nuclear industry sector with the focus on prevention, detection and documenting the acts of corruption. One of the essential trends of the anti-corruption work is to prevent and detect procurement breaches. In order to get that done, the procurement-related procedures are checked for compliance with *Procurement Standard* of the ROSATOM State Atomic Energy Corporation, functions and positions prone to the risk of corruption are put in the list as their substitution implicates the risks of corruption. According to the anti-corruption legislation, the alternates appointed to the posts from the list shall provide information declaring their income, expenditures, property status and liabilities including the same information about other family members.

In order to prevent commitment of corruption offences or other acts involving corruption by the top executives of the Company, the following actions stipulated in the anti-corruption legislation are undertaken:

- Internal control over performing the duties by the top executives by means of auditing initiated due to the fact of corruption manifestation, including complaints and information concerning the facts of theft or fraudulence transferred via dedicated communication channel “Hotline”, publications about corruption practices of the senior executives by media;
- Awareness campaigns, educational work with the staff members with the focus on reducing the possibility of corporate conduct in discharging the duties prone to corruption.

JSC “SSC RIAR” has a special group in charge of economic security to implement the system for preventing unlawful acts and abusive practices. The actual number of staff members in the economic security group is four people. The main trends of work done by this group are as follows:

- Enforcement of economic and assets security at JSC “SSC RIAR”;
- Detection and prevention of threats aimed against economic interests and business standing of JSC “SSC RIAR”;
- Maintenance of business confidentiality regime.

2.6. RISK MANAGEMENT

RISK MANAGEMENT POLICY OF JSC “SSC RIAR”

JSC “SSC RIAR” conducts the risk management activities within the scope of *Unified Industry-Specific Guidelines for Risks Analysis Associated with Budgeting, Budgetary Performance and Medium-Term Plans of ROSATOM State Nuclear Energy Corporation and its Subordinate Institutions* adopted by the order of ROSATOM State Atomic Energy Corporation No. 1/65-P as of the 27th January 2014. The documents of the ROSATOM State Atomic Energy Corporation were used as a basis to make orders concerning the use of Norms and Guiding Documents on the Risk Management (for instance, RIAR-wide Order No. 64/191-P as of the 28th of February, 2014) and to introduce unified requirements for analysis of risks affecting achievement of the financial and business performance indicators.

An important task for the Institute is to establish an effective risk management and internal control systems which confine themselves to identification of risks, their assessment, and elaboration of risk management plans, assessment of risk readiness and implementation of monitoring. The risk management policy is based on the principles and methods of risk management described in the corporate risk management system including the main processes given in Fig. 2.5.

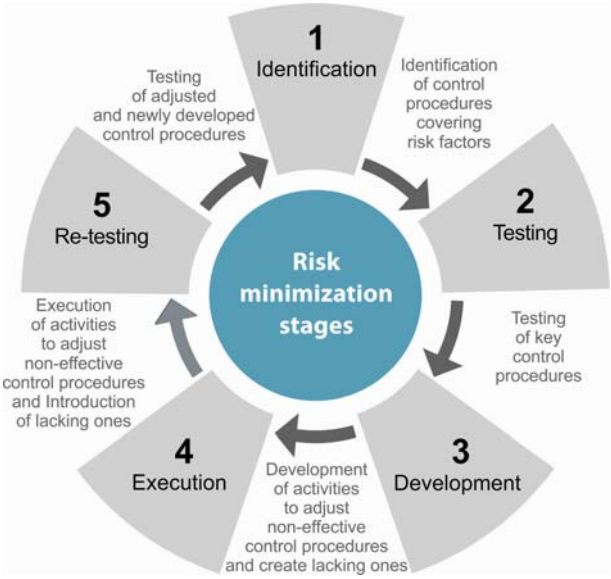


Figure 2.5. System of risk management

These activities are aimed at timely identification of the events which could have an undesirable influence on the achievement of objectives and on application of adequate responses to them. The existing measures for risk minimization are evaluated with reference to each of the identified risks, including procedures of internal control, and their sufficiency for restraining a residual risk level. In order to neutralize some risks, protection measures are taken as to implementation of the work program. Possible algorithms of actions are developed if any risk arises (Table 2.4). Management of risks is done and supervised in the divisions of the Institute within the assigned areas of their responsibility.

Table 2.4

Risk Management Practice

Risk	Risk factor	Risk management activities
Operational risk	Uncertain and unforeseen difficulties in the work process (for instance, technological risks, risks of failures, accidental risks, risks associated with the repair time prolongation etc.)	• Introduction of the state-of-the-art production methods; • Modernization and technical retrofitting of radiation hazardous facilities; • Neutralization (elimination) of hazards
Risk of underemployed capacities	Employment of production facilities is directly related to the demand of the Customers: a decrease in demand leads to the risk of underemployed capacities and underemployment of the staff	• Financial and institutional support of innovative products during the market slump; • Increased production and sales of industrial grade products
Risk of quality	Unconformity of quality to the assigned quality standards or quality specifications as to products, accomplished work and services rendered	Maintenance of the quality management system
Risk associated with the increase in the cost of services	• Setback of the worldwide / Russian financial and monetary system; • Changes in the charge rates for public utilities and services, of shipping companies etc.; • Increase of the minimal subsistence wage etc.; • Failures in the work processes; • Lower level of equipment capacity utilization; • Technological obsolescence	• Implementation of programs targeted at energy saving and energy efficiency enhancement; • Integration of the ROSATOM industrial system; • Optimization of production areas; • Headcount optimization
Risk of price changes for procured materials and products due to changes in economic situation	Changes in the pricing policies of Contractors provided that the concluded contracts for input supplies enable reconsideration of process. Escalation in prices for any particular resources or services leads to incidental expenditures	• Invention of new market segments; • Expansion of the range of products and services rendered

In 2015 JSC “SSC RIAR” plans to continue to work towards further development of the risk management system and its integration into the existing management processes.

LEGAL RISKS

JSC “SSC RIAR” undertakes its business in conformity with the standards and with due consideration for changes in the Russian legislation in force. With this objective in view, JSC “SSC RIAR” constantly monitors changes in the current legislation of the Russian Federation and jurisdiction of its presence in the field of the nuclear energy use, marketing, export control and nonproliferation of mass destruction weapons. It also observes related recommendations of supervisors and regulators at the international and national levels. All the contracts to be entered are subject to the approval by legal office at RIAR. Independent consultants are engaged in some cases also.

SOCIAL RISKS

JSC “SSC RIAR” places particular importance on social sustainability and addresses the social risks as one of the key risks. Outcomes of the RIAR’s dominant undertakings (operating profits) are directly related to the required number of the personnel who has the required professional competences but they also depend on the relations of the employees with the RIAR’s management. Deterioration of such relations as well as any restrictions enforced by the legislation as to the employment could have an undesirable effect on the development of the company. To promote the normal labor-management relations at JSC “SSC RIAR”, a trade union agreement has been concluded and is updated on a regular basis.

A number of factors associated with the human resource risk is beyond the area of RIAR’s influence (for instance, decrease in a number of graduates from schools and higher education institutions and, respectively, in a number of recent graduates; location of the Institute in the single-industry town when there are serious restrictions in employment of appropriate staff, etc.).

A shortcoming of high-skilled and experienced personnel or impossibility to involve them in implementation of new projects, including innovative ones, can have an unfavorable effect on the achievement of strategic objectives of JSC “SSC RIAR”. That is why JSC “SSC RIAR” monitors the effect of risk factors by implementing social programs for its employees and their family members.

Key social and personnel-oriented programs of JSC “SSC RIAR” include the following:

- Housing improvements for employees (compensation for house renting);
- voluntary (additional) medical insurance against accidents and diseases;
- health improvement for the employees’ children;
- social assistance to unemployed retirees (honorable retired employees);
- cultural and sporting events;
- training of recent graduates;
- additional financial support to employees, including force majeur circumstances, child birth, medical treatment and buying of medicine, burials as well as to multi-child families;
- introduction of a motivation system with an individual staff performance appraisal;
- training and advanced training of recent graduates of nuclear engineering-specific specialties;
- strengthening of staff competence.

Satisfaction of the personnel is checked by conducting sociological polls. The results related to human resources management are described in Section 4.2. “Social Policy and Staff Management” of Chapter 4 “Sustainable Development Activities”.

INSURANCE

A number of insurance contracts were concluded during the period under report to provide sustainable functioning of the Institute:

- civil liability insurance:
  - of vehicle owners – Mandatory Third Party Liability OSAGO (thirty five vehicles);
  - against injury to life, health and\or to property of the third parties caused by radiation exposure in transport of radioactive substances, nuclear materials, nuclear products and radioactive waste through Belarus, Moldova, Ukraine, Germany, Poland, Czech Republic, Hungary, and Russia;
  - within the framework of international civil liability insurance system in respect of motor vehicles “Green card” (four motor vehicles);
  - of operating companies and owners of hydraulic engineering installations (a dam located at the Stream IR);
  - of operators of hazardous production facilities against harm to environment as a result of accident at a hazardous production facility (nine hazardous production facilities);
  - of operators of nuclear power facilities (twenty two licenses for insured activities of insurant in the field of nuclear energy use);
  - in case of harm due to inadequate work affecting safety of capital construction buildings and facilities (to obtain the competence certificates for the work to performed at the highly hazardous technically complicated and unique capital constructions from self-adjustable organizations “Soyuzatomstroy” and “Soyuzatomproject”);
- voluntary health insurance (one thousand people);
- casualty insurance:
  - against the harm inflicted to the life and health of insured persons as a result of any accident (twenty people among the senior executives);
  - against the harm inflicted to the life and health of insured persons as a result of any accident (contingency rescue unit numbering twenty people).

Property interests of JSC “SSC RIAR” attributable to its civil responsibility to indemnify the harm caused to the injured or aggrieved persons upon the occurrence of an insured event are the subject matter of insurance under all the above-mentioned insurance contracts.

The aforesaid contracts provide for full coverage of all the losses upon the occurrence of insured events specified in them. All the insurance contracts were made in full conformity with the terms and conditions of insurance stipulated by the RF laws.

RISKS RELATED TO LABOR PROTECTION

Rates of work-related injuries and occupational diseases have a significant effect on both the economic and social component of the JSC “SSC RIAR” business. The measures aiming at prevention of work-related injuries and occupational diseases make it possible to increase the labor productivity efficiency and all these measures in their entirety contribute to higher economic benefit of JSC “SSC RIAR”.

The primary goals of JSC “SSC RIAR” related to the occupational health care and occupational safety are as follows:

- minimization of adverse impacts of production processes on the staff health;

- prevention of occupational injuries;
- improvement of working conditions.

The following work was done in the reporting year with the focus on the above-stated goals:

- Occupational safety and health care in place;
- Control over the adherence to legislative and other regulatory legal acts pertaining to labor protection;
- Identification of hazardous and harmful production activities;
- Control over availability of individual and group protection equipment;
- Consulting of employees on occupational health and safety;
- Development of preventive measures against occupational accidents and diseases;
- Reduction of work-related injuries, occupational accidents and diseases.

Risk reduction activities

In compliance with the occupational safety management system of the ROSATOM State Atomic Energy Corporation, JSC "SSC RIAR" has been employing its own occupational safety management system since 2010. Its purpose is to prevent the job-related injuries and occupational illnesses and to improve working conditions of personnel at RIAR.

In 2013 JSC "SSC RIAR" implemented the *Unified industry-specific policy of ROSATOM State Atomic Energy Corporation and its affiliated companies in the field of occupational health safety* that defines goals, tasks and main trends of RIAR's activities in terms of occupational safety and health care for its employees.

The individual radiation exposure monitoring is available for the staff on the temporary duty assignment and contractors' employees involved in activities radiation hazardous sites and nuclear facilities at JSC "SSC RIAR".

When JSC "SSC RIAR" enters into subcontracts, they specify obligations and commitments of subcontractors to comply with occupational health and safety standards. These subcontracts provide for formalizing appropriate agreements. Occupational safety questionnaires are also completed. JSC "SSC RIAR" together with the representatives of Contractor undertakes regular inspections to ensure the compliance with the occupational safety requirements at the worksites.

The purposeful and goal-oriented activities attributable to occupational health and safety shows evidence for reduction of risks related to labor protection and operational safety of the enterprise during the recent years. Details of these activities can be found in Section 4.4. "Occupational Health and Safety", Chapter 4 "Sustainable Development Activities".

In 2014 JSC "SSC RIAR" took the first place in the category "For hampering rate of job-related injuries and occupational diseases at production plants and facilities" in the regional contest within the framework of the All-Russian Contest "Russian enterprise of high social effectiveness" (Protocol #3 dated October 6, 2014).

NUCLEAR AND RADIATION SAFETY RISKS

The primary goal of the Institute is to provide trouble-free, safe and sustainable operation of nuclear and radiation hazardous facilities at JSC “SSC RIAR”. JSC “SSC RIAR” conducts performance monitoring and undertakes engineering arrangements to ensure trouble-free operation of research reactors and nuclear hazardous sites. All the activities are carried out in full compliance with the regulations and with due consideration of the RF legislation in force. In 2014, the work at nuclear hazardous sites of JSC “SSC RIAR” as well as operation of research reactors was accident free.

JSC “SSC RIAR” developed and has been operating the radiological safety system in order to manage radiation hazard risks incurred by local residents and personnel due to operation of nuclear facilities at the site. It is operated in conformity with legislative, regulatory legal acts of the Russian Federation currently in force, sanitary regulations and standards, specifications, rules, guidelines, instructions and other documents with reference to the following fields:

- Monitoring of external and internal occupational radiation exposure of the personnel is done in accordance with radiation safety standards NRB-99/2009, basic sanitary regulations for radiation safety OSPORB 99/2010, and recommended practices MU 2.6.1.16-2000;
- Radioactive atmospheric releases are monitored in accordance with the *Regulations for monitoring radioactive atmospheric releases at JSC “SSC RIAR”* subject to the strict observance of permissible releases standards;

Maintenance of preparedness of special response units in order to prevent, confine, mitigate and respond to possible emergencies and nuclear power-related accidents at JSC “SSC RIAR” with the help of accident management units and sites, communication and warning systems, emergency response teams and arrangements, physical and financial resources.

The following criteria can be a good evidence of the fact that activities of JSC “SSC RIAR” do not produce any strong impact on the personnel, local residents and environment:

- Main occupational radiation exposure limits were not exceeded in 2014;
- Adherence to specified limit values for radioactive emissions;
- There were no events associated with the operation of the RIAR’s nuclear facilities to be rated at level 1 and higher on the INES scale.

RIAR issues an annual report that provides data on individual and collective doses of internal and external radiation exposure of the personnel and the public, radioactive release monitoring data as well as other related information. The resultant report is used as a basis to work out necessary arrangements targeted at radiological safety enhancement.

The following special arrangements are undertaken to mitigate the risks attributable to operation of nuclear facilities:

- Retrofit and upgrading of process equipment at RIAR;
- Adherence to existing regulatory documents related to production processes and operational procedures specific to operation of nuclear facilities, storage of nuclear and radioactive materials, radioactive waste management.

The achieved level of nuclear and radiation safety is satisfactory.

RISKS ASSOCIATED WITH INVESTMENT PROJECTS

Every quarter a degree of risk is assessed for each RIAR's investment project within the framework of plan-fact analysis procedure that allows issues of concern to be revealed in good time and plans to be coordinated in order to achieve the performance targets of the projects. The ROSATOM State Atomic Energy Corporation provides its risk assessment methodology of investment projects to assess a degree of exposure to risk of one or another project. Table 2.5 summarizes major risks associated with implementation of investment projects at JSC "SSC RIAR".

Table 2.5

Risks attributable to investment projects of JSC "SSC RIAR"

Project risks			
construction of new nuclear power facilities, including technical retrofitting, reconstruction, and upgrading	**within the framework of international technical assistance**	**development of production methods and modernization of radionuclide production processes**	**other**
wrong design	changes in the scope of outside financing	project budget overruns	disruption of funding
project budget overruns	unfavorable changes in currency exchange rates	delay in the project completion time limit (extension of time period)	delay in the project completion time limit (extension of time period)
changes in funding of the federal target-oriented program	project budget overruns	unfavorable changes in the currency exchange rates	inappropriate execution of work by the Contractor
breach of schedule, extension of expected project completion time frames		unfavorable changes in the interest rates on the borrowing	
inadequate quality of project implementation		entry of new players into the market	

JSC "SSC RIAR" undertakes the following arrangements with the focus on the risk management\ minimization:

- Monitoring of risks by means of regular reporting;
- Identification of key risks for the projects;
- Updating of the risk register and risk assessment;
- Identification of risk owners and their liabilities;
- Elaboration and implementation of counterbalance undertakings associated with the risk minimization;
- Professional advancement of employees, development of their competences;
- Involvement of the ROSATOM's resources to deal with challenging tasks;
- Advancement in marketing;
- Improvement of product quality ;
- Expansion of outside and domestic markets;
- Entering long-term contracts;
- Refinement of arrangements, identification of the highest priority ones.

RIAR is based on the regulatory and procedural documents of the ROSATOM State Atomic Energy Corporation associated with the risk management to manage the risks attributable to investment projects.

2.7. QUALITY MANAGEMENT

A system of quality management at JSC “SSC RIAR” is based on the quality management concept stated in International Standard for Business ISO 9001:2008 “Quality Management Systems. Requirements” (hereinafter to be referred to ISO 9001) and in National Military Standard GOST PB 0015-002-2012 “Military Product Development and Pilot Production System. Quality Management System” (hereinafter to be referred to as GOST PB 0015-002).

The quality management system (QMS) is intended to ensure management of organizational performance, scientific work, business concept, and technological work at the Institute and is aimed at meeting the customer’s requirements (consumer) to the full extent and within the fixed timeframes as well as at safe performance.

The quality management system of JSC “SSC RIAR” is under the direct supervision of the Chief Engineer, i.e. the management representative to be in charge of quality. As to the management system implementation and guidance, it is provided by the Quality & System Engineering Department that is subordinate to the Chief Engineer of RIAR.

QUALITY ASSURANCE POLICY

Senior executive officers of JSC “SSC RIAR” worked out and approved *Quality Assurance Policy*. Its timely applicability is verified annually when functioning of the quality management system is analyzed at the enterprise. The quality assurance policy was made up to date in 2013 (Order No. 45 as of January 24, 2013). Its next revision is scheduled for 2015.

Quality assurance at JSC “SSC RIAR” is based on the requirements stipulated in ISO 9001 (GOST ISO 9001) and GOST RV 0015-002. The quality management system of JSC “SSC RIAR” was certified against these international standards (Fig. 2.6) applicable to design and engineering development, production and supply, fuel rods and fuel assemblies, radiochemicals and radionuclide sources; research and development work in the field of nuclear energy application (GOST ISO 9001) and in the field of design, development (R&D), shipment for military products associated with the nuclear energy application (GOST RV 0015-002).


СЕРТИФИКАТ СООТВЕТСТВИЯ

Figure 2.6. Certificate of QMS conformity to State Standard GOST RV 0015-002-2012

Pursuant to the claimed objectives, undertakings in the field of quality assurance enabled to achieve the following:

- Valid Certificate of Conformity No. VR 02.1.6513-2013 was validated (certification authority is the Russian Agency for Certification of Quality Management Systems i.e. Autonomous Non-Profit Institution “Institute for Testing and Certification of Armaments and Military Equipment” accredited within the “Military Register ” Voluntary Certification System);

- The following valid certificates of conformity were validated (Fig. 2.7) (certifying association Russian Register Baltic Inspection Center):

– No. 12.1063.026 (Certificate of Conformity against compliance to the requirements of Standard ISO 9001:2008 within the “Military Register ” Voluntary Certification System);

– No. ROSS RU.IS08.K01665 (Certificate of Conformity against compliance to the requirements of State Standard GOST R ISO 9001-2008 within the GOST R certification system);

– No. RU-12.1063.026 (Certificate of Conformity against compliance to the requirements of Standard ISO 9001:2008 within the international certification network IQNet).

Figure 2.7. Certificates of Conformity of JSC “SSC RIAR” QMS against compliance to the requirements of International Standard ISO 9001

• JSC “SSC RIAR” continues its work targeted at adequate functioning and improvement of the certified quality management system in conformity with the requirements of International Standard ISO 9001 and State Military Standard GOST RV 0015-002 based on the following plans and enacted orders:

– dated January 30, 2014 No. 64/83-P “About arrangements pertaining to adequate functioning and improvement of the quality management system at JSC “SSC RIAR”;

– dated February10, 2014 No. 64/117-P “About conducting the internal auditing of the quality management system at JSC “SSC RIAR”;

– dated August 22, 2014 No. 64/670-P “About conducting auditing of the quality management system at JSC “SSC RIAR” to reveal the conformity with the requirements of GOST RV 0015-002-2012”;

– dated September 24, 2014 No. 64/756-P “ About conducting auditing of the quality management system at JSC “SSC RIAR” to reveal the conformity with the requirements of International Standard ISO 9001:2008”;

– dated December 11, 2014 No. 64/964-P “About undertaking the analysis of compliance of the existing quality management system against the requirements of International Standard ISO 14001:2004”;

• The internal auditing was conducted at the RIAR’s divisions and departments to reveal the compliance of work with the requirements of GOST ISO 9001:2008, GOST RV 0015-002;

• Sixty four (64) attended training courses on the quality management system.

All the activities associated with the quality management system development at JSC “SSC RIAR” which were scheduled for 2014 have been fully implemented.

The main activities associated with the quality management for 2015 and for the nearest future will be targeted at:

• keeping the quality management policy up to date ;

• development, implementation, preparation for certification and improvement of the integrated quality management system at JSC “SSC RIAR”;

• further development of the quality management system with the focus on policymaking and its implementation, and keeping the regulatory framework up to date;

• implementation of standard ISO 14001:2004 “Environmental management systems. Requirements and guidance for use”;

• full range internal auditing of integrated quality management system in conformity with the internal auditing program for 2015.

2.8. PROCUREMENT MANAGEMENT

The principles and objectives stated in the nuclear power procurement policy are the framework of the JSC “SSC RIAR” procurement activities. The key principles of the JSC “SSC RIAR” procurement activities are as follows:

- timely scheduling of the procurement activities that makes it possible to give quick response to adjustment of the procurement criteria;
- equality, justice, non-discrimination and no groundless restrictions on competition of the procurement participants;
- appropriate and cost-effective expenditures for procurement of the goods, work and services, and implementation of the measures targeted at reduction of the customer expenditures;
- transparency of the procurement activities;
- use of modern information technologies, e-document flow means and computer-aided procurement including electronic trading platforms;
- group decision-making on the most crucial procurement management activities as a whole and with reference to individual procurements.

The objective of the RIAR procurement activities is to fully and timely meet the needs of its subdivisions in the goods, work and services providing the target performance indicators and optimal prices. In order to implement this objective the Company is aimed at:

- appropriate and cost-effective expenditures in procurement;
- creating the market of qualified suppliers, contractors and executors that are able to meet the needs of JSC “SSC RIAR” in the best way possible;
- preventing fraud and errors in procurement;
- creating a positive image of JSC “SSC RIAR” as a good-faith acquirer of the goods, work and services.

Being a socially oriented company, JSC “SSC RIAR” is interested in providing incentives for the economic development of the regional suppliers (executors). It creates conditions to expand possibilities for participating, developing fair competition and preventing groundless restrictions on competition of the procurement participants. Thus, a local purchase rate was equal to 24.6 % of the total signed contracts on procurement of the goods, work and services in 2014.

In order to improve procurement transparency of JSC “SSC RIAR”, at each procurement stage all the information is placed on the ROSATOM official website and on the official website of government procurement. An electronic procurement rate made up 100 % in 2014.

In 2014 as a result of open competitive bidding RUB 154 889.9 thousand has been saved making up 10.57 % of the scheduled price.

JSC “SSC RIAR” has procurement objectivest o be implemented in 2015 in order to fully provide the RIAR subdivisions with the goods, work and services in due time at least cost. They are as follows:

- to increase the rate of open competitive bidding due to reduction of a single supplier purchase rate;
- to increase the rate of timely competitive bidding procedures up to 95 %;
- to keep small and medium business in procurement at the level established by the Government of the Russian Federation.

2.9. PRODUCTION MANAGEMENT

PROJECTS ON IMPROVEMENT OF THE MANAGEMENT SYSTEM

The key projects launched in JSC "SSC RIAR" in the reporting year related to improvement of the management system are as follows:

- arranging and preparing for inspection audit by the certification bodies (Autonomous Nonprofit Organization "Institute for Testing and Certification of the Weapons and Military Equipment" and Russian Register – Baltic Inspection, Ltd.) to check the compliance of the quality management system with GOST RV 0015-002-2012 and ISO 9001:2008 in order to approve the current certificates;
- updating the quality management system documentation;
- developing and updating the RIAR programs related to quality assurance in compliance with the requirements of the federal rules and regulations NP-090-11 "Requirements for the Quality Assurance Programs Intended for the Nuclear Facilities", arranging and carrying out audit of the quality assurance programs, and assessing their effectiveness.

In accordance with the 2014 objectives in quality assurance all activities on development of the quality management system envisaged by Order No. 64/83-P as of January 30, 2014 'On Activities Related to Operation and Improvement of the Quality Management System of JSC "SSC RIAR"' were fulfilled in a full scope.

The activities to be conducted in 2015 in JSC "SSC RIAR" are as follows:

- recertification of the quality management system for compliance with GOST RV 0015-002-2012 and ISO 9001:2008 (GOST ISO 9001-2011);
- certification of the environmental management system for compliance with ISO 14001:2004 under the integrated management system;
- further development and improvement of the management system in terms of implementation of the coherent quality policy, updating and integration of the management system regulatory documents;
- development and launch of the quality assurance programs under operator's responsibility (including nuclear facility lifetime prolongation) in compliance with NP-090-11 "Requirements for the Quality Assurance Programs Intended for the Nuclear Facilities".

ACTIVITIES ON IMPLEMENTATION OF THE METHODOLOGY AND PROCESS MANAGEMENT

The Administration of RIAR has established, implemented and maintained a sequence for designing and developing processes needed to conduct research and development activities and services for timely response to the expectations of its customers.

In accordance with ISO 9001 (GOST ISO 9001) and GOST RV 0015-002:

- processes needed for quality management system operation have been identified in RIAR(management, primary and supporting processes), and the following standards of the enterprise have been developed:

– STO KP 086-412 “Strategic Management”;
– STO KP 086-413 “Research and Development. Reactor Materials Science”;
– STO KP 086-414 “Nuclear Fuel Fabrication”;
– STO KP 086-415 “Operation of Nuclear Facilities”;
– STO KP 086-416 “Human Resources Management”;
– STO KP 086-418 “Radioisotope Production”;
– STO KP 086-419 “Mid-Term Planning. Budgeting”;
– STO KP 086-421 “Research and Development. Irradiation Tests”;
– STO KP 086-422 “Research and Development. Radiochemistry”;
– STO KP 086-423 “Procurement”;
– STO KP 086-424 “Communications”;

- a flow of processes and their interaction (process landscape) have been determined;
- criteria and methods of assessing the effectiveness of these processes have been identified;
- resources and information needed for implementation of these processes and their monitoring are provided;
- monitoring, measurement and analysis of the current quality management system processes are performed;
- activities aimed at achieving the target results and their continuous improvement are conducted.

Management of these processes is carried out in compliance with ISO 9001. Each process envisages activities under the PDCA cycle (plan – do – check (analyze) – act (revise)). The processes are given in the flow charts describing the objective of the process, action items, methods and criteria to assess the process effectiveness, responsibility and authority.

- The priority task of JSC “SSC RIAR” is both ongoing enhancement of the quality management system, its organizational structure and documentation and implementation of the integrated management system (quality management system, environmental management system) that complies with the requirements of ISO 9001, GOST RV 0015-002, ISO 14001 operating as a single whole. Implementation of the integrated management system will allow resolving the issues faced in simultaneous or consistent independent implementation of several standards. These issues are as follows:

- duplication of the processes, documents, positions and functions of the subdivisions;
- complexity of relations between the quality management system and environmental management system;
- complexity of the perceptual unity of the management system by the RIAR Administration, therefore low efficiency of planning, control and management in general;
- a long term of standard implementation;
- high labor intensity and important needs in resources in implementing the standards.

Activities related to development, implementation, preparation for certification and enhancement of the integrated management system are scheduled for 2015.

A comprehensive and systematic analysis (self-assessment) of the RIAR activities was performed in compliance with ISO 9004:2009 “Managing for the Sustained Success of an Organization. A Quality Management Approach”. The self-assessment results are provided in the corresponding report. The quality management system of JSC “SSC RIAR” complies with the third level of maturity (following the self-assessment results – 59 %): the key management principles in the company

are implemented, however not in all areas. Below are the characteristics of the third level:

- improvement is evident;
- the process-based approach is evident, and it is more of a proactive kind rather than of a reactive one;
- the root causes are identified with reference to the faced issues in application of the management principles, and several good remedial actions accompanied by systematic improvements are introduced;
- the information about the objectives and operation is provided with reference to these objectives, there are good improvement tendencies;
- stakeholder satisfaction is generally taken into account;
- there is evidence that application of the management principles is taken into account at the medium level with the established analysis and action items;
- there is evidence of clear improvement or enhancement, however application of the management principles is not always taken into consideration.

In 2014 the experts from 'TKB "INTERSERFIKA"', Ltd. held workshops for the JSC "SSC RIAR" specialists, 95 certificates on completion of the courses were obtained on the following topics:

- "Integrated Management Systems: Quality, Environment, Occupational Health and Safety (ISO 9001:2008, ISO 14001:2004, OHSAS 18001:2007)";
- "Retraining of the Internal Auditors of the Management Systems under ISO 9001:2008 (GOST ISO 9001-2011) and ISO 14001:2004".

PROJECTS ON IMPROVEMENT OF PRODUCTION EFFICIENCY

Implementation of the ROSATOM production system is a sectoral project targeted at creating a comprehensive management system related to integrated optimization of production and management processes at ROSATOM enterprises based on the best Russian and foreign practices. The objective is to improve the efficiency of nuclear enterprise performance including cost reduction and improvement of labor efficiency to achieve the level of Russian and foreign competitors.

In 2014 three sectoral projects were implemented in JSC "SSC RIAR" in the course of development of the ROSATOM production system:

- improvement of VK-50 reactor utilization efficiency;
- implementation of the 5C system and operation analysis at the enterprises of the Block for Innovation Management;
- improvement of radioisotope production efficiency.

To achieve the set objectives, working groups have been established in RIAR including those specialists who are authorized for achievement of the objectives. The members of the working groups undergo training and learn the principles, approaches and methods of the ROSATOM production system (since 2012 more than 160 specialists have been trained). The general management of the working group activities and methodical support are carried out by Assistant Director responsible for the implementation of the ROSATOM production system. The number of the subdivisions involved in the implementation of the projects related

to implementation of the ROSATOM production system is given in Fig. 2.8.

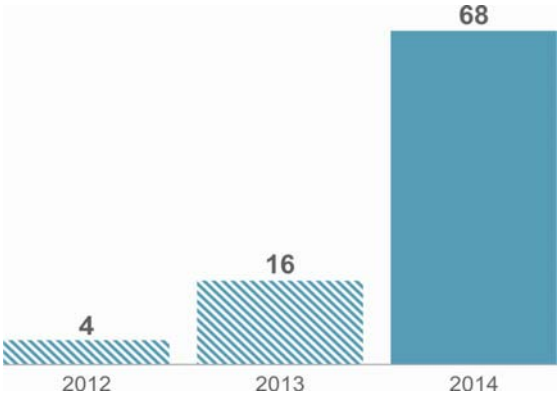


Figure 2.8. The number of subdivisions involved into the projects on implementation of the ROSATOM production system

The key results of the projects related to implementation of the ROSATOM production system in 2014 are as follows:

- reduction of the VK-50 repair term (in spring) by 5 days, development of a schedule ensuring reduction of the autumn repair term by 11 days;
- reduction of VK-50 reactor operating expenditures by RUB 6.9 million;
- decrease in deviation in molybdenum-99 production up to 2.8 %.

ASSESSMENT OF CUSTOMER SATISFACTION

Customer satisfaction with the services and products is assessed to determine the level of conformance of JSC “SSC RIAR” to the requirements of a consumer. The arrangement of work, data acquisition methods and frequency, as well as a data analysis method are provided in STO DP 086–410-2012 “Quality Management System of JSC SSC RIAR”. Customer Satisfaction Monitoring and Assessment”.

To assess customer satisfaction questionnaires of two types have been compiled following the results of 2014:

- on service quality (R&D);
- on product quality.

Both questionnaire types include four sections with questions on contracting, obligations to meet the requirements, rendered services and product quality, interaction with consumers, and results of cooperation. The questionnaires also contain questions to determine consumer loyalty reflecting the intention to use again the RIAR products and services, recommend RIAR to other consumers and buy other RIAR products and services.

A list of consumers was compiled based on the provided information about organizations that had revenue agreements with the RIAR subdivisions in 2014. The questionnaire was sent to 12 organizations (the main product consumers), and to 22 organizations (the main service consumers).

The percentage of the organizations that gave their response made up 50 % of the planned number (17 of 34 organizations sent 21 filled questionnaires). The information about the organizations that sent the filled questionnaires is presented in Table 2.6.

Table 2.6

The number of the questionnaires filled in 2014

Name of the organizations	Number of the completed questionnaires
JSC “Ulyanovskneft”	1
JSC “TVEL”	2
Source Radiographics Pty, Ltd.	1
Public JSC “Mashinostroitelny Zavod”	1
JSC “NIKIET”	2
JSC ‘OKB “Gidropress”’	1
The Petersburg Nuclear Physics Institute	1
FSUE “VNIIA”	1
JSC “Afrikantov OKBM”	1
JSC “Mordovtsement”	2
FSUE “SSC RF – IPPE”	2
JSC “V.G. Khlopin Radium Institute”	1
ZAO “KVANT”	1
JSC “NIITFA”	1
JSC ‘Scientific and Technical Center “RATEC”’	1
FSUE ‘PA “MAYAK”’	1
‘Industrial and Trading Company “URAL–ASPECT”’ LLC	1

Figures 2.9. and 2.10 provide the results of organization satisfaction assessment.

Figure 2.9. Assessment of organization (product consumers) satisfaction

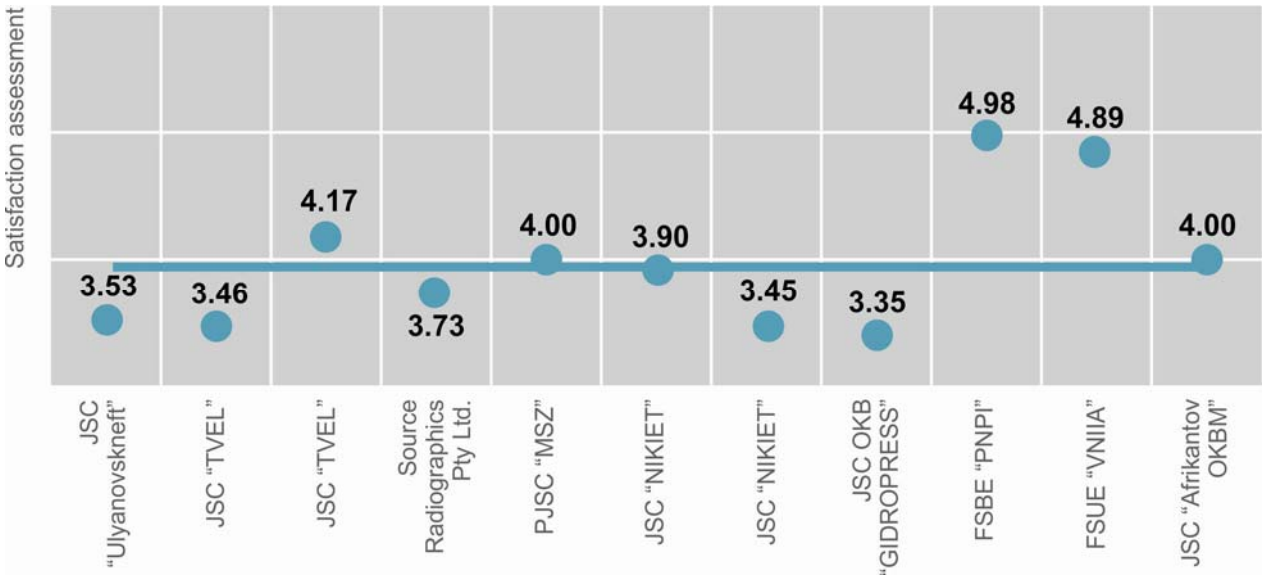


Figure 2.10. Satisfaction assessment of the organizations-service users

The average satisfaction of the service users is 79.1 %, so, on the whole, the service users are satisfied with the rendered services.

The average satisfaction of the product users is 88.1 %, so, on the whole, the product users are satisfied with the services on the product delivery. In 2014, the total average index of the users satisfaction was 83.6 % from 100 %, or 2.1 % higher than in 2013.

The customer survey has showed that 100 % of the users of RIAR services and products consider RIAR a reliable supplier, they have plans to continue cooperation under the contracts and are ready to refer other consumers to RIAR; in their opinion, the information on RIAR services and products is available (Fig. 2.11).

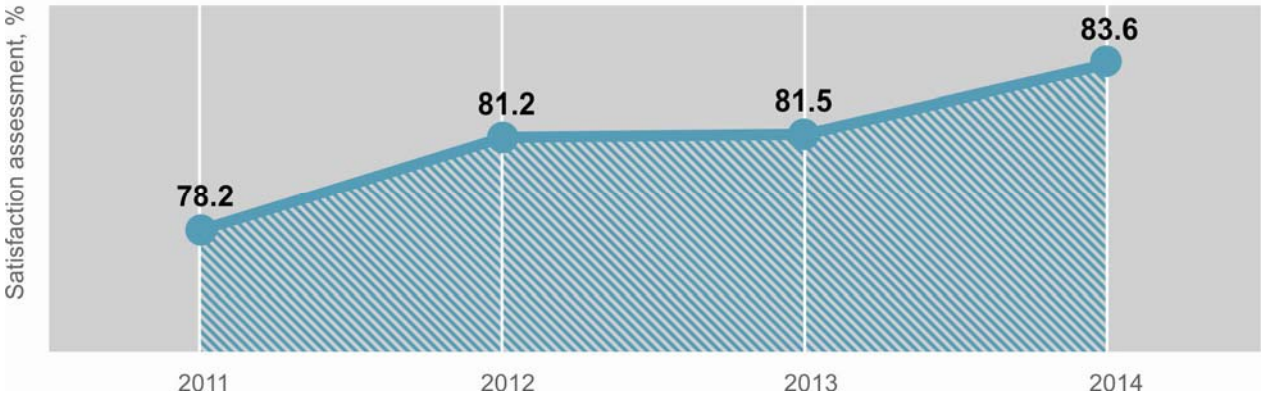


Figure 2.11. Average customer satisfaction for 2011–2014

In recent years, RIAR customers are satisfied with the services rendered and products supplied.

2.10. KNOWLEDGE MANAGEMENT

In the process of its activities, a Company should use appropriate gained knowledge. A knowledge management system, which includes development and patenting of new knowledge and accumulation of non-material assets, should become a part of the enterprise management system and assist in developing its intellectual capacity.

The process of knowledge generation, keeping, dissemination and use is one of the cornerstones of the innovative activity management and organization development. Like any other business process, it should be manageable, plannable and controllable. It is very important for JSC "SSC RIAR" that the scientific and technical competencies needed for the safe operation of the existing nuclear facilities and effective implementation of new developments be kept. Knowledge Management aims at replacing the staff with full regard for the succession of generations; gained competencies being transferred.

In 2012, RIAR launched a project "Knowledge Management System" (more detailed information on the project development can be found in Annual Report for 2013). In 2014, the system was developed along the following three main areas: (Table. 2.7):

- keeping critical knowledge in the Company,
- protecting intellectual property,
- managing scientific and technical information content.

Table 2.7

Key activities to develop knowledge management system in JSC "SSC RIAR"

Areas to develop knowledge management system		
Keeping Critical Knowledge	**Protecting Intellectual Property**	**Managing Scientific and Technical Information Content**
Development and annual updating of the knowledge map and critical knowledge listing	Registering technologies and projects as the results of intellectual activities	Gained knowledge formalization and recording
Implementation of programs to keep critical knowledge	Registering ownership for the results of intellectual activities	Digitization of the critical knowledge archive
Making multi-media modules on specific topics	Technology commercialization (selling the rights to the technologies)	Maintaining the unified catalogue of information resources in the library system IRBIS, updating the database "Employees' articles in periodicals"
Holding lectures and workshops under the project	Control over the timely revealing of the results of intellectual activities and their legal protection	Providing the access for RIAR employees to the external sources of information: - the international information-analytical system of scientific citing "Scopus", - the electronic database of the ELSEVIER publisher; - the weekly electronic abstract journal "Science in the world", - collections of the State Public Scientific and Technical Library and others

Table 2.7 (continued)

Areas to develop knowledge management system		
Keeping Critical Knowledge	**Protecting Intellectual Property**	**Managing Scientific and Technical Information Content**
Development of regulatory and guidance documents to keep critical knowledge	Development of regulatory and guidance documents to manage intellectual property	Enhancing the "Information Exchange" database
Participation in the events under the project Keeping Critical Knowledge	Collecting and submitting the information on the results of intellectual activities to both the State Authorities and bodies authorized in the field of intellectual property	Enhancing the collections of scientific and technical information on the following thematic sections: - "Industry–oriented publications", - "Proceedings of Scientific-Technical Conferences", - "Publications", - "Master Catalogue of the Scientific-Technical Library" included into the scientific and technical information portal of SC ROSATOM
	Implementing patent search and making a portfolio of critical technology rights	Promoting scientific and technical information, Informing RIAR workers (individually and collectively) about scientific and technical information content
	Establishing mechanisms to calculate and pay remuneration to authors	

KEEPING CRITICAL KNOWLEDGE

Critical Knowledge Management assists in identifying risks in a timely manner and supports basic and complementary manufacturing processes; therefore, it indirectly affects the organization efficiency and production.

Critical knowledge is

- particularly important knowledge to contribute to continuous successful innovative activities;
- knowledge in the organization which is prioritized in resource-constrained environments;
- knowledge determined by the job instruction and particularly important to ensure continuous successful operation of the company.

Keeping critical knowledge aims at:

- reducing risks of losing knowledge when staff members who have important knowledge leave the Organization;
- providing specific ways to keep knowledge;
- ensuring the safe use;
- ensuring non-proliferation.

The instruments to keep critical knowledge are as follows:

- a multi-media library;
- teaching guides,memoirs, autobiographies;
- master classes, special courses, mentorship, workshops, lectures.

In 2014, the following activities were carried out under the project Keeping Critical Knowledge:

- a time schedule was developed and approved; local regulatory documents to keep critical knowledge were issued;

- the company knowledge map was updated; it involves nine key areas of activities comprising a list of ninety five research themes and a list of critical knowledge;
- the assessment of the risk of losing knowledge was conducted due to four factors for employees who have critical knowledge;
- the work was done to elaborate and fully implement the programs to keep critical knowledge in the following areas of expertise:
  - nuclear fuel cycle analysis techniques,
  - X-ray diffraction analysis of the irradiated materials,
  - nuclear and neutron physics;
- a multi-media module "X-ray Structure Analysis of Irradiated Materials" was elaborated and made available on the portal of the RIAR scientific library;
- the work was done to determine and approve areas of critical knowledge to be kept in 2015; multi-media modules were produced for each of the following areas:
  - justification of radiation safety at nuclear facilities,
  - strength calculations for the NPP equipment,
  - production of metal alloyed, pelletized MOX and nitride fuel,
  - material science problems in developing innovative projects,
  - methods for reactor material mechanical testing.

In order to keep and share critical knowledge as well as to provide the continuity in developing research in JSC "SSC RIAR", our company annually arranges competitions, forums and conferences for students, post-graduates and young scientists. In 2014, the following events were held: the annual contest of RIAR's young professionals aged up to 35, the Seventh Conference of RIAR's Young Professionals aged up to 35, the youth forum "Energy of Generations" (in cooperation with DETI NRNU MEPhI).

The following activities are scheduled for 2015 and the near future:

- to update the knowledge map;
- to develop a list of RIAR employees who have critical knowledge (including the cumulative risk factor);
- to prepare multi-media modules on five topics and to include them into the scientific and technical portals of JSC "SSC RIAR" and SC ROSATOM;
- to fully implement five programs to keep critical knowledge in 2015; to develop and to approve five programs for the year 2016;
- to hold lectures and workshops to keep critical knowledge.

INTELLECTUAL PROPERTY PROTECTION

JSC "SSC RIAR" implemented and successfully uses technologies which can be divided into the following groups:

1. *Techniques to perform tests and research in nuclear reactors* to simulate operation conditions of core components of advanced power and transport reactors and to investigate their performance in these conditions.

By the end of 2014, the techniques are protected by 50 patents of the Russian Federation exclusive rights for which belong to RIAR; four patents are obtained and one secret of production (know-how) is registered exclusive rights for which belong to the Russian Federation.

2. ***Post-irradiation examination techniques*** to obtain information on the change of the core components performance under operation conditions using destructive and non-destructive methods. In total, by the end of 2014, the techniques are protected by 29 patents for invention and useful models and six secrets of production (know-how).

3. ***Techniques for radiochemical research*** to experimentally obtain information on physical-chemical processes used for reprocessing of irradiated materials and spent nuclear fuel, fractioning, refabrication and released fission product disposal. By the end of 2014, the techniques are protected by nine patents for invention and useful models and one secret of production exclusive rights for which belong to JSC "SSC RIAR"; nine secrets of production (know-how) are registered exclusive rights for which belong to JSC "SSC RIAR" and the Russian Federation; sixteen secrets of production (know-how) are registered exclusive rights for which belong to the Russian Federation only.

4. ***Techniques to produce nuclear fuel and non-nuclear reactor materials*.** These are the advanced pilot techniques to produce nuclear fuel, including refabricated fuel, and components of the reactor control and protection system. By the end of 2014, the techniques are protected by three patents exclusive rights for which belong to JSC "SSC RIAR", three patents, two secrets of production and one certificate for registration of one database exclusive rights for which belong to the Russian Federation.

5. ***Techniques to produce isotopes and radiation sources*.** These are the techniques to produce various radionuclides and to fabricate ionizing sources for use in medicine, industry and research. By the end of 2014, the techniques are protected by 22 patents and 16 secrets of production (know-how) rights for which belong to JSC "SSC RIAR".

In the reporting period, nine key techniques were developed in JSC "SSC RIAR". The values of the intellectual property objects and the dynamics of the inventive activities are presented in Tables 2.8 and 2.9.

Major activities planned for 2015 and for the near future are as follows:

- developing policies in the field of intellectual property management;
- implementing patent search and forming a portfolio of the critical technology rights;
- registering the techniques as the results of intellectual activities;
- commercializing the techniques developed in RIAR;
- providing mechanisms to calculate and pay remuneration to authors.

Table 2.8

Values of the objects of the RIAR intellectual property

Type of the intellectual property object	Cost, thous. rubles	
	primary	residual
Invention	383.4	293.1
Useful model	101.2	63.6
Know-how	255147.4	240658.5
Trade mark	22	7.7
Total	255654	241022.9

Table 2.9

Inventive activities in JSC "SSC RIAR"

Indicator	Indicator by the year		
	2012	2013	2014
Applications for inventions and useful model	15 (of which the RF is the owner of the rights for 4 inventions and useful models)	13 (of which the RF is the owner of the rights for 4 inventions and useful models)	8 (of which the RF is the owner of the rights for one invention and useful model)
Obtained patents for inventions and useful models	8+1 database	13 (of which the RF is the owner of the rights for two useful models and inventions and the RF jointly with JSC "SverdNIIChimmash" is the owner of rights for one patent and useful model	19 (of which the RF is the owner of the rights for 4 patents and useful models)
Registering the legal protection for secrets of production	–	26	23 (of which the RF is the owner of rights for one secrets of production)
Supported inventions and useful models; know-how	118 (of which 80 –inventions; 35 –useful models; 1 – database; 2 – know-how)	153 (of which: 83 – inventions; 41 – useful models; 1 – database; 28 –know-how)	181 (of which: 88 – inventions, 41 – useful models, 1 – database, 51 – know-how, 1 – trademark)
Used inventions and useful models	52	54	38

PROVIDING SCIENTIFIC AND TECHNICAL INFORMATION

In 2014, the work was continued to build collections of scientific and technical information according to the following thematic sections: "Industry-oriented publications", "Proceedings of scientific and technical conferences", "Publications", "Master catalogue of the scientific-technical library". These collections of information were placed on the scientific and technical information portal of SC ROSATOM. The content was added with both the up-to-date scientific and technical information and information on the digitized archives of the RIAR scientific and technical documentation.

In the framework of the industry-oriented project, the work was done to arrange the access for RIAR scientists to the international information-analytical system of scientific citing "Scopus" and the electronic database of one of the world's largest publishing houses "ELSEVIER" (over 2000 journals covering about 250 thousand papers per year).

In 2015, we are going to extend the access to the full-text collection of the ELSEVIER electronic books and journals – "Science Direct Corporate Edition (Journals, Backfiles, Books)", to the Elsevier abstract database – "Scopus Corporate Edition", to arrange the access to the weekly electronic abstract journal "Science in the world" which provides a review of the most reputed scientific English-language periodicals (Nature, Science, PNAS), and to continue the work to add the collections of scientific-technical information with the following thematic sections: "Online scientific information resources", "Catalogue of digitized archive documents".

SYSTEMS FOR PERSONNEL TRAINING AND DEVELOPMENT

The most important thing of the knowledge management system is people and their competencies. JSC “SSC RIAR” employs ninety specialists who have the degree of Master of Science, of which twelve people are awarded with the Doctor of Science degree.

In accordance with the Program of Activities of the scientific-educational innovation-technological consortium of the Ulyanovsk region higher education institutions and scientific establishments, JSC “SSC RIAR” assisted in establishing an industry-oriented department “Radiation Technologies” at the faculty of High Technology Physics and Engineering in Ulyanovsk State University. In 2014, nine post-graduates, RIAR employees, undertook postgraduate courses in the above-mentioned department with a specialization in “Condensed Matter Physics” and “Material Science (power engineering)”. Fifteen RIAR employees combine their work in RIAR with the position of a lecturer at the above-mentioned department, of which seven people are Doctors of Science and three people are Masters of Science.

RIAR, together with the Dimitrovgrad Engineering Technology Institute (DETI NRNU MEPhI), opened an industry-oriented department “Nuclear Reactors and Materials” with the following specializations: “Chemical Technology of Modern Power Engineering Materials”, “Nuclear Reactors and Materials”, “Radiation Safety of the Man and Environment”, “Nuclear Physics and Technologies”. Nineteen RIAR employees combine their work in RIAR with the position of a lecturer at the above-mentioned department, of which five people are Doctors of Science and four people are Masters of Science (more detailed information on the activities in the field of personnel training can be found in Section 4.2. “Social Policy and Staff Management” of Chapter 4 “Sustainable Development Activities”.

MENTORSHIP

From its first days in 1956, RIAR implemented the mentorship system. It is still of interest at the present time. Mentors are always highly-qualified RIAR employees. In JSC “SSC RIAR” mentorship covers the following areas:

1. Mentorship for students and trainees.

To implement activities in this area, the Staff Service signs cooperation agreements with industry-oriented and regional higher education institutions, establishments of secondary vocational education and schools of Dimitrovgrad, Ulyanovsk region. JSC “SSC RIAR” offers all practices which are unique in that the students are involved in the implementation of the Federal Target Programs and projects (for example, the program “Nuclear Power Technologies of New Generation for 2010-2015 and until 2020” and the project “Enhancing Safety and Efficiency of the RIAR Research Facilities”).

This condition requires an individual approach to the trainee, a close cooperation with the training departments and RIAR-oriented departments established in collaboration with the Dimitrovgrad Engineering Technology Institute and Ulyanovsk State University. The information on students’ practice in JSC “SSC RIAR” in the past three years is given in Table 2.10.

2. Mentorship for young professionals.

Practical training of newcomers aims at providing professional and social-psychological adaptation; young specialists

also acquire theoretical knowledge and practical skills necessary for their occupation.

In accordance with the RIAR Collective Labour Agreement, Section "Work with the Youth", the employer provides the young professionals with the possibility of adapting to the new community. For example, mentors are attached to the newly-employed young workers for the time period up to six months; and the newly-employed young specialists with the major in industry-oriented specialties have mentors for the period up to one year.

Table 2.10

Number of students of higher education institutions who did practical training in JSC "SSC RIAR"

Name of the educational institution	Indicator by years		
	2012	2013	2014
"Ulyanovsk State Technical University"	2		5
"Ulyanovsk State University"	18	5	6
"National Research Nuclear University – Moscow Engineering Physics Institute" with branches in Dimitrovgrad, Obninsk, Seversk	116	172	240
"Moscow State University named after M. V. Lomonosov"	15	10	18
"National Research Tomsk Polytechnic University"	6	7	8
"Nizhniy Novgorod State Technical University named after R.E. Alekseev"	49	46	
Others	27	12	35
Total	233	253	313

* The majority of the students are from the Dimitrovgrad Engineering Technology Institute (DETI NRNU MEPhI).

3. Mentorship in transferring key knowledge and skills.

One of the forms of such mentorship is a scientific supervision for post-graduates. It helps to keep and transfer key industry-oriented knowledge and skills. In 2014, postgraduate courses in seven industry-oriented specialties attended twenty four young RIAR employees to which eleven scientific supervisors-mentors were assigned from the RIAR's highly-qualified staff.

In the reporting period, the number of mentors in JSC "SSC RIAR" was 204 people, of which 129 people were for trainees, 44 – for young professionals and specialists, 20 people – for management reserve participants and 11 people- for post-graduates.

The Youth Association, Youth Council, representing the interests of young workers, was established and is successfully operating in JSC "SSC RIAR" in order to create conditions and to ensure the inflow of young people to RIAR, to strengthen their chance of staying in the company, to improve their professional skills and qualifications, including through the transfer of knowledge and experience from leading RIAR scientists. The activities of one of the thematic sections of the Youth Council – the research and production section – aims at helping young employees to improve their professional skills and to gain practical knowledge which contribute to the production and engineering development as well as career growth.

KNOWLEDGE SHARING

The components of the knowledge management system are both periodicals and books on key areas of research performed in RIAR; the authors of the books are RIAR employees (Fig. 2.12).

Figure 2.12. RIAR publications in 2014

RIAR seeks to make all RIAR publications official; so, publications are assigned an ISBN and UDK code, the materials are being edited which guarantees high quality of the materials published and full compliance with the standards in the field of editorial and publishing activities.

In 2014, the Editorial and Publishing Group of the RIAR Office for Internal and External Communications edited and released the following publications:

- Monograph by Yu. A. Kushnir “Applied Metrology in Nuclear Research and Technology”;
- Collection of Abstracts of the Scientific Conference “New Materials for Innovative Development of Nuclear Power Engineering” which was devoted to the 50-year anniversary of the RIAR Reactor Materials Testing Complex and was held on March 24–27, 2014, in Dimitrovgrad;
- Collection of Abstracts of the International Conference “Safety of Nuclear Research Facilities” held on May 26–30, 2014, in Dimitrovgrad.

In addition to those named above, the following publications are released on an annual basis with funding from RIAR:

- Collected Papers of JSC “SSC RIAR” – a collection of scientific articles in which works of RIAR scientists are published; in 2014, two issues were published;

- Report on key research performed in the reporting period (JSC “SSC RIAR” Annual Report) – the report intended for workers of research organizations, design bureaus, atomic branch enterprises and students of relevant specialties; the report is sent to the atomic branch enterprises;

- JSC “SSC RIAR” Annual Report – an integrated report which incorporates key results of RIAR financial-economic and production activities in the reporting period, as well as results of sustainable development activities; the report is of interest for a wide audience.

Exhibition arrangements also contribute to the knowledge sharing and technology promotion to the market. In 2014, RIAR participated in the sixth International Forum “ATOMEXPO–2014” where the dummy polyfunctional research radiochemical complex which is under construction in RIAR and simulators of ionizing sources and radiopharmaceuticals produced in RIAR were exhibited. RIAR also participated in the annual national exhibition “VUZPROMEXPO” and presented the following projects: “Comprehensive Upgrading and Development of the Production of Radionuclides in RIAR Nuclear Reactors to Ensure Progress in Nuclear Medicine and Radiation Technologies” and “Development of a Technique to Produce ^{99}Mo Radionuclide Using Low-Enriched Uranium”.
In October 2014, the second labour forum “To the future with a man of labour” was held in the city of Ulyanovsk. RIAR presented banners and a video presentation about RIAR Men of Labour and awards in 2014.

RIAR arranges excursions in order to increase the openness, to raise awareness and to attract new workforce (Table 2.11).

Technical tours include visits to both the laboratories in key RIAR divisions and Research Reactors Complex.

Table 2.11

Number of people who visited JSC “SSC RIAR”

Visitors	Indicator by years		
	2012	2013	2014
Schoolchildren	600	420	253
Students	350	395	357
Others	50	269	553
Total	1000	1084	1224

Over the last three years, 827 people visited the museum exposition located on the RIAR territory in the administrative building (Table 2.12).

Table 2.12

Number of visits to the RIAR museum exposition

Year	Number of	
	visits	visitors
2012	34	192
2013	63	257
2014	75	378
Total	172	827

2.11. MANAGEMENT OF INVESTMENT ACTIVITIES

The aim of the investment management is to ensure the fulfillment of key strategic long-term tasks under the limited investment resources and changing external environment.

The principal objectives of the investment management are as follows:

- To maintain current positions in the market and to ensure development of activities in new markets both in the medium and long terms;
- To maintain and update RIAR infrastructure in the field of radiation, environmental and industrial safety as well as scientific infrastructure.

To address these challenges, investment resources should be shaped and used effectively, economic and other benefits from implementation of the projects should be increased.

The investment management is performed in strict compliance with the regulatory documents of SC ROSATOM and JSC "SSC RIAR" (Table 2.13) by managing the investment projects at all stages of their implementation: from initiation and approval to monitoring, control and completion of investment projects.

Table 2.13

Regulatory environment governing the investment activities

Name of the document of SC ROSATOM and its organizations	Number of the Order confirming the implementation of the document	
	In SC ROSATOM	In JSC "SSC RIAR"
The Uniform Sectoral Investment Policy	as of 16.04.2013 No. 1/402-П	as of 30.04.2013 440
The Uniform Sectoral Interaction Procedure for Making Investment Decisions on a Project of Rosatom	as of 02.10.2013 No. 1/1060-П	as of 27.12.2013 64-1302П
The Uniform Sectoral Procedure "Corporation's Projects Portfolio Management	as of 02.10.2013 No. 1/1061-П	as of 27.12.2013 64-1302П
The Uniform Sectoral Methodological Documentation for Making Passports of Rosatom's Projects	as of 02.10.2013 No. 1/1062-П	as of 27.12.2013 64-1302П
The Uniform Sectoral Methodological Documentation for Calculating the Application for Consolidated Investment Resource of Rosatom"	as of 27.10.2013 No. 1/1130-П	as of 18.04.2014 64-343П
The Structure of the Process Groups "Management of Investment Activities"	as of 02.12.2014 No. 1/1315-П	as of 18.04.2014 64-343П
The Uniform Sectoral Methodological Documentation on Preparing Projects for Making Investment Decisions	as of 30.05.2014 No. 509	as of 28.08.2014 64/694

The role of members of investment activities in the system of RIAR investment management is shown in Table 2.14.

Table 2.14

Role of members of investment activities

Member of investment activities	Role of the member
Initiator (any official / division)	Development of the project idea
Office for Economics and Investment Activities Controlling	• Investment project management, participation in the project development • Control over project timetable and budget. • Methodical support
Project Manager	Project Management (making passports, timetables and budgets, setting tasks for the project team members, responsibility for the result)
Working group to develop and implement the project	• Feasibility study • Development of the project documentation • Project implementation according to the timetable and project budget
Body to make investment decisions	Making investment decisions at all stages of the project implementation

2.12. PROPERTY MANAGEMENT

RIAR main goals in the field of property management are as follows:

- to strengthen the effective functioning of the property complexes in cooperation with the stakeholders from RIAR structural subdivisions;
- to increase incomes and reduce costs by means of effective management and economically feasible use of immovable property;
- to enhance RIAR competitiveness, to improve financial and economic performance through effective property management, including non-core assets;
- to create a balanced structure of property complexes for them to be loaded proportionally;
- to implement integrated approaches to improving the management of non-core property complexes, non-core immovable property and share capital of JSC “SSC RIAR” and its subsidiaries and dependent companies.

As of December 31, 2014, JSC “SSC RIAR” owned 105 land lots with a total area of 3156.02 ha, of which:

- 89 land lots with a total area of 242.54 ha belong to JSC “SSC RIAR” on the basis of the right of ownership;
- 16 land lots with a total area of 2913.19 ha were used by JSC “SSC RIAR” on a leasehold basis and on a permanent termless basis.

During 2014, JSC “SSC RIAR” purchased nine land lots. Six land lots resulted from division of earlier accounted land lots.

As of December 31, 2014, JSC “SSC RIAR” owned 1254 objects of immovable property under the property right, of which the right of ownership was registered for 1225 objects; for the other 29 objects, the documents were under preparation for the State cadastral registration and registration of the right of ownership.

3

ANNUAL RESULTS

Achievements are possible in any industry,
at any enterprise, if economics
and its laws are put at the top of priorities

Elena V. GALANT,
Head of the Department
for Budget Management, Prices and Costs
in 2014 awarded a lapel pin
“For Merit to the Atomic Industry”, II degree

IGOR A. KNYAZKIN

Deputy Director for Economics and Finance

In 2014, RIAR Finance and Economics Services put great emphasis on automating the business processes, reducing the time required to prepare contracting documents, developing and implementing the measures to decrease financial risks, and creating a system to monitor key performance indicators and investment projects.

The year 2014 was marked by the RIAR's participation in the corporate projects to create the ROSATOM State Corporation integrated information system. A large-scale implementation of the 1C-based ERP system took place in the second half of the year. The system was tested, the key users were trained, and, as a result, an Order was signed to put the system into operation from 1 January 2015. This event required significant efforts, time and knowledge on the part of the RIAR Finance and Economics Department, manufacturing groups and Personnel Services. The successful implementation of the project resulted in transferring the accounting and tax functions to the common service center in the framework of the Program of Finance and Economics Services and Information Technologies Transformation.

The key performance indicators in the area of the Finance and Economics staff responsibility were achieved at the target and low level. The implementation of all measures to control the achievement of the key performance indicators as well as a well-developed risk management system contributed to this process.

The dynamics of the financial performance indicators reflects a general industrial trend that aims at developing new markets, producing new types of products for the nuclear industry, and updating the infrastructure facilities and scientific expertise.

3.1. RESULTS OF THE FINANCIAL AND ECONOMIC ACTIVITIES

The key financial and economic indicators characterizing RIAR financial standing as well as efficiency and effectiveness are presented in Tables 3.1 and 3.2.

Table 3.1

Key economic performances, million rubles

Performance indicator by years	In reality			Prognosis	Ratio, %	
	2012	2013	2014	2015	2014–2013 / 2013	2015–2014 / 2014
Revenue from sales of goods, products, works, services	4 458.8	5 882.9	3 700.9	3 995.0	–37.1	7.9
Cost of sold goods, products, works, services	4 433.1	5 617.7	3 862.2	3 921.5	–31.2	1.5
Gross proceeds (loss)	25.7	265.2	–161.3	73.5	–160.8	145.6
Administrative and selling costs	551.1	768.0	811.0	913.3	5.6	12.6
Sales profit (loss)	–525.4	–502.7	–972.2	–839.8	–93.4	13.6
EBITDA	–230.0	–48.8	–877.2	–431.0	–1 697.5	50.9
Net Operating Profit After Taxes (NOPAT)	–336.2	–175.7	–825.9	–691.7	–370.1	16.2
Net profit (loss)	–411.2	–190.1	–980.4	–983.5	–415.7	–0.3

As compared to 2012 and 2013, the decrease in revenue in 2014 is 758 and 2182 million rubles accordingly. The key factors affected the decrease are as follows:

- Decreased federal budget funding for the Target Programs “Nuclear Power Technologies of New Generation for 2010–2015 and until 2020” and “Ensuring Nuclear and Radiation Safety for 2008 and until 2015” (by 693 million rubles as compared to 2012 and by 924 million rubles as compared to 2013);
- Decreased amount of energy services rendered to third parties because the RIAR Production and Energy Unit was withdrawn from the RIAR structure to establish a subsidiary company “RIAR-Generation” (by 340 million rubles as compared to 2012 and 160 million rubles as compared to 2013);
- Non-confirmed Work Order to manufacture FAs for the BN-800 reactor because the work was in progress to evaluate their condition in the BN-800 reactor core (by 270 million rubles as compared to 2012 and by 1207 million rubles as compared to 2013);
- Divestment of non-core assets: the vehicle fleet, the Protected Ground Unit and the Suburban Command Point (by 56 million rubles as compared to 2012 and by 51 million rubles as compared to 2013).

But, we can note an increase in revenue (by 600 million rubles as compared to 2012 and by 160 million rubles as compared to 2013) as a result of increased research and development, production and sales of isotope products.

Table 3.2

Economic and financial performances

Performance indicator by years	In reality			Prognosis	Ratio, %
	2012	2013	2014	2015	2014 – 2013 / 2013
Economic value generated (revenues from sales, as well as earnings from financial investments and sale of assets), million rubles	4 926.8	6 676.0	4 426.4	4242.0	–33.7
Direct economic value distributed, million rubles:	5 491.4	6 837.9	5 222.6	5015.5	–23.6
Operating costs	3 526.2	4 654.4	3 069.1	2864.3	–34.1
Remuneration and other compensations and allowances for employees	1 365.0	1 598.5	1 546.9	1520.1	–3.2
Payments to capital provides	117.0	33.8	91.9	100.0	171.9
Gross tax payments	403.0	472.7	449.0	489.3	–5.0
Investments to associations	80.1	78.6	65.7	41.8	–16.4
Economic value undistributed, million rubles	–564.6	–162.0	–796.2	–713.8	–391.5
Financial performances: Gross proceeds, million rubles	25.7	265.2	–161.3	73.5	–160.8
Revenue (amount of sold products (works, services), million rubles	4 458.8	5 882.9	3 700.9	3995.0	–37.1
Labour efficiency, thous. rubles/per person	928.1	1 335.1	928.6	1090.2	–30.4
Internal performance (added value), %	31.4	34.7	45.5	54.7	31.1

In 2014, the Company's revenue amounted to 3700.9 million rubles which was 580 million rubles greater as compared to the 2011 amount (Fig. 3.1).

Figure 3.1. Dynamics of the RIAR revenue from sales of services in 2011–2015 indicating the deviation of the 2015 indicator in relation to the 2011 figures, million rubles

Both positive (Fig. 3.2) and negative factors caused changes in this performance indicator. The increase in revenue can be explained by:

- Increased funding for research and development within the Federal Target Program “Nuclear Power Technologies of New Generation for 2010–2015 and until 2020” (258 million rubles, or 28 per cent);
- Increased production and sales of isotope products (294 million rubles, or 79 %), and commencement of sales of medical isotope ^{99}Mo (124 million rubles);
- Research and development contracts (397 million rubles);
- Other factors (53 million rubles).

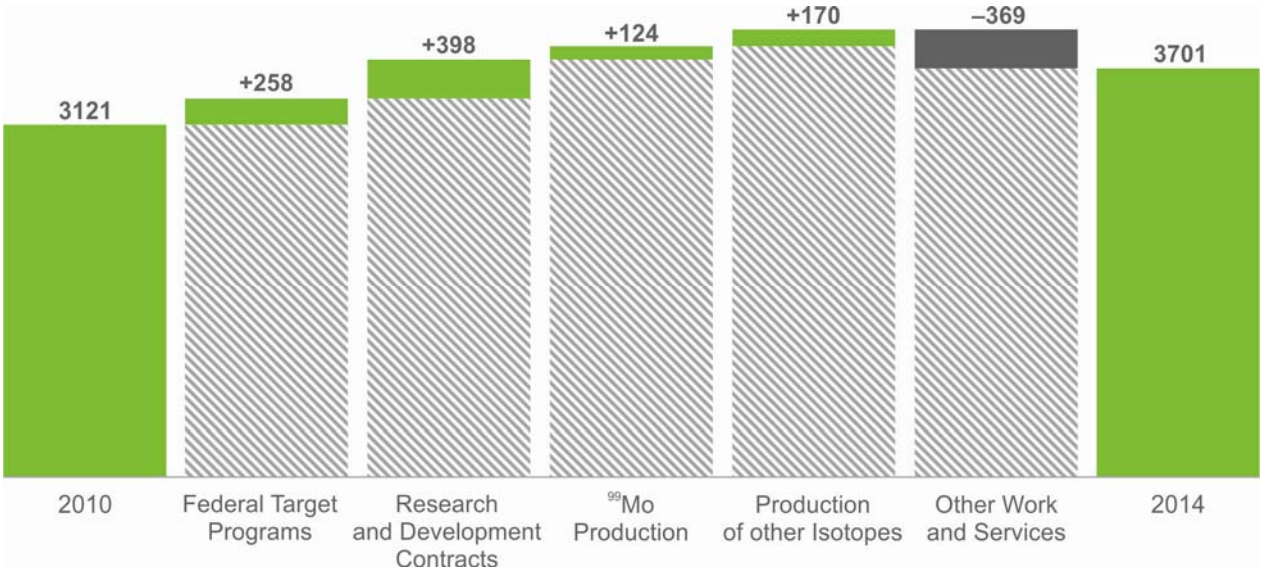


Figure 3.2. Factors of revenue growth in 2014 as compared to 2010, million rubles

As compared to 2010, 29 per cent of the revenue growth in 2014 is associated with the entry into the new market segments, and 71 per cent is provided by the development in the primary market.

The reduction of volume of services may be a negative factor which caused changes in the presented revenue. The reduction of services provided occurred due to the following events:

- Withdrawal of the Production and Energy Unit from the RIAR structure in the first quarter of 2013 to establish a subsidiary “RIAR –Generation” and to transfer responsibilities on producing energy services, that resulted in the decrease in revenue by 369 million rubles;
- Divestment of non-core assets: the vehicle fleet, the Protected Ground Unit and the Suburban Command Point, resulting in the decrease in revenue by 53 million rubles.

During the reporting and previous periods, JSC SSC RIAR did not receive subsidies and loans from the State Budget of the Russian Federation.

Table 3.3 presents the revenue distribution by geographical segments and main areas of the RIAR activities.

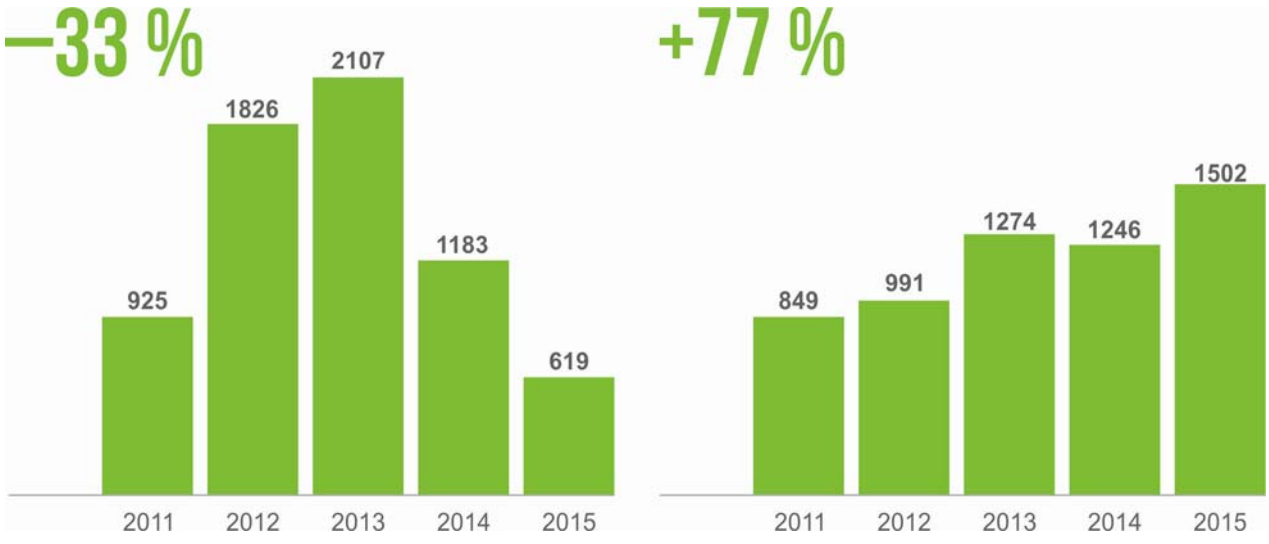
Table 3.3

Revenue distribution by geographical segments and main areas of RIAR activities, million rubles

Performance indicator	Values by years			
	2011	2012	2013	2014
Revenue (sold products, works, services)	3 121	4 459	5 883	3 701
Incl. internal volume	848	1 222	2 514	1 180
Distribution by geographical segments:				
Russian Federation	2 802	4 127	5 466	3 014
CIS	27	35	20	22
Non-CIS countries	292	296	397	665
Distribution by areas of activities:				
Production of FAs for the BN-800 reactor	0	270	1 207	0
Research and Development	1 774	2 867	3 381	2 429
Isotopes Production	372	364	479	666
Energy Services	829	799	620	460
Other services	146	159	197	146

The geographical segment of the sold products shows a sustainable growth on the part of foreign customers. The decline in sales in the territory of the Russian Federation resulted from a decrease in funding under the Federal Target Program "Nuclear Power Technologies of New Generation for 2010–2015 and until 2020" and completion of deliveries of fuel assemblies to the "Rosenergoatom Concern" JSC to ensure the initial loading of the BN-800 reactor.

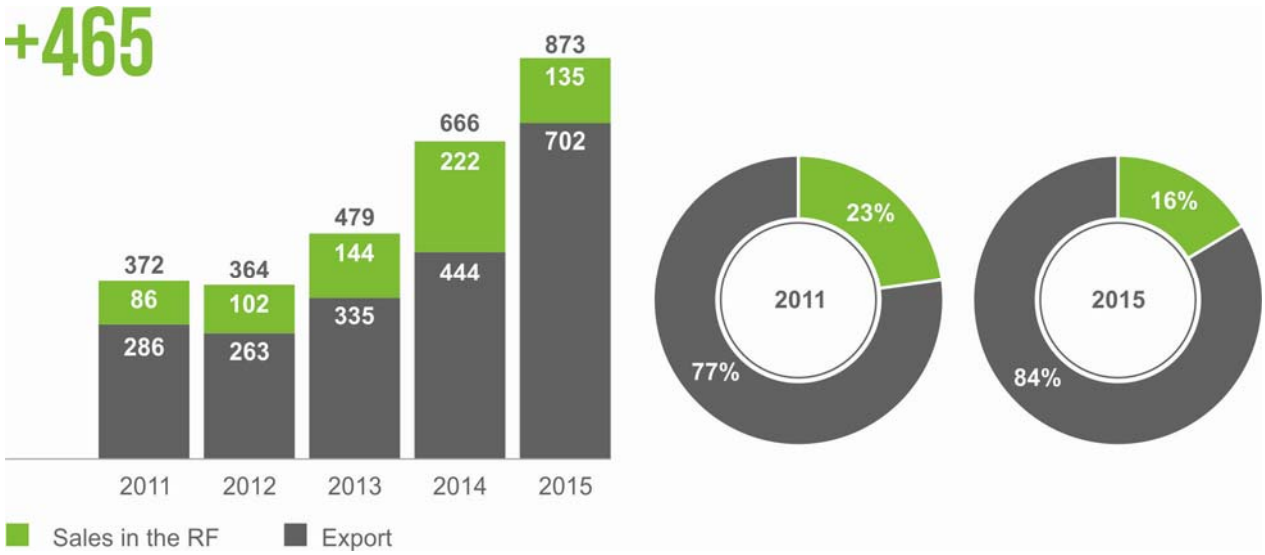
As in previous years, the bulk of the Company's revenue in 2014 came from research and development (Fig. 3.3) and made up 65.6 per cent from the total revenue.



a b

Figure 3.3. Dynamics of the revenue from research and development under the Federal Target Programs (a) and contracts (b) in 2011–2015 in million rubles indicating the deviation of the 2015 performance indicator in relation to the 2011 figures

18 per cent from the total revenue came from production of radionuclide products (FIg. 3.4), 16.37 per cent came from rendering energy and other services.



a b

Figure 3.4. Dynamics of the revenue from sales of isotope products in 2011–2015 indicating the deviation of the 2015 performance indicator in relation to the 2011 figures in million rubles (a) and the revenue distribution by geographical segments (b)

The scope of research and development performed within the Federal Target Programs resulted from the funding under the Program “Nuclear Power Technologies of New Generation for 2010–2015 and until 2020”. The largest amount of funding allocated to research and development activities was in 2013.

Between 2011 and 2014, the revenue from sales of the research and development under the contracts increased by 397 million rubles (47 per cent), and the volume of the research and development exported increased by 7.7 times (by 208 million rubles) and amounted to 239 million rubles as compared to 31 million rubles in 2011.

In 2015, the revenue from sales of research and development under the contracts is expected to be increased up to 1502 million rubles (20 per cent as compared to the 2014 indicator).

Between 2011 and 2014, the production and sale of isotope products increased by 1.8 times (by 294 million rubles, including 124 million rubles with the starting production of ^{99}Mo medical isotope). In 2015, the production and sales of isotope products is expected to be increased up to 837 million rubles (by 26 per cent as compared to 2014).

In 2014, the share of work performed with the assistance of contractors was about 26 per cent of the RIAR’s total revenue (Fig. 3.5).

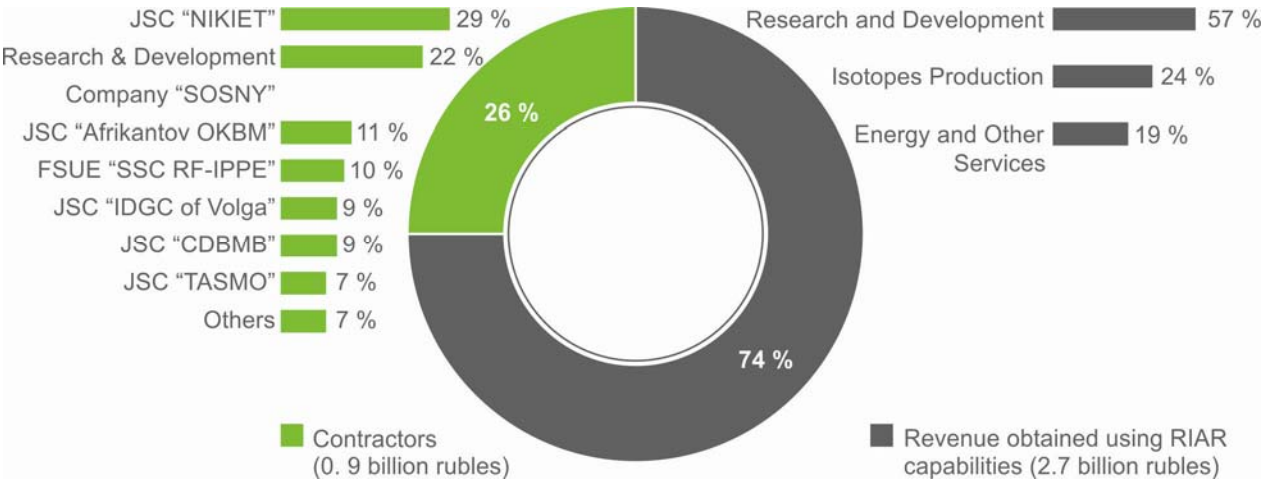
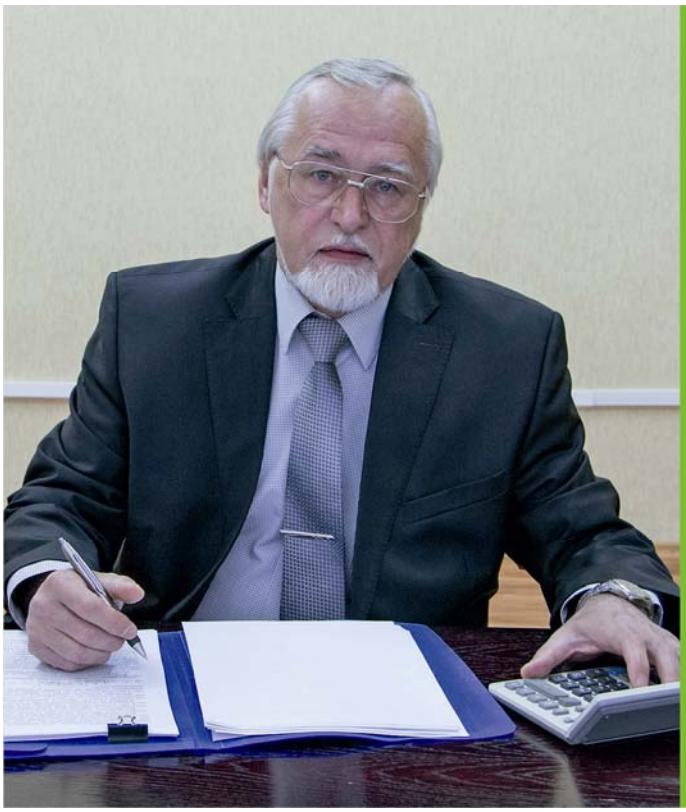


Figure 3.5. Structure of the 2014 revenue and percentage of the key co-contractors

In view of the changes resulted from both the economic processes in the country and adjustments of the development programs, RIAR shows a sustainable growth in sales of isotope products and an increase in orders for research and development from Russian and foreign customers in a medium-term perspective.



VLADIMIR V. KALYGIN

**Deputy Director
for Science and Innovations,
Doctor of Engineering,
Professor**

In 2014, many RIAR employees aimed their efforts at solving problems specified in the *Program for RIAR Innovative Development until 2020*. First of all, the work included implementation of the Federal Target Program “Nuclear Power Technologies of New Generation for 2010–2015 and until 2020”, enhancement of the RIAR experimental expertise and provision of safety and efficiency.

Completion of the work to justify the BOR-60 reactor service life extension and obtaining the license for its further operation till 2020 are the most significant results of the RIAR activities. In the reporting period, the State Expert Review of the MBIR design documentation was completed and a license was obtained to construct the MBIR reactor on RIAR site. A great deal of research, design and engineering work was done to justify the establishment of the polyfunctional research radiochemical complex, a license was obtained permitting its construction and the construction work started.

We cannot ignore the completion of work to update the MIR PG-1 gas-cooled loop facility. The work resulted in a timely testing of the experimental fuel assembly under the program to develop a space-purpose reactor system. One more significant work performed by the RIAR specialists was a long-term study of the high-burnup VVER fuel. The study was completed in 2014 and proved the fuel to be still operable.

I mentioned the most significant outcomes of the RIAR activities. Totally, in 2014, the work was completed under sixty two agreements and nine state contracts.

3.2. INNOVATIVE ACTIVITIES

INNOVATIVE DEVELOPMENT PROGRAM

In December 2013, The Program of RIAR Innovative Development until 2020 was developed and approved. The Program aims at solving the strategic goals assigned by the ROSATOM State Corporation and identifies projects focused on the strategic industry development priorities specified in the Federal Target Program “Nuclear Power Technologies of New Generation for 2015–2020 and until 2020”.

These projects aim at establishing in RIAR experimental research facilities of new generation to ensure the development of new NPP-oriented nuclear power energy technologies based on a closed nuclear fuel cycle with fast rectors. These new technologies are expected to meet the Russia’s energy needs and improve the efficiency of the use of natural uranium and spent nuclear fuel; they are oriented toward building scientific and technical capacity in RIAR to establish an International Innovative Science and Technology Center to implement the following projects:

- Technical retrofitting of the 60 MW test fast reactor;
- Construction of a multi-purpose fast research reactor;
- Construction of the Polyfunctional Research Radiochemical Complex;
- Comprehensive technical upgrade of reactor radionuclides production facilities to develop nuclear medicine and radiation technology;
- Development of a technique to produce Mo-99 radionuclide using low-enriched uranium;
- Providing safety and operational efficiency of the RIAR research reactors.

CONSTRUCTION OF THE MUPTI-PURPOSE FAST RESEARCH REACTOR (MBIR)

Under the Federal Target Program “Nuclear Power Technologies of New Generation for 2010–2015 and until 2020”, a project is being implemented to construct a nuclear research facility – multi-purpose fast research reactor (MBIR). The project is considered to be a part of the national concept to create a new technological platform for the nuclear engineering using fast reactors and closed nuclear fuel cycle.
The MBIR reactor experimental capabilities (Fig. 3.6) will allow the experimental research to be provided under the programs to develop Russia’s nuclear industry.
The research work will be also performed for foreign customers.

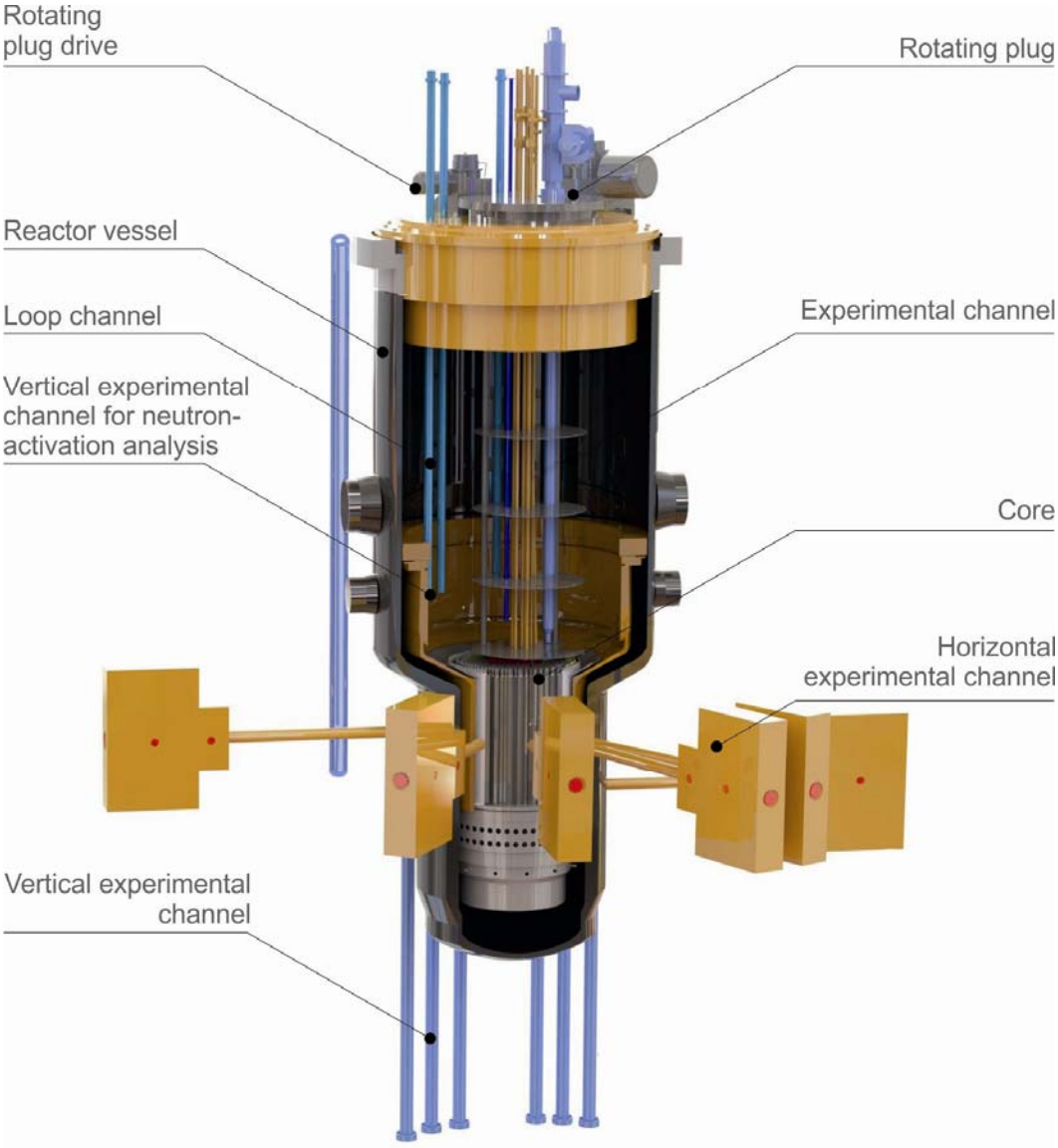
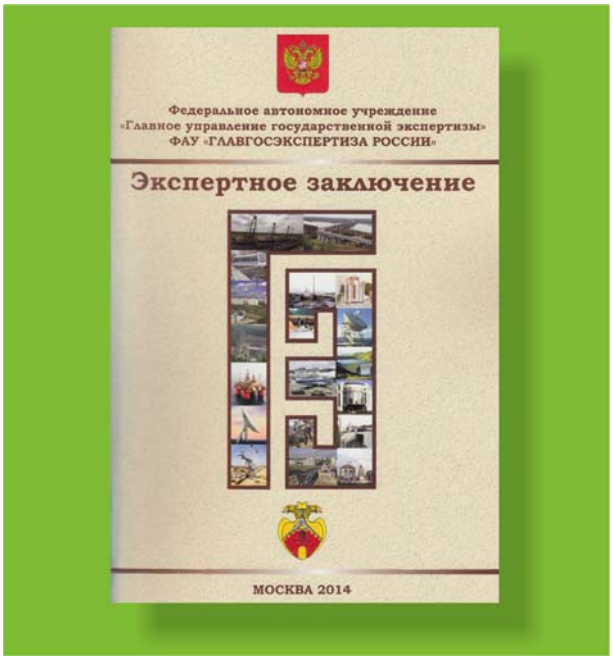


Figure 3.6. MBIR reactor general layout

MBIR-related key events in the year 2014



March

The State Expert Review of the design documentation "Construction of the Multipurpose Fast Research Reactor (MBIR)" was completed.

Positive decisions were made by the Federal Autonomous Organization "Directorate General of the State Expert Review" for the design documentation, results of the engineering research and estimated budget.


МИНИСТЕРСТВО СТРОИТЕЛЬСТВА И ЖИЛИЩНО-КОММУНАЛЬНОГО ХОЗЯЙСТВА РОССИЙСКОЙ ФЕДЕРАЦИИ (МИНСТРОЙ РОССИИ)

ФЕДЕРАЛЬНОЕ АВТОНОМНОЕ УЧРЕЖДЕНИЕ «ГЛАВНОЕ УПРАВЛЕНИЕ ГОСУДАРСТВЕННОЙ ЭКСПЕРТИЗЫ» (ФАУ «ГЛАВГОСЭКСПЕРТИЗА РОССИИ»)

УТВЕРЖДАЮ

ПОЛОЖИТЕЛЬНОЕ ЗАКЛЮЧЕНИЕ ГОСУДАРСТВЕННОЙ ЭКСПЕРТИЗЫ № 265 -14/ГГЭ-9014/02

(№ в Реестре 00-1-4- 0958 -14)

Объект капитального строительства

Строительство многоцелевого исследовательского реактора на быстрых нейтронах МБИР, открытое акционерное общество «Государственный научный центр - Научно-исследовательский институт атомных реакторов», г. Димитровград, Ульяновская область (Российская Федерация 433510, Ульяновская область, город Димитровград-10)

Объект государственной экспертизы

проектная документация и результаты инженерных изысканий «Строительство многоцелевого исследовательского реактора на быстрых нейтронах МБИР, открытое акционерное общество «Государственный научный центр - Научно-исследовательский институт атомных реакторов», г. Димитровград, Ульяновская область»

Проектная документация и результаты инженерных изысканий


МИНИСТЕРСТВО СТРОИТЕЛЬСТВА И ЖИЛИЩНО-КОММУНАЛЬНОГО ХОЗЯЙСТВА РОССИЙСКОЙ ФЕДЕРАЦИИ (МИНСТРОЙ РОССИИ)

ФЕДЕРАЛЬНОЕ АВТОНОМНОЕ УЧРЕЖДЕНИЕ «ГЛАВНОЕ УПРАВЛЕНИЕ ГОСУДАРСТВЕННОЙ ЭКСПЕРТИЗЫ» (ФАУ «ГЛАВГОСЭКСПЕРТИЗА РОССИИ»)

УТВЕРЖДАЮ

« 28 » марта 2014 г.

ПОЛОЖИТЕЛЬНОЕ ЗАКЛЮЧЕНИЕ № 384 -14/ГГЭ-9014/10

(№ в Реестре 00-1-6- 0583 -14)

Проверка достоверности определения сметной стоимости объекта капитального строительства по проектной документации «Строительство многоцелевого исследовательского реактора на быстрых нейтронах МБИР, открытое акционерное общество «Государственный научный центр – Научно-исследовательский институт атомных реакторов», г. Димитровград, Ульяновская область»

(Российская Федерация, 433510, Ульяновская область, город Димитровград-10)

ФЕДЕРАЛЬНАЯ СЛУЖБА
ПО ЭКОЛОГИЧЕСКОМУ, ТЕХНОЛОГИЧЕСКОМУ И АТОМНОМУ НАДЗОРУ

ЛИЦЕНЗИЯ

Регистрационный номер ГН-01-108-2910 от 25 июля 2014 г.

Лицензия выдана открытому акционерному обществу «Государственный научный центр — Научно-исследовательский институт атомных реакторов» (ОАО «ГНЦ НИИАР»).

Местонахождение лицензиата: Ульяновская обл., г. Димитровград-10.

Основной государственный регистрационный номер юридического лица (ОГРН) 1087302001797

Идентификационный номер налогоплательщика 7302040242

Лицензия дает право на размещение ядерной установки.

Объект, в отношении которого проводится заявленная деятельность: многоцелевой исследовательский ядерный реактор на быстрых нейтронах МБИР.

Основание для выдачи лицензии: заявление ОАО «ГНЦ НИИАР» от 22.07.2013 № 88-05/789, решение Федеральной службы по экологическому, технологическому и атомному надзору от 18.07.2014 № 2910.

Срок действия лицензии до 25 июля 2019 г.

Лицензия действует при соблюдении условий действия лицензии, являющихся ее неотъемлемой частью.

Руководитель органа лицензирования А.В. Алёшин

Серия А В № 358525

May
The ROSATOM's permission was obtained to construct the multi-purpose fast research reactor (MBIR).

July
A license for the right to place the multi-purpose fast research reactor (MBIR) was obtained from the Federal Service on Environmental, Technological and Nuclear Oversight.

The above-mentioned key documents being obtained, the construction and installation work could be started as a preparatory stage of the MBIR construction. The invitation to tender was issued and the following contractors were chosen to perform the construction and installation work:

- The principal contractor is "Management Company Uralenergostroy" (Limited Liability Company). They will perform the construction and installation work in the preparatory phase of the construction);
- The contractor is JSC "Eleron". They will perform construction and installation work under Phase 1 and install the physical protection system.

JSC "Engineering Company AEM-Technology" won the tender to select a Manufacture of the MBIR reactor vessel and in-vessel internals.

Research and Development

During the implementation of the MBIR construction in 2014, a great scope of work was carried out and, specifically, a State Contract was concluded and completed.

Two experimental fuel assemblies containing dummies of the MBIR fuel rods were manufactured. In-pile tests were initiated in the BOR-60 reactor to validate the fuel serviceability. Dummies of the MBIR absorber rods were tested in the reactor to validate the manufacturing procedure of boron carbide pellets and absorbers of the MBIR control rods and to determine their design service life under the nominal conditions.

The MBIR core calculations with various types of fuel showed that the neutron flux density not less than $5 \cdot 10^{15}$ $cm^{-2} \cdot s^{-1}$ (the condition specified in the Statement of Work) can be provided only if the uranium-plutonium fuel is used: mixed oxide (MOX-fuel) and metallic fuel (UPuZr).

Calculations were performed to analyze the possibility of critical masses formation in case of hypothetical core disruptive accidents at the MBIR reactor. In the event of an accident with an unprotected loss-of-flow (ULOF), the reactor remains subcritical and its total reactivity is negative.

The results of the neutron-physical calculations of the standard fuel loading/unloading, unirradiated and spent nuclear fuel storage showed that the nuclear safety would be provided both in normal operation and in case of emergency.

The following engineering documentation was updated and issued: Technical Designs of the Reactor, Reactor Components and Equipment, an Interim Safety Justification Report, Statement of Work, the MBIR Core Technical Design (Fig. 3.7).

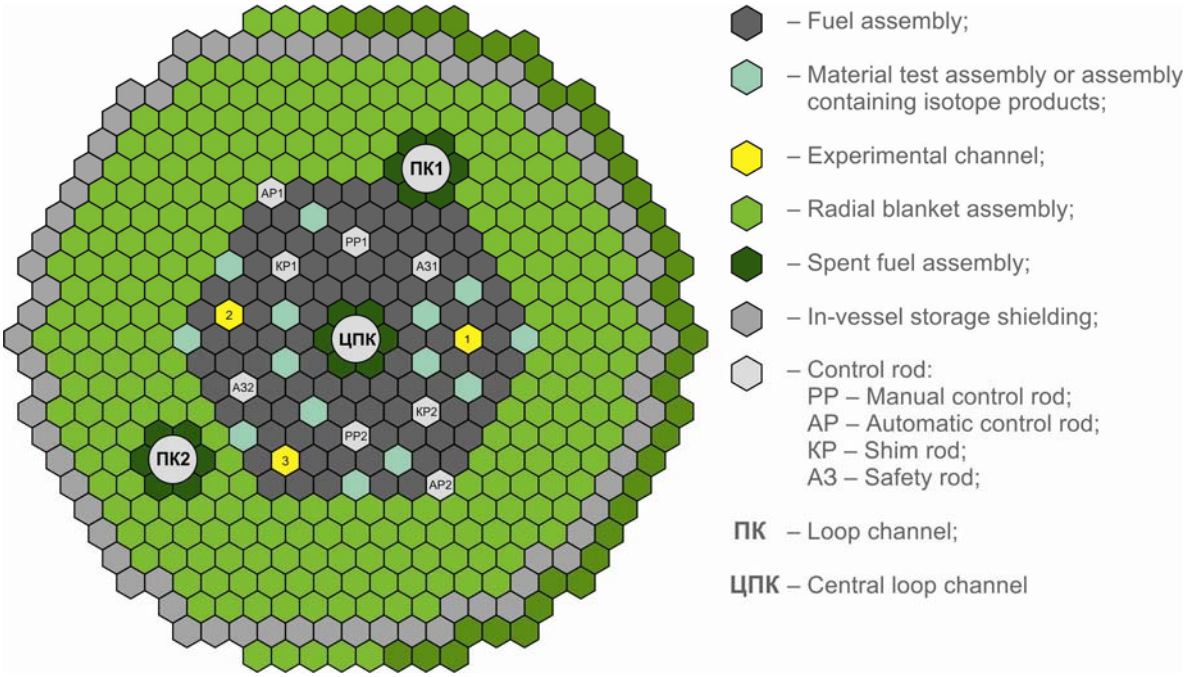


Figure 3.7. Configuration of the MBIR core

The MBIR core configuration was developed for campaigns with or without the use of experimental devices. Maximum neutron flux density was calculated:

– In the core and radial blanket ($5.3 \cdot 10^{15}$ $cm^{-2} \cdot s^{-1}$);

– In the central loop channel location ($4.9 \cdot 10^{15}$ $cm^{-2} \cdot s^{-1}$);

– at the level of the core mid-plane in loop channels РК1 (ПК1) ($2.1 \cdot 10^{15}$ $cm^{-2} \cdot s^{-1}$) and РК2 (ПК2) ($1.3 \cdot 10^{15}$ $cm^{-2} \cdot s^{-1}$);

– in the core cells intended for an experimental channel, a material test assembly or an assembly containing radionuclides (from $2.4 \cdot 10^{15}$ $cm^{-2} \cdot s^{-1}$ to $4.7 \cdot 10^{15}$ $cm^{-2} \cdot s^{-1}$).

The results of the intellectual activity under the State Contract are as follows: five applications for the utility model, six applications for an invention, three applications for the trade secrets (know-how) and fourteen R&D publications.

Work performed to obtain the license

In April 2014, in order to license the activities on the use of atomic energy, RIAR held public hearings on the assessment materials of the environmental impact resulted from the MBIR reactor construction.

Representatives of different public institutions, the population of Dimitrovgrad and Ulyanovsk region as well as other stakeholders attended the event (Fig. 3.8).

Figure 3.8. Public hearings to assess the environmental impact of the MBIR construction

МИНИСТЕРСТВО ПРИРОДНЫХ РЕСУРСОВ И ЭКОЛОГИИ РОССИЙСКОЙ ФЕДЕРАЦИИ

ФЕДЕРАЛЬНАЯ СЛУЖБА ПО НАДЗОРУ В СФЕРЕ ПРИРОДОПОЛЬЗОВАНИЯ

ПРИКАЗ

11.09.2014 г. МОСКВА № 559

Об утверждении заключения экспертной комиссии государственной экологической экспертизы материалов обоснования лицензии на осуществление деятельности в области использования атомной энергии «Сооружение исследовательской ядерной установки Многоцелевой исследовательский реактор на быстрых нейтронах МБИР (ИЯУ МБИР)»

В соответствии с Федеральным законом от 23.11.1995 № 174-ФЗ «Об экологической экспертизе» п р и к а з ы в а ю:

1. Утвердить прилагаемое заключение экспертной комиссии государственной экологической экспертизы материалов обоснования лицензии на осуществление деятельности в области использования атомной энергии «Сооружение исследовательской ядерной установки Многоцелевой исследовательский реактор на быстрых нейтронах МБИР (ИЯУ МБИР)», образованной приказом Росприроднадзора от 24.07.2014 № 460.

2. Установить срок действия заключения, указанного в пункте 1 настоящего приказа, пять лет.

Руководитель В.В.Кириллов

In September 2014, the materials justifying the license for the MBIR construction underwent the State Environmental Expert Review and a positive decision of the Federal Service for the Oversight of Natural Resources was obtained (Fig. 3.9).

A set of documents justifying safety during the MBIR construction was prepared. In July 2014, an application was submitted to the Federal Service for Environmental, Technological and Nuclear Oversight (Rostekhnadzor) to carry out the licensing procedure.

The application being considered, Rostekhnadzor decided to accept the documents submitted to receive the license for the right to construct the MBIR reactor for further consideration.

Figure 3.9. Order to approve the State Environmental Expert Review Commission conclusion

On October 20–25, 2014, the Federal Service for Environmental, Technological and Nuclear Oversight represented by the Commission of the Volga Interregional Territorial Directorate for Surveillance on Nuclear and Radiation Safety carried out a targeted inspection.

The Commission's conclusions are as follows: JSC "SSC RIAR" is ready to perform the activities to construct the nuclear research facility MBIR; the data submitted to obtain the license for the construction are true and in compliance with the real situation at the site.

Construction and installation activities

As part of the construction and installation activities in the preparatory phase, the following work was done: the topsoil was cut, leveling operations were finalized, and communication paths covered by the construction site were removed.

The work still continues to arrange the temporary power supply of the construction site, to build temporary roads and a construction camp. The construction and installation activities of the physical protection system (Phase 1) are in progress, too (Fig. 3.10).

Figure 3.10. Preparatory phase: construction and installation work

CONSTRUCTION OF THE POLYFUNCTIONAL RESEARCH RADIOCHEMICAL COMPLEX

While executing the State Contract "Research and Development to Justify the Technology and Design Concepts for Establishing the Polyfunctional Research Radiochemical Complex. The 2013–2015 Phases", major efforts were aimed at seeking solutions to technical issues and developing the design documentation: new components of the measuring tools were designed to be used during the hydrometallurgical processing of newly unloaded irradiated fuel under the conditions of entirely remote operation, including mounting, maintenance and repair; we also continued developing protective, lifting, transport and processing equipment for the Polyfunctional Research

Radiochemical Complex as well as processes and facilities to be used in radioactive waste management, conditioning and immobilization system.

In the reporting period, the electric schematic diagrams and design documentation were developed for the hydrostatic level indicator, reserve dosing mechanism and system for radioactive solutions automatic sampling with the use of a capillary impulse line; the software is included. Manufactured equipment prototypes were tested using a special-purpose facility and were recommended for use (Fig. 3.11).

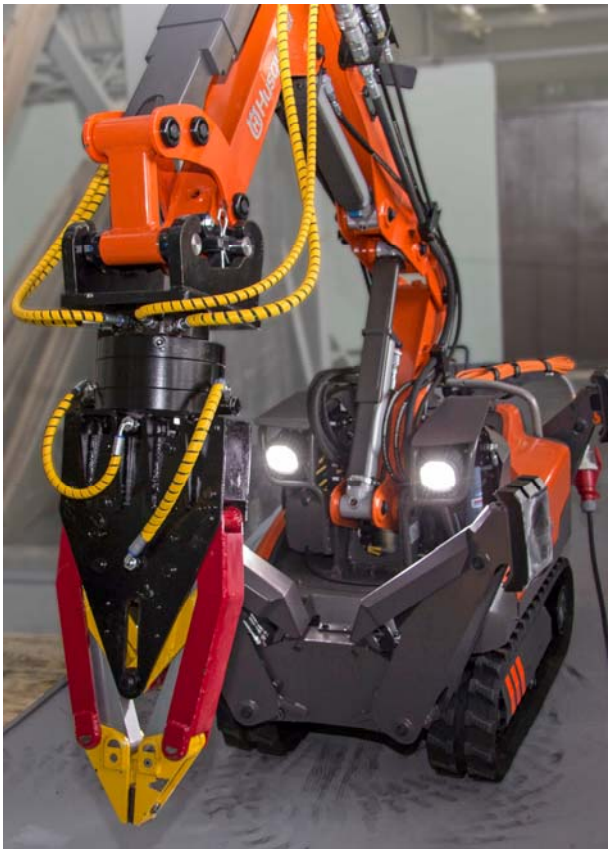


Figure 3.11. Electro hydraulic machine to perform work in the shielded box with no man present

We are not going to wait for the construction completion to test the developed instrumentation. In 2015, these components will be used in experiments in the shielded boxes existing in RIAR.

In 2014, RIAR performed work to study kinetics of the neptunium recovery in nitric acid solutions and developed the technique “Neptunium-237. The determination of concentrations in the solutions obtained after opening the spent nuclear fuel samples”. The technique passed the metrological certification in the RIAR Metrology and Measurement Instrumentation Department. The neptunium-237 isotope has a long half-life and high rate of migration in the earth shell. So, its disposal is inadmissible. The plan is to bring neptunium-237 back to fast reactors and burn it out. The new technique will allow the accuracy of the ^{237}Np account in the processed products to be improved.

In the reporting year, the work was carried out to develop the radiation protective equipment for the Polyfunctional Research Radiochemical Complex. For example, cases and equipment were developed to connect the engineering and support systems of the head cells with inert atmosphere. These are large-size cells designed to demonstrate processes to handle the full-sized fuel assemblies and fast reactor components. The technical solutions found made it possible to opt out both a factory production and further complicate transport of one-piece sealed cases of the cells and to start their assembling directly on the construction site. At present, there are no technical solutions like the developed ones.

Great attention was given to the safe handling of subjects of research: spent nuclear fuel, reprocessed half-finished products, ready-made actinide powder, samplings.

Elements of the optimized transport technological system were developed: containers, gateway devices, fuel handling cells, a pneumatic rabbit system, equipment for the spent nuclear fuel and radioactive waste storage cells.

The work was carried out to develop standardized production modules. The first prototype models are expected to be manufactured in 2015 and tested before their mass production.

Some of the equipment meant for the Polyfunctional Research Radiochemical Complex was put into operation by this time (sealed safety doors, multi-ton dampers of the hot cells, openings to connect the standardized production modules). Another part of the equipment has just been manufactured (a set of tanks to collect and store non-process liquid radioactive waste and a system of basement radioactive drains). This bulky equipment is installed during the construction phase and should not slow down the rate of construction.

In view of the current situation in the world, we can no longer rely on the deliveries of the high-tech manipulator equipment from the Western Europe countries and have to start our own R&D cycle.

At present, we developed preliminary designs of the following equipment: ceiling crane manipulators for hot cells with inert and air atmosphere, intermediate tanks canyon, and standardized production modules. A complete cycle of investigations to be performed in 2015–2016 will result in the manufacturing a prototype model of the Russian power manipulator surpassing the similar imported goods. (Fig. 3.12).

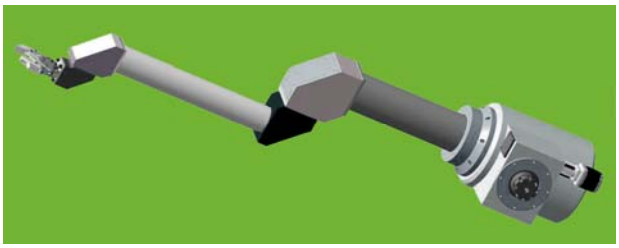


Figure 3.12. Design of the robotized arm of the Russian remote controllable electric-driven manipulator

The development work was continued to optimize and improve technologies to manage liquid radioactive waste, processes to decontaminate equipment of various origin, systems to handle intermediate materials of hydrometallurgical processing. The work was done to develop proposals for the use of neutron monitoring gages under conditions of tanks canyon in the Polyfuctional Research Radiation Complex and engineering solutions to place gamma monitoring gages.

The implementation of the State Contract "Research and Development to Justify the Technology and Design Concepts for Establishing the Polyfunctional Research Radiochemical Complex. The 2013–2015 Phases" is on schedule and a full set of engineering solutions to construct the Polyfunctional Research Radiochemical Complex will be ready by December 2015.

TECHNICAL RE-EQUIPMENT OF THE 60 MW TEST FAST NEUTRON REACTOR

The 60 MW test fast neutron reactor BOR-60 is a unique multipurpose facility to test structural, fuel and absorber materials used and supposed to be used in nuclear reactors of various types, including fusion reactors. In addition, specific equipment units of fast reactor primary and secondary circuits are tested.

Performed tests of reactor materials cover almost all existing and developed types of reactors from fast (BN-800, BN-1200, BREST, SVBR, MBIR) and thermal (VVER-TOI, VVER-1500, GT-MGR, VTGR) to fusion (ITER) and special-purpose ones.

The BOR-60 operating period is more than 40 years and its technical upgrading is required.

For this purpose, provisions are made to invest 555.9 million rubles under the Federal Target Program "Nuclear Power Technologies of New Generation for 2010–2015 and until 2020"within the action line "Creation of New Experimental Facilities and Special-Purpose Equipment. Modernization and Development of the Bench Fleet to Justify Physical Principles and Design Concepts and to Analyze and Justify Safety of the Key Science and Technology Solutions of the Innovative Nuclear Energy".

Through the same Federal Target Program and under the project "Technical Re-equipment of the 60 MW Test Fast Neutron Reactor", technical re-equipment and examination of the BOR-60 reactor is planned to extend its lifetime.

The implementation of these actions will allow the BOR-60 safety to be improved and experimental capabilities to be upgraded in order

to provide an experience-based justification of Gen IV reactors key parameters, safety and fuel cycle.

Toward this goal, the following research and development was performed in 2014:

1. Stress calculations for the de-aerator, five-point heat exchanger, air exchanger buffer, sodium outlet sleeves of the steam generator buffers; vent buffers, high-pressure heater, specific components of the reactor facility design;
2. Surveillance tests of the equipment components spent in the reactor and special-purpose samples irradiated on a long term basis to evaluate conditions of the materials of the reactor facility components;
3. Comprehensive examination of the reactor facility to extend its service life; an appropriate report was issued;
4. Expert review of the data on comprehensive engineering review of the reactor facility;
5. Work to extend the BOR-60 reactor service life.

COMPREHENSIVE UPGRADING AND DEVELOPMENT OF THE PRODUCTION OF RADIONUCLIDES IN NUCLEAR REACTORS TO ENSURE PROGRESS IN NUCLEAR MEDICINE AND RADIATION TECHNOLOGIES

The project aims at upgrading the RIAR's production of ^{60}Co, ^{131}I, ^{89}Sr, ^{90}Y, ^{252}Cf isotopes, other trans-plutonium elements and establishing a new line of radionuclide products: ^{177}Lu, generators based on ^{223}Ra, ^{224}Ra, ^{228}Th, ^{227}Ac and ^{225}Ac.

During the implementation of the Project, we should develop and update engineering processes to manufacture radionuclide products, namely

- ^{89}Sr radionuclide by manufacturing targets from enriched ^{88}Sr, irradiating the targets in the reactor and reprocessing by radiochemical techniques;
- ^{177}Lu radionuclide by manufacturing the targets from enriched ^{176}Lu, irradiating the targets in the reactor and reprocessing by radiochemical techniques;
- ^{90}Y radionuclide produced via periodical ^{90}Y radiochemical extraction from ^{90}Sr and further purification from radioactive impurities;
- ^{228}Th and ^{227}Ac radionuclides by manufacturing ^{226}Ra-based targets, irradiating the targets in the reactor and reprocessing by radiochemical techniques to extract and purify ^{228}Th and ^{227}Ac;

- ^{223}Ra and ^{224}Ra radionuclides produced via radiochemical extraction from ^{228}Th and ^{227}Ac;
- ^{60}Co high-dose Ionizing radiation sources;
- ^{131}I preparation;
- Targets to generate californium and trans-plutonium elements.

To implement the engineering processes, the following working areas should be arranged and updated:

- Area to produce ^{60}Co ionizing radiation sources;
- Area to produce ^{131}I radiopharmaceuticals;
- Area to prepare targets to generate californium and trans-plutonium elements.

High-tech end products resulted from the project implementation will be:

- ^{60}Co gamma-ray sources for nuclear medicine;
- ^{131}I radionuclide(sodium iodide) for medical use;
- ^{252}Cf radionuclides and trans-plutonium elements – ^{243}Am, ^{244}Cm and ^{248}Cm isotopes;
- ^{177}Lu, ^{89}Sr, ^{90}Y radionuclides;
- Short-lived alfa-emitting radionuclides of ^{223}Ra, ^{224}Ra, ^{228}Th, ^{225}Ac, ^{227}Ac, ^{212}Bi and ^{213}Bi for medical use.

The intended use of the end products resulted from the project implementation is as follows:

- Medical radionuclides for radiation therapy, production of radiopharmaceuticals and tagged compounds for investigations;
- Radio isotopic products of general industrial application, including preparations and sealed alfa-, beta-, gamma- and neutron radiation sources;
- Isotopes for scientific research.

These products have a high export potential and will allow RIAR to expand its presence in the market of ^{60}Co, ^{131}I, ^{89}Sr, ^{90}Y, ^{252}Cf isotopes as well as in the market of other trans-plutonium elements and ^{177}Lu market and to develop new market sectors by expanding the assortment of the radionuclide products: generators based on ^{223}Ra, ^{224}Ra, ^{228}Th, ^{225}Ac, ^{227}Ac, ^{212}Bi and ^{213}Bi.

In 2014, a number of activities were implemented under the project.

Technical designs of technological tools, draft Statements of Work, Waste Certificates, analytical techniques were developed for engineering processes to produce ^{89}Sr, ^{177}Lu, ^{90}Y, ^{228}Th, ^{227}Ac, ^{223}Ra and ^{224}Ra.

Dummies of in-cell equipment (Fig. 3.13) were fabricated for engineering processes to produce ^{89}Sr and ^{177}Lu and performance verification tests were carried out.

As part of trial tests, pilot batches of activated ^{89}Sr obtained by irradiating initial ^{88}Sr in the SM neutron trap were delivered to the Customer.

As part of the work to update the engineering process of ^{131}I production, a reactor technique was developed to irradiate the initial tellurium oxide pellets. The elaboration of the technique included development of the designs of both a reusable standardized irradiation device and new target with increased capacity. The work was carried out to develop working design documentation, to fabricate two irradiation devices and seven targets to perform trial irradiation. Experiments were carried out in the RBT-10 and RBT-6 reactors to study the influence of tellurium oxide irradiation devices on reactor macro parameters and to obtain a pilot batch of ^{131}I preparation. The experiments showed that the newly designed irradiation devices and targets allow the ^{131}I production to be increased twice without increasing the number of cells used.

a **b**

Figure 3.13. Tools for ^{89}Sr crystallization (a) and dissolution (b)

In 2014, the working area to produce ^{131}I preparation was upgraded:

- New equipment was purchased to replace the obsolete and worn-out equipment (Fig. 3.14);
- New equipment was installed in the shielded boxes and tested;
- Start-up and adjustment work was carried out; the pilot batch of the ^{131}I preparation was obtained.

Figure 3.14. New equipment for the ^{131}I production area

Construction, installation and commissioning work was completed in the new working area to produce tellurium oxide targets. This production sector was put into pilot operation in December 2014 (Fig. 3.15). It is estimated that RIAR will fully adopt the new technique of ^{131}I production in the first half of 2015.

Figure 3.15. New area to produce tellurium oxide pellets

The work was continued to update the manufacturing procedure to prepare targets to accumulate californium and other trans-plutonium elements:

- Prototypes of the in-cell equipment were manufactured (Fig. 3.16). Acceptance testing, further development and installation work in the hot cells are supposed to be performed in the first half of 2015;
- Working design documentation was developed; a prototype of the container to transport targets accumulating trans-plutonium elements was manufactured;
- Spare parts were manufactured for the new design accumulating targets;
- Working design documentation was developed to upgrade RIAR hot cells, boxes and targets manufacturing procedure. Work was done to decontaminate and dismount the in-cell equipment.

a **b**

Figure 3.16. Thermal destruction facility (a) and targets welding facility (b) at the working area to produce targets accumulating trans-plutonium elements

DEVELOPMENT OF A TECHNIQUE TO PRODUCE ^{99}MO RADIONUCLIDE USING LOW-ENRICHED URANIUM

The project is aimed at solving the basic task that is to develop a ^{99}Mo production procedure. This radionuclide should be obtained by irradiating specific targets containing uranium enriched in ^{235}U lower than 20 % and reprocessing the targets by means of radiochemical techniques to extract and purify ^{99}Mo radionuclide. To solve this task, we need:

- to develop a new design of the target to accumulate ^{99}Mo;
- to perform a full cycle of calculations to justify the technique of ^{99}Mo accumulation during the rector irradiation;
- to update the existing reprocessing procedure of the irradiated targets reprocessing to ensure its applicability to the newly-designed targets of new composition and conformance of the product quality to the requirements specified.

Figure 3.17. Dummy equipment to separate ^{99}Mo

Here, we should take into account the following needs:

- to minimize losses of the process performance resulted from the use of the low-enriched uranium and to provide, if possible, the performance achieved with the highly-enriched uranium;
- to use the existing processing equipment; replacements should be avoidable or minimal.

The project aims at developing a ^{99}Mo production technique with the use of low-enriched uranium providing a minimal reduction in the existing production, the product quality being the same.

The project goal is to implement the Russia's international obligations in the area of the non-proliferation of nuclear weapons.

In 2014, a number of activities were performed under the project.

The dummy separation equipment (Fig. 3.17) was tested to work out conditions of the ^{99}Mo solution separation from impurities.

Computational analysis of the irradiation device strength (Fig. 3.18) was performed using a licensed multi-purpose software ANSYS (version 13.0).

The calculations resulted in a detailed distribution of the stresses and displacements in the device, the strength assessment was performed according to the ANSYS strength criteria and an area with the maximal stresses was determined. This area is a frame in the zone of joining the upper ring. The strength assessment was performed for this area and the results are given in Table 3.4.

We assessed the irradiation device strength depending on the axial load produced by the IR unloading device during loading/unloading operations in the reactor. We saw that the obtained stresses did not exceed the yield strength and ultimate tensile and compression strengths. The displacement values range within the limits allowable for the channel.

Figure 3.18. Irradiation device for ^{99}Mo reactor accumulation in a reactor

Table 3.4

Analysis of the irradiation device strength in the maximum stress area

Parameter	Value, MPa	
	calculated	allowable
Equivalent stress	26.4	100
Stress intensity	26.8	100
Compression stress	–26.6	59
Tensile stress	2.6	59
Share stress	13.4	100

Metallographic testing of the irradiated target mock-up was performed. The testing confirmed that the design documentation requirements to the cladding-kernel gap size are feasible if the proposed target manufacturing procedure (Fig. 3.19) is used.

Figure 3.19. Image of the cladding-kernel contact zone as a result of under pressure inside the product, including lengths of the gaps in the contact zone

Laboratory experiments and research with the use of the dummy dissolver were done to study influence of the target material composition on both dissolution in NaOH + $NaNO_3$ with the concentration 3 mol/L and 4 mol/L respectively, and properties of the produced sodium diuranate and precipitates formed by impurities. It turned out that the dissolution rate and heat effect of the aluminum alloy considerably depend on its composition. The highest dissolution rates and maximum heat effects are observed in AMr3 and АД31 alloys. The AMCH2 alloy has a lower dissolution rate, but heat effects of the dissolution are sufficient to control the temperature change process. The A99 alloy provides the lowest dissolution rate and the least heat effect. So, the use of the A99 alloy to produce the targets is less favorable than the use of the AMCH2 alloy.

The compatibility of the AMCH2 alloy with the technique developed was shown. This alloy being used, hardly-filterable precipitates are not produced and the heat rate during dissolution is enough to control the dissolution process by the change of the solution temperature in the apparatus.

Despite the high rate of dissolution in alkaline solutions, alloys AMr3 and АД31 are not compatible with the ^{99}Mo production technique since they produce hardly-filterable precipitates which are based on impurity elements, primarily magnesium. The spectrophotometrical technique showed the presence of uranium (IV) ions in precipitates. Perhaps, uranium (IV) in the precipitates is in the form of hydroxide $U(OH)_4$, that is inconsistent with the previous concepts of the form of uranium in the precipitates (filter-cake).

A cycle of research tests was performed to examine operations of the ^{99}Mo sorptive extraction from solutions. We also analyzed the influence of the solution flow rate though the sorption column on the amount of the extracted molybdenum (a “slip” – unabsorbed substance at the sorption phase) and ^{99}Mo distribution along the sorption column length. It was shown that the sorbent capacity before the slip depends on the rate of the solution flow through the column (Fig. 3.20) and should not exceed 1–1.5 ml/(cm^2·min).

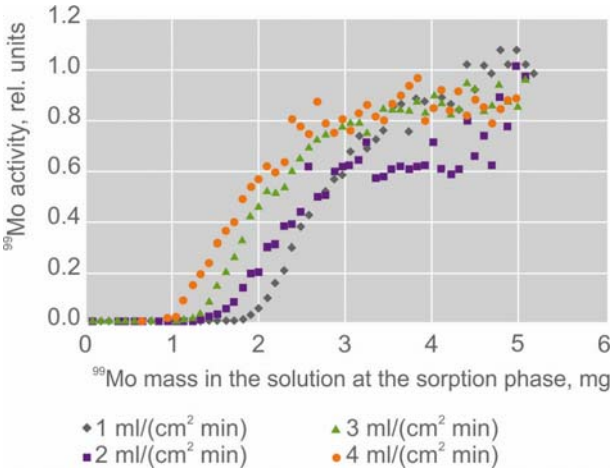


Figure 3.20. Sorbent capacity vs. various rates of the solution flow through the sorption column

We found out that if sorption occurred on aluminum oxide from solutions containing aluminum nitrate, the coefficient of ^{99}Mo distribution significantly depends on the nitric acid concentration (Fig. 3.21). At the sorption stage, the degree of acidity should not exceed 0.5 mol/L.

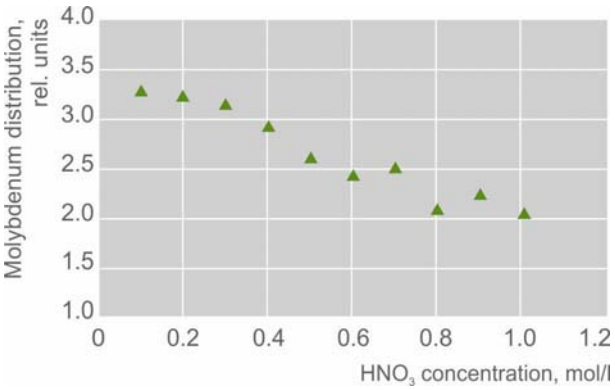
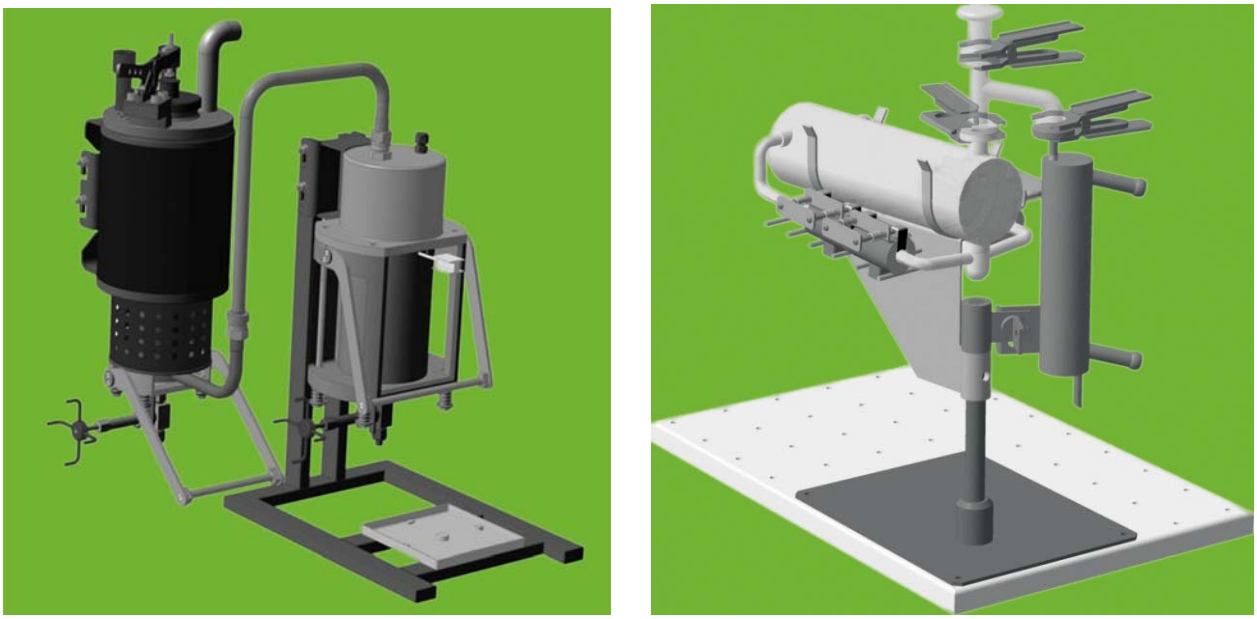


Figure 3.21. Molybdenum distribution coefficient vs. nitric acid concentration in sorbing from solutions containing aluminum nitrate

Experiments showed that the aluminum concentration in the solution does not have a significant influence on the molybdenum yield during its extraction from solutions containing up to 50 g/l of aluminum. At that, the yield is more than 80 per cent.

The ^{99}Mo distribution along the sorption column length was measured experimentally for the first time (Fig. 3.22) using a mock-up facility intended for the sorption extraction of ^{99}Mo from solutions.



a b

Figure 3.22. A dissolver (a) and a mock-up separation facility (b)

The data obtained prove a higher efficiency of the ^{99}Mo sorption from solutions with low acidity and allow us to make a conclusion that the sorption column dimensions can be reduced. So, it will be possible to shorten the time needed for this processing procedure and next processing procedures, such as separation and purification.

The work was done to develop draft designs of the equipment to perform the following operations:

- Dissolution of the irradiated targets and initial separation of ^{99}Mo from uranium;
- Sorption extraction of ^{99}Mo from the solution;
- Separation and purification.

Two options of the dissolver were proposed; both designs are compatible with the existing manufacturing equipment.

3.3. RESULTS OF THE KEY ACTIVITIES

NUCELAR REACTORS PHYSICS AND ENGINEERING, IRRADIATION TECHNOLOGY AND SAFETY OF NUCELAR REACTORS

RIAR Research Reactor Complex offers a wide range of services to off-site organizations, including foreign companies, and operates five nuclear reactors, of which key performances for 2014 are given in Table 3.5.

Table 3.5

Reactors performances in 2014

Performance indicator	SM	RBT-6	MIR	RBT-10/2	BOR-60
Maximum capacity, MW	90	6	38	10	53
Operation factor, rel. unit:					
scheduled	0.65	0.68	0.68	0.71	0.59
actual	0.67	0.68	0.70	0.71	0.61
Capacity factor, rel. unit:	0.87	0.96	0.24	0.88	0.83
Channels operation factor, rel.unit:					
scheduled	0.82	0.40	0.52	0.30	–
actual	0.82	0.40	0.52	0.30	–
Operating time, days:					
scheduled	235	248	247	258	216
actual	243	248	255	258	222
Number of shutdowns	27	45	18	49	7
Including unscheduled	1	–	–	1	1

In 2014, the main areas of work done at the RIAR's nuclear reactors were as follows:

- Capsule and loop tests of dummy fuel and absorbing elements, neutron sources and other core components of nuclear reactors having different coolants under the stationary, transient and design-basis accident conditions;
- In-reactor examination of the effect of the neutron flux and reactor emission on the properties of structural, absorbing and fuel materials of various-purpose nuclear facilities;
- Development of the techniques and experimental devices for in-pile tests and examinations of mechanical, electro- and thermo physical characteristics of the materials for nuclear and fusion reactors;
- Development of the irradiation techniques for accumulation of trans-plutonium elements and radioisotopes and transmutation of minor actinides;
- Development of the techniques to provide, maintain and control water- and gas-chemistry conditions, to decontaminate equipment

of research and nuclear power reactors; experimental research in these areas;

- Development of the techniques to calculate thermal-hydraulic and neutron-physical characteristics to support operation and safety analysis of the research reactors and their experimental devices;

- Development and manufacture of sensors for in-reactor control of temperature, pressure, neutron flux, linear displacements to equip experimental devices and control systems of the nuclear reactors;

- Development and manufacture of automated systems to acquire and process experimental data obtained during in-pile examinations;

- Calculations and experiments to justify safe handling of unirradiated and irradiated nuclear materials.

MIR Reactor

In 2014, a wide range of work was done to justify and extend the license for the MIR reactor operation. The license was obtained to operate the reactor till December 31, 2017. A general program was developed for the overall examination of the reactor. A plan was elaborated and work began to justify and extend the MIR reactor operation till 2030.

The overall upgrading of loop facilities PV-2 and PVK-2 was started to replace obsolete and worn-out equipment from the instrumentation and radiation control systems and a part of heating equipment. Measuring tanks for the cladding integrity control system, experimental channels and heat-exchange equipment were manufactured. The gage system to control parameters of the radioactive ventilation was upgraded.

The work was done to improve the MIR reactor safety on the results of additional safety assessments performed after the Fukushima accident: two diesel-generators were assembled and connected; designs were developed to install and connect apparatus of the industrial anti-seismic protection system; necessary equipment was purchased.

Investigations were continued in the PV-2 loop facility under the boric-lithium chemistry to test experimental fuel rods with claddings made from advanced zirconium alloys. The experimental fuel rods are a part of the second fuel assembly with square spacer grids (TVS-KVADRAT).

The reactor being on the scheduled shutdown, interim investigations of these fuel rods were performed using the test facility in the reactor cooling pool. The technology for dozing zinc to the loop facility primary coolant was improved.

RIAR continued performing in-pile tests of:

- Fuel assemblies with modified advanced fuel rods with a dispersed fuel composition for the reactors of transport nuclear power plants, in particular, with the purpose to justify the components of the new-generation reactor RITM intended for the nuclear icebreakers;

- Experimental fuel rods made of advanced cermet fuel with claddings of modified zirconium and nickel-chromium alloys. These fuel rods make part of the irradiation rig “Girlyanda” (Garland). The PV-1 loop facility was used to perform two experiments with leaking refabricated fuel rods of VVER-1000 advanced design to obtain experimental data and improve calculation codes to predict radiation environment in the VVER-1000

primary circuit under the normal operation of advanced fuel.

The experiment was performed using the irradiation rig with a high burn-up VVER-1000 refabricated fuel rod. In the course of the experiment, we reproduced dynamics of parameters changes typical for the second and third stages of the design-basis loss-of-coolant accident (LOCA).

Sophistic work was completed to update the PG-1 gas-cooled loop facility to perform in-pile testing of fuel rods, fuel assemblies and structural materials for high-temperature gas-cooled reactors. We began to test an experimental fuel assembly.

The procedure was developed and tested to produce Carbon-14 radionuclide in the reactors. Neutron-physical and thermohydraulic calculations were performed. A design was developed and a target was manufactured to irradiate initial materials in the reactor channel. A methodical experiment was performed to improve the procedure. The first batch of standard targets was loaded into the reactor to accumulate the radionuclide.

Under the contract with the French company "AREVA" to investigate stress corrosion cracking of Inconel-718 samples under irradiation, an experimental irradiation rig was developed to test the samples. Neutron-physical and thermal-hydraulic calculations were performed. As a result, test conditions were determined for the specified values of the fast (E > 1 MeV) neutron flux density and samples temperature to be accomplished.

Table 3.6 presents a list of the MIR reactor key experiments and their purposes, including brief characteristics of the subjects of research and test parameters.

Table 3.6

Basic information on the loop tests of fuel rods and experiments performed in the MIR reactor

Test purpose	Fuel rod length, mm	Number of fuel rods	Fuel burnup
To obtain experience-based data on the behavior of the fuel assembly containing dispersed fuel composition fuel rods intended for reactors installed on floating power units	1000	9	More than 1 g/cm^3
To obtain experience-based data confirming serviceability of fuel rods of advanced design with intermetallide and uranium dioxide. The fuel rods were tested in the irradiation "Girlyanda" (Garland)	250	120	0.9 g/cm^3
To investigate life-time capabilities of fuel assemblies containing fuel rods of various types made from dispersed fuel composition and intended for reactors installed on transport nuclear power units	1000	19 31 55	0.4–1.0 g/cm^3
To obtain experienced-based data on corrosion resistance of fuel rod claddings made from advanced zirconium alloys and tested under the boric-lithium chemistry conditions	1000	12	17 MW day/kgU
To obtain experienced-based data on the behavior of VVER-1000 fuel rods with high burnup of fuel under conditions of design-basis loss-of-coolant accident	1000	1	76 MW·day/kgU
To obtain experienced-based data on the kinetics of basic fission products yield from leaking fuel rods into the coolant	1000	2	44 MW·day/kgU
To obtain experienced-based data on the serviceability of fuel rods, fuel assemblies and structural materials for high-temperature gas-cooled reactors	1000	–	–

RBT-10/1 and RBT-10/2 Reactors

The RBT-10/1 reactor was written-off the list of objects of use of atomic energy whose activities are regulated by the Federal Service of Environmental, Technological and Nuclear Supervision.

The work was done to update the RBT-10/2 thermal monitoring and reactor control gauge systems. The work performed being checked, the updated thermal monitoring and reactor control system was accepted into service.

The work was done to improve the RBT-10/2 reactor safety on the results of additional safety assessments performed after the Fukushima accident: two diesel-generators were assembled and connected; designs were developed to install and connect apparatus of the industrial anti-seismic protection system; necessary equipment was purchased.

The RBT-10/2 reactor was used to perform the work on nuclear transmutation doping of silicon and to produce ^{131}I and ^{99}Mo radionuclides. ^{99}Mo accumulation was done to ensure its weekly shipment.

A new procedure to produce ^{131}I in the reactor was developed and implemented. The procedure aims at using targets of greater capacity and standardized irradiation devices.

BOR-60 Reactor

As part of the Federal Target Program "Nuclear Power Technologies of New Generation for 2010–2015 and until 2020", the work was done to reequip the BOR-60 reactor and to extend its operation. More detailed information can be found in Section 3.2 "Technical Re-equipment of the 60MW Test Fast Neutron Reactor" herein.

A wide range of work was done to justify and extend the license for the BOR-60 reactor operation. The license was obtained permitting its operation till December 31, 2019. The work performed ensures safe operation of the BOR-60 reactor and effective use of its experimental capabilities to solve challenges facing the industry.

The work was done to improve the BOR-60 reactor safety on the results of additional safety assessments performed after the Fukushima accident: two diesel-generators were assembled and connected; designs were developed to install and connect apparatus of the industrial anti-seismic protection system; necessary equipment was purchased.

The following experimental work was completed:

- Irradiation of structural materials samples (zirconium alloys, materials of core components of various reactors) at 320–450 °C;
- Irradiation of both dummy absorbers made of highly-enriched boron carbide and SVBR-100 fuel rods;
- Irradiation of BREST-OD-300 dummy absorbers made of both boron carbide pellets with lead sublayer and dysprosium hafnate pellets with helium sublayer;
- Irradiation of dummy fuel rods containing uranium-plutonium mixed nitride fuel and claddings made of EP823-Sh, ChS-139 and EK-181 steels;
- Irradiation of EP823-Sh steel samples for the BREST-OD-300 reactor;

- Irradiation of the MBIR reactor dummy fuel rods containing vibropacked MOX-fuel to justify their serviceability;
- Irradiation of the MBIR reactor dummy absorbers shaped as rings and cylinders and made of highly-enriched boron carbide;
- Irradiation of the MBIR reactor radiation shielding material (corundum crumbs);
- Irradiation of structural materials under the contracts with CEA (France), AREVA (France), TerraPower (USA) and KAERI (South Korea).

Along with the research and development, the work was continued to accumulate Sr-89 radionuclide.

Tables 3.7 and 3.8 present brief information on the experiments performed in the BOR-60 reactor during the reporting period.

Table 3.7

Characteristics of fuel assemblies

Fuel composition	Number of fuel assemblies	Number of fuel rods in the fuel assembly	Enrichment in U-235, %	Fuel type	Peak values			FA specifics
					Fuel burnup, %	Thermal flux linear density, kW/m	Neutron fluence (E ≥ 0,1 MeV), ×10^{22} cm^{-2}	
Fuel assemblies irradiated in the BOR-60 reactor and unloaded in 2014								
UO_2	21	37	75	Vibropacked	20	40	15.0	Fuel claddings of ChS-68 steel, shrouds – EP-450 steel
$0.8UO_2 + 0.2PuO_2$	7	37	72	Mixed vibropacked	19.2	25	14.7	
(U. Pu)N	1	7	–	Mixed nitride fuel	0.7	45	1.5	Dismountable; dummy fuel rods of the BN-1200 reactor, fuel rod claddings of ChS-139 and EK-181steels
UO_2	1	7	10	Pellet	3.3	40	11.5	Dismountable; dummy fuel rods of the SVBR-100 reactor, fuel claddings of EP-823 steel
Fuel assemblies held in the BOR-60 reactor as of the end of 2014								
UO_2	112	37	75	Vibropacked	16.1	40	13.6	Fuel claddings of ChS-68 steel, shrouds of EP-450 steel
$0.8UO_2 + 0.2PuO_2$	2	37	72	Mixed vibropacked	18.0	40	13.7	
(U. Pu)N	4	7	–	Mixed nitride fuel	2.1	35	6.9	Dismountable; dummy fuel rods of the BREST-OD-300 reactor, fuel claddings of EP-823 steel
$0.8UO_2 + 0.2PuO_2$	2	19	72	Mixed vibropacked	6.7	50	5.3	Dismountable; dummy fuel rods of the MBIR reactor, fuel claddings of ChS-68 steel, shrouds of EP-450 steel

Table 3.8

Characteristics of the material testing fuel assemblies irradiated in the BOR-60 reactor in 2014

Irradiation rig type		Number of irradiation rigs	Test temperature, °C	Neutron fluence achieved (E≥0,1 MeV), × × 10^{22} cm^{-2}	Characteristics of the samples
Non-instrumented	Flow through	1	320−450	Up to 21.0	Structural materials of core components of various reactors, including zirconium alloys
		2	320−550	Up to 11.0	Materials to accumulate ^{89}Sr isotope
		1	320−360	7.3	BREST-OD-300 dummy absorbers made of boron carbide and dysprosium hafnate
		1	320–500	2.9	MBIR dummy absorbers made of boron carbide
		1	320–360	2.4	SVBR-100 dummy absorbers
		1	420−550	4.3	Samples of BREST-OD-300 fuel claddings
Instrumented		3*	440–625	Up to 2.7	Samples of structural materials for the TWR reactor (USA)
		2	350–420	Up to 3.9	
		1	315–335	Up to 9.5	Zirconium alloy samples (France)
		1	380–420	1.9	Samples of structural materials for the fast neutron reactor (France)
	Thermally-insulated	1	490–580	6.9	
		1	620–680	0.1	Samples of fuel claddings for the fast neutron rector (South Korea)

* With fuel heater.

SM Reactor

An annual report was issued to assess the SM nuclear and radiation safety in 2013.

A full range of activities was performed to inspect metal parts of the reactor equipment and pipelines. The work was done to evaluate technical conditions of the apparatus in the reactor control and protection system.

The work was done to improve the SM reactor safety on the results of additional safety assessments performed after the Fukushima accident; designs were developed to install and connect apparatus of the industrial anti-seismic protection system; necessary equipment was purchased.

A general program for the reactor overall examination was developed. A plan was elaborated and work began to justify and extend the reactor operation

We put a great emphasis on optimizing the core configuration and loading/unloading procedures to improve the efficiency of the reactor experimental channels. Designs were developed to construct irradiation rigs of new types for high-dose instrumented irradiation of structural materials. The work was continued to develop effective fuel with lower parasitic neutron absorption.

In the reporting period, material testing experiments were continued under the high-temperature gas-cooled reactors program:

- Samples of high-melting temperature alloys were tested in the reactor core;
- Advanced fuel samples as part of the dummy fuel rods were tested at different powers in the reflector cells;
- Dummy fuel rods were tested in the reflector cells.

The VP-3 high-temperature loop facility was used to test dummies of advanced VVER absorbers to investigate both their radiation resistance and various welding techniques.

Two methodical experiments were performed in the near-to core and middle rows of the reflector cells under the contract with “AREVA” (France) to investigate stress corrosion cracking of the Inconel-718 samples under irradiation at 300 °C and fast (E > 1 MeV) neutron flux density $(0.7–1.6)10^{14}$ $cm^{-2}·s^{-1}$.

A comprehensive program was implemented to produce radionuclides of various purposes in the reactor. The SM neutron trap was used to accumulate medical radionuclides with a high specific activity: ^{89}Sr, ^{188}W and ^{109}Cd. Cores of the ^{75}Se sources were activated to perform nondestructive examinations. We continued to accumulate high specific activity radionuclides ^{191}Ir and ^{60}Co and to produce trans-plutonium elements, including ^{252}Cf. The upgrading of the facility to accumulate ^{125}I was completed and it was accepted into service. A new procedure to produce ^{131}I in the reactor was developed and implemented; the technique aims at using targets of greater capacity and standardized irradiation devices.

RBT-6 Reactor

An annual report was issued to assess the state of the RBT-6 nuclear and radiation safety in 2013.

A full range of activities was performed to inspect metal parts of the reactor equipment and pipelines.

The work was done to improve the RBT-6 reactor safety on the results of additional safety assessments performed after the Fukushima accident; designs were developed to install and connect apparatus of the industrial anti-seismic protection system; necessary equipment was purchased.

To fulfill the production plan, the work was continued to irradiate targets for ^{99}Mo accumulation to ensure its weekly shipment.

A new procedure to produce ^{131}I in the reactor was developed and implemented; the technique aims at using targets of greater capacity and standardized irradiation devices.

During the reporting period, key areas of the experimental research were as follows:

- Irradiation of advanced radiation shielding materials under the program to develop high-temperature gas-cooled reactors;
- Creep tests for the uranium dioxide fuel with large grain size and specified microstructure at 670 °C to predict both the stress-strain behavior and operating lifetime of the fuel rod as a result of fuel-cladding interaction;
- Irradiation of gas-filled samples made of X18H9 stainless steel to investigate the irradiation effect on the steel and weld metals durability at 550–600 °C and fast ($E > 0,1$ MeV) neutron flux density $5 \cdot 10^{13}$ $cm^{-2} \cdot s^{-1}$ in the helium environment;
- Creep tests for the samples made of VZh159-ID alloy under stress in the range from 43 to 96 MPa; the tests being completed, short-term rupture tests were performed in the experimental facility “Neutron-8” at 850 °C;
- Irradiation of the BREST-OD-300 vessel materials to investigate physical and mechanical properties of concrete under the heat and radiation exposure at 320–420 °C to achieve fast ($E > 0.1$ MeV) neutron fluence equal to $1.07 \cdot 10^{20}$ cm^{-2}.

AST-1 Reactor

The ARBUS unit-type reactor facility with organic primary coolant (renamed to AST-1 after reconstruction) was designed as a research facility to justify technical solutions to develop low-power nuclear plants and heating NPPs to supply electricity and heat to the Russia's Far North outer production facilities and inhabited settlements. The ARBUS reactor was mounted and put into operation in 1963. Since this year, the reactor was operated as a two-circuit nuclear power plant with the thermal output of 5 MW and the electrical output of 750 kW. The electricity generated was used in RIAR. In 1979, the ARBUS reactor facility was redesigned into a three-circuit nuclear heating plant (AST-1) and was operated till 1988. The heat generated was used to heat the RIAR buildings. Due to the lack of funding, the reactor was shut down in May 1988. Based on the Decision of the Ministry of Medium Machine- Building Industry of the USSR as of April 5, 1989, No. GZh-788, the AST-1 nuclear heating plant was temporarily decommissioned. A wide range of work was performed to preserve the equipment and ensure nuclear and radiation safety for that period. Based on the Decision of the Ministry of Atomic Energy and Industry of the USSR as of December 12, 1990, No. S-01-3639, the AST-1 reactor is being decommissioned since January 1, 1991.

Since 2008, the decommissioning activities have been performed and financed under the Federal Target Program "Ensuring Nuclear and Radiation Safety for 2008 and until 2015". The main objective of the reactor decommissioning is its complete dismantling. The decommissioning activities being completed, the reactor vessel cavity is supposed to be used to build a storage area for high-level solid waste generated during the reactor operation and decommissioning.

In the reporting period, a wide range of work was performed to obtain a new license for the AST-1 decommissioning. A decommissioning program was developed. Detailed design documentation was elaborated to create a high-level solid waste storage area in the reactor vessel cavity; the construction work began. The work was performed under the "Atomproject" design:

- The following equipment was dismantled: metal structures in the reactor hall, special-purpose crane with a load capacity of 12.5 t and a 15-tonne crane, crane beams, concrete structures of the equipment foundations, floors, reactor sumps;
- Floors in the storage area were covered with concrete;
- Storage area was coated with metal;
- Walls of the reactor building were insulated and the roof was replaced;
- Metal structures for new crane beams were manufactured;
- A new travelling crane with a load capacity of 12.5/0.5 t was ordered;
- All high-level solid waste generated during the reactor operation and decommissioning were unloaded from the storage area;
- Metal structures were assembled for the storage area equipment.

The decommissioning activities are expected to be completed in 2015.

VK-50 Reactor

The physical start-up of the VK-50 reactor took place in October 1964, and the energy start-up – in October 1965. The successful reactor operation for almost 50 years offers the possibility for extending its life-time till 2025. Comprehensive use of engineering solutions worked out during the reactor operation, camera-aided non-destructive examination of the reactor vessel outer surface, rings and welds, as well as unique inherent reliability and safety features of the VK-50 reactor (inherent control) ensure its radiation and nuclear safety.

The VK-50 is a vessel-type boiling research reactor that has a direct-cycle scheme with natural circulation of the coolant and uses VVER-440 fuel rods. The core configuration can be five-row (91 cells) or six-row (109 cells). The VK-50 core cross section is given in Figure 3.23.

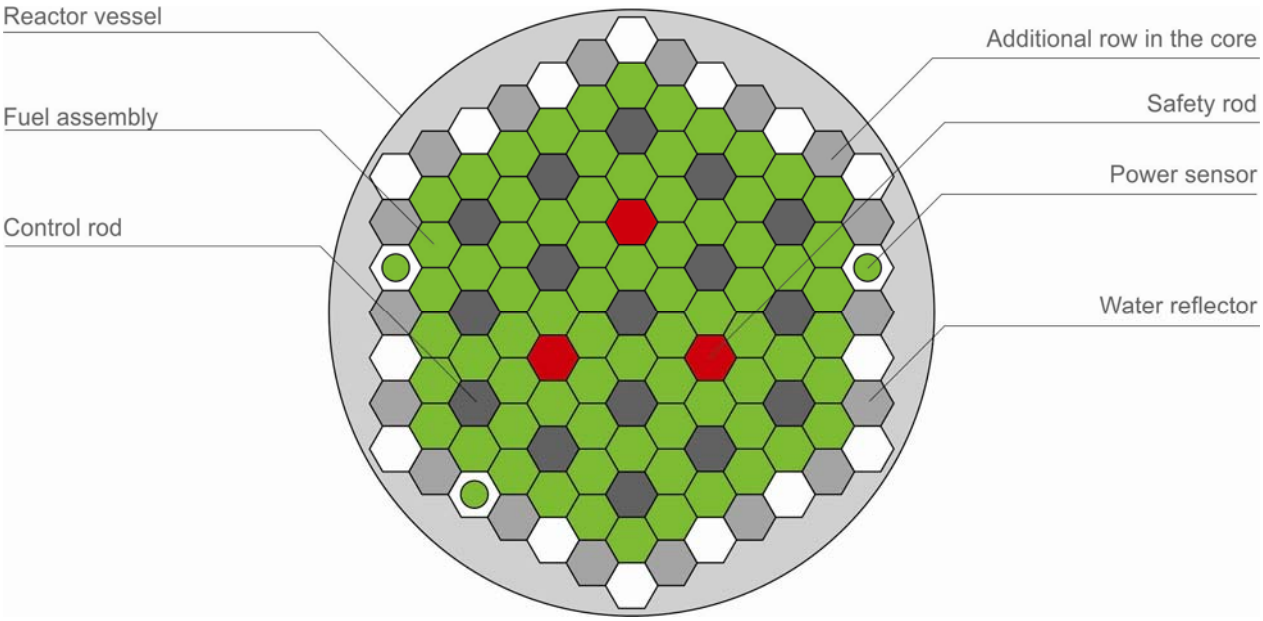


Figure 3.23. Cross section of the VK-50 extended core

The VK-50 reactor is shut down for the preventive maintenance twice a year. The outage time was 452 hours in spring and 1277 hours in autumn.

The key areas of work performed in the VK-50 reactor are as follows:

- Generation and delivery of electricity and heat to satisfy needs of the RIAR production area as a result of a longer operation at the nominal power;
- Calculations on the effective use of fuel in the reactor core as a result of fuel assemblies modernization:
  - by installing burnable/absorbing rods and using solid absorbers: gadolinium, hafnium and others;
  - by increasing fuel enrichment in ^{235}U up to 3.6 %;
- research to study behaviour of the extended core containing 18 fuel assemblies in the additional row to justify reactor safety during the reactor start-up

and operation at power and to possibly extend the reactor campaign up to 1.5–2 years;

- generation of the experimental data on physics, thermal physics, thermal hydraulics, fission product release and distribution, behaviour of fuel rods and fuel assemblies under irradiation; the data are needed to verify software, developments and proposals on the existing and innovative reactors as well as to justify safety of the operating reactors;
- verification of the RELAP5/MOD3.2 and BIPR-K software in relation to the reactors of this type and preparation of the draft certification passport for the software;
- development of the technique to maintain and control water chemistry conditions;
- improvement of the calculation and methodological support to justify safety and efficient operation of the VK-50 reactor;
- work to justify and extend the license duration;
- work with the spent fuel assemblies and their preparation for shipment to FSUE “Mayak, PA”.

Key performance indicators of the VK-50 reactor operation are given in Table 3.9.

Table 3.9

VK-50 key performance indicators in 2014

Performance indicators	Value
Maximal thermal capacity, MW	200
Number of un-irradiated fuel assemblies loaded at the campaign startup, pcs.	19
Maximal electrical capacity, MW	Up to 50
Pressure, MPa	5,5
Core specific capacity, kW/l	Up to 40
Average linear heat-flux density, MW/m^2	0.29
Fuel burn-up in the unloaded FAs, MW·day/kgU	24–30
Maximum operating time of fuel assemblies, year	6
Heat load on fuel rods, W/cm: – average – maximal	 180–220 320
Operating time, days: – scheduled – actual	 298 281
Energy production, MW·h: – scheduled – actual	 1430400 1182755
Energy generated: – electrical, MW·h – thermal, Gcal	 217598 43594
Number of shutdowns: – scheduled – unscheduled	 2 3

REACTOR MATERIAL SCIENCE, TECHNIQUES TO TEST REACTOR MATERIALS AND COMPONENTS

In 2014, the Reactor Materials Testing Complex celebrated its 50-year anniversary. The event was marked with the scientific conference “New Materials for Innovative Development of Nuclear Power Engineering” which brought together more than 200 experts, including 24 representatives of foreign organizations.

A major part of the research activities performed in 2014 was focused on generating experimental data to justify materials and core components for different-purpose operating and future reactors.

Since the first fuel assembly from the “Lenin” nuclear-powered icebreaker was delivered for testing in March 1964, the research in the field of transport nuclear power engineering became the principal research area for the Reactor Materials Testing Complex and remains as such till today.

In 2014, investigations were completed for two experimental fuel assemblies operated in the core of the “Vaygach” icebreaker up to the record figures in energy production, operating time at power and fuel burn-up.

Experimental data were obtained both to confirm high lifetime performance and to determine performance margin of the fuel rods having claddings of Russian-manufactured nickel-chromium alloy 42XHM and intended for new generation NPPs.

Further irradiation of fuel rods from the experimental loop fuel assembly tested in the MIR reactor was carried out and the investigations were completed. The data obtained allowed the conclusions to be made on the fuel rod manufacturing technique and possibility of using these materials for floating power units and low-power NPPs. The research results are used to certify materials and confirm reliability and operational lifetime of the components intended for the head power unit of the “Mikhail Lomonosov” floating nuclear power plant with the KLT-40S reactor.

The second building of the Materials Testing Complex was introduced into service in 1988 and significantly enlarged RIAR capabilities as compared to other laboratories in Russia and abroad. The building is equipped with shielding cells and unique equipment (Fig. 3.24 and Fig. 3.25) which allow the full-size fuel assemblies of power reactors of all types to be investigated. As of today, the following fuel assemblies were tested in the Reactor Materials Testing Complex: seventeen fuel assemblies of the VVER-440 reactor, forty two FAs of VVER-1000 reactor, twenty two FAs of the RBMK-1000 reactor and nine FAs of the BN-600 reactor.

In 2014, further research was carried out for fuel rods and spacer grids from two RBMK-1000 fuel assemblies operated during 5.1and и 6.9 years up to the average fuel burn-up 28.4 and 34.3 MW·day/kgU, accordingly.

Post-irradiation examinations were completed with experimental fuel assemblies and fuel rods made of vibro-packed uranium-plutonium oxide fuel using advanced techniques; these FAs were irradiated in the BN-600 reactor up to the maximum burn-up of 10.4 % and damage dose of 79 dpa. The study revealed that the advanced technique significantly improved the uniformity of distribution of fuel fraction composition and plutonium both along the fuel rods height and cross section.

Post–irradiation examinations showed the experimental fuel assemblies and fuel rods to be in good condition, fuel rods to be still operable and their key operational performances to be unexhausted.

Figure 3.24. Reactor Materials Testing Complex

Figure 3.25. Transport hall

In 1990, the first full-size VVER-1000 fuel assembly spent in the first power unit of the Yuzhno-Ukrainskaya NPP was delivered to RIAR. In 2014, we continued the work

to experimentally justify the VVER-1000 core components and materials:

1. The work was done to perform post-irradiation examinations for three refabricated fuel rods tested in the BIGR reactor under RIA (reactivity –initiated accident) conditions. The refabricated fuel rods are made of a standard VVER-1000 fuel rod irradiated in Unit 1 of the Kalinin NPP up to the burn-up of 77.7 MW·day/kgU. Based on the PIEs results, the specifics of high burn-up fuel behavior under RIA conditions were revealed;

2. We completed investigations of the gadolinium fuel rods spent in Unit 1 of the Kalinin NPP in the TVSA-5M fuel assembly up to the average burn-up of 57.7–60.6 MW·day/kgU during five campaigns. The PIEs results revealed that neither of fuel rod performance parameters showed any lifetime exhaustion;

3.The work was done to study characteristics of the TVSA-Alfa fuel microstructure. The fuel rods had pellets with increased diameter (up to 7.8 mm); no central hole and bigger grains (25–27 μm);

4.We continued testing VVER-1000 fuel rods of various design and fuel burn-up in experiments to justify dry storage safety.

The work was done to investigate E-65 blanket fuel assembly irradiated in the BOR-60 reactor in the temperature range from 320 to 380 °C typical for in-vessel internals of various reactors. By the end of the fuel assembly irradiation, record fast neutron fluence (~$38 \cdot 10^{22}$ cm^{-2}) was reached as well as damage dose in the steel (about 150 dpa). Experience-based data on the radiation resistance of steel 12X18H10T were obtained to justify lifetime extension of the non-removable in-vessel internals of the BOR-60 reactor and VVER-type reactors.

The work was done to investigate void swelling, creep and short-term mechanical properties of both the samples made of the base metal (steel 08X18H10T) and weld joints irradiated in the BOR-60 reactor up to the maximum damage dose 102 dpa and the results were obtained to justify performance of the VVER-TOI internals for the 60- year operation.

In 2014, the Reactor Materials Testing Complex performed a considerable volume of work under the project on the lead-cooled fast- neutron reactor BREST-OD-300:

1. The work was done to complete post-irradiation examinations of the dummy absorbers with fuel meats made as pellets of boron carbide, dysprosium hafnate and tungsten carbide. The results obtained were used for calculations to justify designs of BREST-OD-300 control rod absorbers;

2. An experimental fuel rod with nitride uranium-plutonium fuel and cladding made of EP-823Sh steel was investigated after the first stage of irradiation in the BOR-60 reactor. Experimental data on the change of fuel and cladding characteristics at an early stage of irradiation were obtained to justify safety of the fuel rods testing in the BN-600 reactor and to verify the software;

3. Data were obtained on the short-term mechanical properties and crack resistance characteristics of the base metal (steel EP302-Sh) and weld joint metal (steel TsT-24U) after their irradiation up to 17 dpa in the BOR-60 reactor at (420 + 50) °C.

These data are expected to be used to manufacture internals and components of the BREST-OD-300 primary equipment.

4. Experimental data were obtained on irradiation-induced changes in the main physical and mechanical properties of the candidate concrete samples. The data were obtained for the BREST-OD-300 vessel.

To improve the MBIR fuel rod design, its fabrication technique and control methods, experimental fuel rods with mixed uranium-plutonium vibro-packed fuel were investigated after the second phase of irradiation in the BOR 60-reactor up to the maximum fuel burn-up 5%.

The fuel rods contained a fuel meat made of a mechanical mixture of uranium and plutonium dioxides and differed in getter material composition and its location.

Experimental data were obtained and showed influence of the unique design features of fuel rods on the radiation-thermal and physical-chemical processes under irradiation.

In 2014, the Reactor Materials Testing Complex continued investigations of advanced reactor materials and components.

The in-pile tests being completed, samples of high-melting-temperature alloys and advanced fuel samples were investigated at various powers as components of dummy fuel rods. A dummy control rod was also investigated.

The work was done to continue the autoclave corrosion tests (Fig. 3.26) of irradiated zirconium alloys in water at 350 °C.

Figure 3.26. Autoclave before loading the samples

The objects of the study are base and advanced zirconium alloys E-110 and E-635 irradiated at 315–330 °C up to the fast (E ≥ 0.1 MeV) neutron fluence $2 \cdot 10^{22}$ cm^{-2} as well as developed alloys based on Zr-Nb-Sn-Fe-O.

In 2014, methodological activities were continued to study influence of the oxide film on the hydrogen determination in the irradiated zirconium materials. The research results showed that the oxide film contained hydrogen which content could significantly change in relation to the total hydrogen content in the sample.

A new algorithm was developed to determine hydrogen content individually in oxide film and in metal with no preliminary removal of the oxide. The algorithm rests on the fact that hydrogen releases from oxide at a lower temperature as compared to its release from metal. This research work was made possible after a new gas-analyzer ELTRA-OH-900 (Fig. 3.27) had been put into operation in 2013. The facility was received under the program to update RIAR experimental capabilities. The gas-analyzer software allows the samples to be heated on a step-by-step basis.

Figure 3.27. Gas analysis facility with ELTRA-OH-900 gas-analyzer

RADIOCHEMISTRY, NUCLEAR FUEL CYCLES

In 2014, the corrosion behavior of technetium in the 3LiCl-2KCl melt was studied using electrochemical and spectroscopic techniques: the dependence of the stationary potential of corrosion on the temperature was obtained; the rate of technetium corrosion in chloride melts at 450–550 °C (Fig. 3.28) was calculated. We proved that while reprocessing dense spent nuclear fuel, technetium would be accumulated in the anode chamber in the form of slimes as a result of electrolysis in the chloride melt.

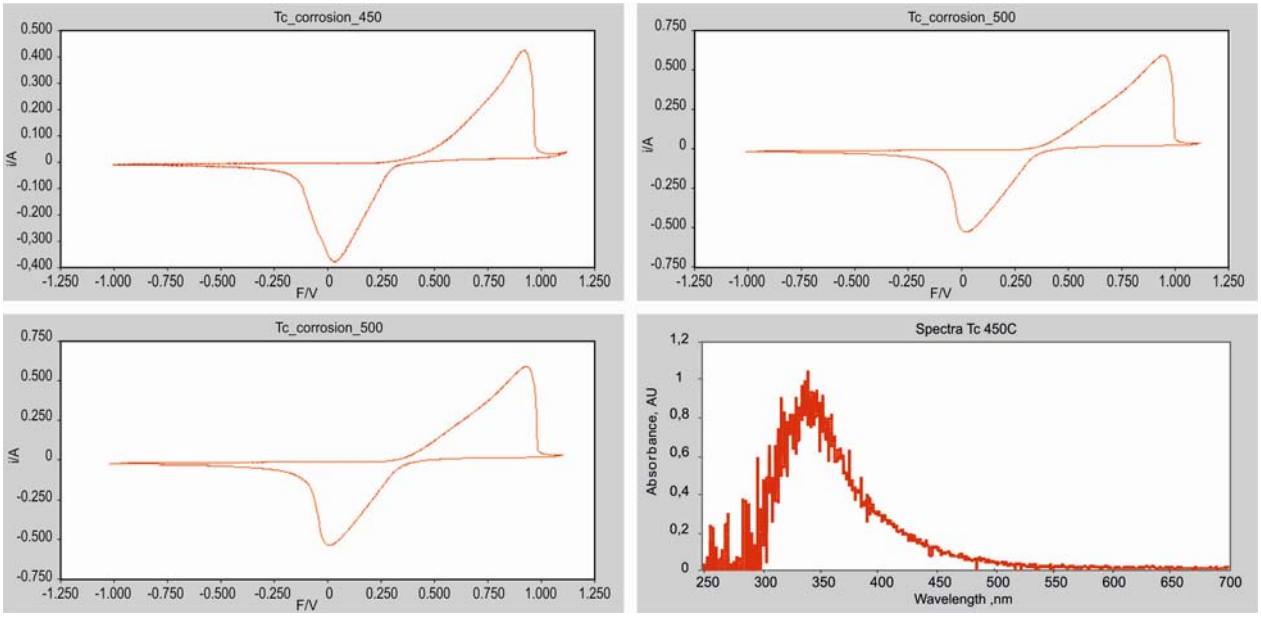


Figure 3.28. Cycle current-voltage curves and technetium spectrum in the 3LiCl-2KC melt

In the reporting period, the work was done to experimentally verify the process of salt sorption purification from cesium, strontium and barium radionuclides at the sorbent modified with lithium and potassium – NaA zeolite (Fig. 3.29) (the salt was used to reprocess BOR-60 reactor dense spent nuclear fuel).

Figure 3.29. Laboratory pilot apparatus to purify salts from fission products using the sorption technique

Possible presence of any lithium-oxygen compounds resulted from salts hydrolysis has no effect on the sorption. Loss of salt results from occlusion and amounts to 30 % from the sorbent mass before purification. The sorption process is easily introduced into the technological chains regardless of the way of its implementation-immersible or flow-thought. To reduce the volume of radioactive waste, the sorption should be performed under the critical, in other words, under the greatest possible content of cesium in the melt.

The efficiency of the following procedures was verified: freezing products resulted from irradiated fuel cladding dissolution and zinc filtration procedure using a laboratory apparatus to purify process media from fission products, intermetallides and fuel particles in conditions of a shielded cell (Fig. 3.30). Dendritic precipitate appeared on the coarse-meshed lattice; coefficient of purification from structural materials and cladding activation products equals to 30.

Figure 3.30. Filtrate (of the regenerated zinc alloy) to be reused in the process of cladding removal

RESEARCH IN AND PRODUCTION OF RADIONUCLIDE SOURCES AND CHEMICALS

The situation at the radionuclide market is rather favorable to develop business based on the production of radionuclides in nuclear reactors. We see a stable growth in demand for isotopes used in non-destructive diagnostics, for example ^{192}Irand ^{75}Se. Neutron sources are still in great demand, especially sources based on ^{252}Cf; ^{60}Co of high specific activity is in short supply at the market. Chemicals based on ^{89}Sr are widely used in clinical practice in China; the need for ^{131}I increases. The demand for ^{188}W and ^{153}Gd sources remains the same as in 2013. These tendencies had an impact on the radionuclide production in JSC “SSC RIAR” (Fig. 3.31).

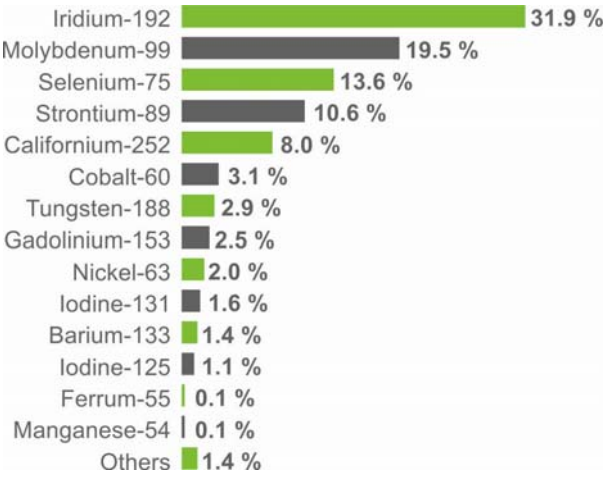


Figure 3.31. Sales of radionuclide products in 2014

The most sales accrued to Ir-192 which was supplied to the customers both as sources and chemicals (irradiated iridium disks). An increase in ^{192}Ir sales was due to the higher price and better use of reactor capabilities. The average supply rate of iridium disks being equal to 3700–4070 TBq (100–110 kCi) per month, the production output over the year reached 5069 and 6068 TBq (137and 164 kCi) per month, and the number of ^{192}Ir-based sources approached two thousand which is close to the maximum output possible in RIAR.

The number of ^{75}Se-based sources reduced by 15 per cent; however, these sources are the third in sales in the range of RIAR radionuclide products. Jointly, radionuclides based on ^{192}Ir and ^{75}Se cover approximately 45 per cent of the total sales volume.

In 2014, a significant increase was noted in the sales of ^{89}Sr-based chemicals which production is now based on a new technique, namely by irradiating enriched ^{88}Sr.

The volume of deliveries exceeded 1.85 TBq (50 Ci) per year, and this figure can be doubled. A small amount of ^{89}Sr (about 5 per cent by activity) was accumulated using the old technique, namely by irradiating yttrium in the BOR-60 reactor since we had to secure supplies of this chemical to the Russian health care centers for the period of registration of the chemical produced from ^{88}Sr. The ^{89}Sr accumulation in the BOR-60 reactor is expected to be completed in 2015; the chemical will be accumulated in the SM rector.

In the third quarter of 2014, the work was completed to upgrade the existing facility to produce ^{131}I. As a result, the activity

of the accumulated chemicals increased up to 1.85 TBq (50 Ci) with the seven-day calibration.

This work was done under the investment project which was supported by the ROSATOM SC and included into the project “Comprehensive Upgrading and Development of the Production of Radionuclides in RIAR Nuclear Reactors to Ensure the Development of Nuclear Medicine and Radiation Technologies”. The project was implemented in cooperation with the Federal State Budgetary Educational Institution of Higher Professional Education “Ulyanovsk State University” under the contract with the Ministry of Education and Science of the Russian Federation. In 2014, the total volume of deliveries exceeded 29.6 TBq (800 Ci). The performance of upgraded area confirms the planned level of efficiency 1.85 TBq (50 Ci) per week or 92.5 TBq (2500 Ci) per year to be achieved.

In the framework of the above-mentioned project, the work was done to create a working area to produce targets. Its main function is to prepare starting materials (pelletized tellurium oxide, strontium carbonate, tungsten oxide, iridium disks and others) for irradiation. The equipment installed will allow the quality of the materials preparation for irradiation to be improved and the production costs to be reduced.

One of the key problems of the radionuclide production development is the establishment of a working area to produce ^{60}Co sources. This task is integrated into the above-mentioned project, too. In 2014, engineering solutions were found to place the working area. The co-contractors developed and manufactured prototype models of the tools needed for the sources fabrication.

To test the radiation tolerance, a temporary working area was established where irradiated high specific activity cobalt (5550 TBq (150 kCi)) was reprocessed using the short procedure. The products were delivered under the contract with FSUE “Mayak PA”. The second phase of the tests to reprocess ^{60}Co will be performed in the second quarter of 2015. ^{60}Co deliveries under the proposed temporary scheme will cover some costs associated with the working area establishment.

In 2014, the important task was to increase production of ^{99}Mo. In the first quarter of 2014, the transaction with the JSC “V/O Isotope” was completed to purchase the equipment for the second-stage facility; encumbrances prevented its commissioning were released. The work to restore the serviceability of the equipment after a long outage was completed in the second quarter. Regular production began in the third quarter. The total volume of ^{99}Mo output was 325.119 TBq (8787 Ci). The deliveries were carried out:

- against orders from the Obninsk branch of the Karpov Institute of Physical Chemistry – 52 batches with the total activity of 225.33 TBq (6090 Ci);
- under the contracts with the following companies:
  - “Bacon” (Argentina) – 47 batches with the total activity 44.548 TBq (1204 Ci),
  - “Sam Yong Unitech” (Republic of Korea) – 19 batches with the total activity of 20.239 TBq (547 Ci),
  - “Gamma-Service Group” (Switzerland) – 45 batches with the total activity of 12.247 TBq (331 Ci).

Test batches were delivered to Brazil, China, Japan and Poland. After commissioning the second stage equipment, the work was started to maintain the first stage equipment which had been under operation for 18 months. The work is expected to be completed in the first quarter of 2015.

In 2014, the work was done to replace components of the ^{125}I production facility: the vacuum pump and the valves which

were spent during seven years and became exhausted. In November 2014, the work to upgrade the facility was completed and ^{125}I production was restarted.

We started activities to increase the production of this radionuclide, since it is in great demand in the market.

Previous option of the facility could not satisfy the demand due to its limited capacity. Upgrades are expected to be completed in 2015–2016 to have the output multiplication.

Production of other radionuclides was the same as in 2013.

MOX FUEL PRODUCTION

Production of oxide fuel for fast reactors

In 2014, the Chemical and Technological Division implemented activities to produce oxide nuclear fuel: fuel compositions, fuel pins and fuel assemblies. The work was performed along several main lines:

- Fabrication of granulated MOX-fuel compositions and fuel elements for the BN-800 fuel assemblies;
- Fabrication of fuel assemblies for the BOR-60 reactor to ensure standard refueling of the reactor core;
- Fabrication of experimental fuel compositions, fuel pins and fuel assemblies to justify serviceability of the MBIR reactor vibro-packed MOX-fuel;
- Fabrication of granulate and fuel pins to meet other challenges faced by the industry (for example, under the cooperation program with TerraPower Company);
- Fabrication of combined experimental fuel assemblies within the project “Breakthrough”.

Bu the end of 2014, the Chemical and Technological Division developed and fabricated:

- Twenty five batches of granulate to fabricate 2184 BN-800 fuel pins incorporated into twenty fuel assemblies;
- Forty standard fuel assemblies for the BOR-60 reactor;
- Two experimental fuel assemblies for the BOR-60 to justify the serviceability of the MBIR fuel pins;
- Two hundred and thirty one fuel pins under the cooperation program with TerraPower Company;
- Two combined experimental fuel assemblies, each containing four fuel rods with uranium-plutonium nitride fuel manufactured in JSC “SKhK” and JSC “VNIINM”.

Fuel pins to be tested under the cooperation program with TerraPower Company are designed to heat sodium at the set flow rate in the irradiation rig. Samples of the structural materials irradiated in this irradiation rig are placed in the special-purpose capsules remaining in the circulating sodium and heated up to the required temperature. According to the experimental program, the samples will be irradiated in the BOR-60 reactor in six temperature intervals: from 350 to 370, from 390 to 410, from 425 to 455, from 445 to 495, from 525 to 575, from 600 to 650 °C. Calculations were performed and showed that temperatures of the sodium flowing around the investigated materials could be provided in the range

from 320 to 650 °C in the irradiation rig with pre-heated fuel pins.

The design of the combined experimental fuel assembly is largely similar to the design of a standard BN-600 fuel assembly. Design solutions and structural materials used in this fuel assembly were borrowed from standard fuel assemblies which serviceability was confirmed by both the long term operation in the BN-600 reactor and positive results of the post-irradiation examinations. Combined fuel assemblies differ in their component parts. For example, they contain fuel rods with increased amount of the nitride fuel and use bottom end components with oversize orifices.

The combined experimental fuel assemblies being prepared for fabrication, the operation analysis was performed and the design documentation was updated. The combined experimental fuel assemblies were sent to the Beloyarskaya NPP to be tested in the BN-600 core.

All redesigns (manufacturing the fuel compositions, vibropacking the fuel rods and manufacturing the fuel assemblies) were performed in the technological complex of the Chemical and Technological Division. At that, we used new and updated, basic and auxiliary process equipment commissioned in 2013. In 2014, the work was continued to upgrade the technological complex: a facility for heat treatment of weld joints and a facility for FA integrity control were put into operation in the working area to assemble and control FAs; a facility for process gas supply to the working area for electrochemical recrystallization of granulate was also put into operation; the work was completed to upgrade the working area to wash granulate from the captured electrolyte.

Measurements quality control improvement

In 2014, the Production Processes Control Laboratory passed accreditation in the national accreditation system. Based on both the results of the expertise of the presented documents and on-site assessment of conformity of the Laboratory operation in the declared area of accreditation, it was found that the Production Processes Control Laboratory met the requirements of the accreditation and GOST ISO/MEK 17025-2009 requirements in the declared area of accreditation and the Laboratory was accredited as the Test Laboratory (Center). Accreditation Certificate No. POCC.RU.0001.515091 was granted on October 15, 2014.

In 2014, through the implementation of the Quality Policy to provide credibility of the measurement results and to maintain the trust of the Customers to the Laboratory operation, five techniques within the given area of accreditation were developed and submitted to the Federal Information Fund for Ensuring the Uniformity of Measurements.

In addition, the work was done to optimize calculations of the mass-spectrometer measurements for the purpose of reducing the data processing time and saving the data effectively thanks to the automated backup of the information at the local computer and file archiving on the server, as well as networked access to the information in determining the right of access to information.

Fuel fabrication for the MBIR reactor

In 2014, the work was continued to create a system to provide the MBIR reactor with vibro-packed MOX-fuel. The work was implemented under the State Contract No. Н.4х.44.9Б.14.1078 as of June 3, 2014 “Updating the MBIR reactor technical design and technical designs of the MBIR research reactor equipment”. The work was focused on the following areas:

- Adjustment of the MBIR fuel rod design documentation;
- Development of a technique to produce PuO_2 granulate by the volumetric crystallization in the molten salt;
- In-process testing of the uranium metal powder (getter) produced in JSC “NZKhK” by the plasma spraying technique;
- Development of the design and production documentation, fabrication and quality control of the MBIR fuel pins containing MOX-fuel as mechanical mixtures of granulated components UO_2+$UPuO_2$+PuO_2+U (up to 40 % of PuO_2, up to 10 % of U);
- Documentation development, fabrication and irradiation tests of three FAs containing MBIR fuel pins in the BOR-60 reactor;
- Development of PIE programs for the MBIR fuel pins, assessment of the used fuel pins performance and development of new improved ones.

The following work was carried out: adjustment of the MBIR fuel pin design documentation, development of the engineering design for the MBIR fuel pins containing fuel made of a mechanical mixture of granulated uranium-plutonium oxide fuel and plutonium dioxide.

The preliminary justification of the fuel pin serviceability was done considering the results of the experiments performed in the BOR-60 and BN-600 reactors to study the serviceability of the fuel pins containing vibro-packed oxide fuel. The analysis included thermal-physical and strength calculations for the fuel pins exposed to the highest heat rate under normal operating conditions and under abnormal conditions in the core.

For an unirradiated newly-loaded fuel pin, the fuel and cladding temperatures were shown not to exceed the admissible values under the normal operation at the specified scenario of bringing the reactor to power in the first campaign.

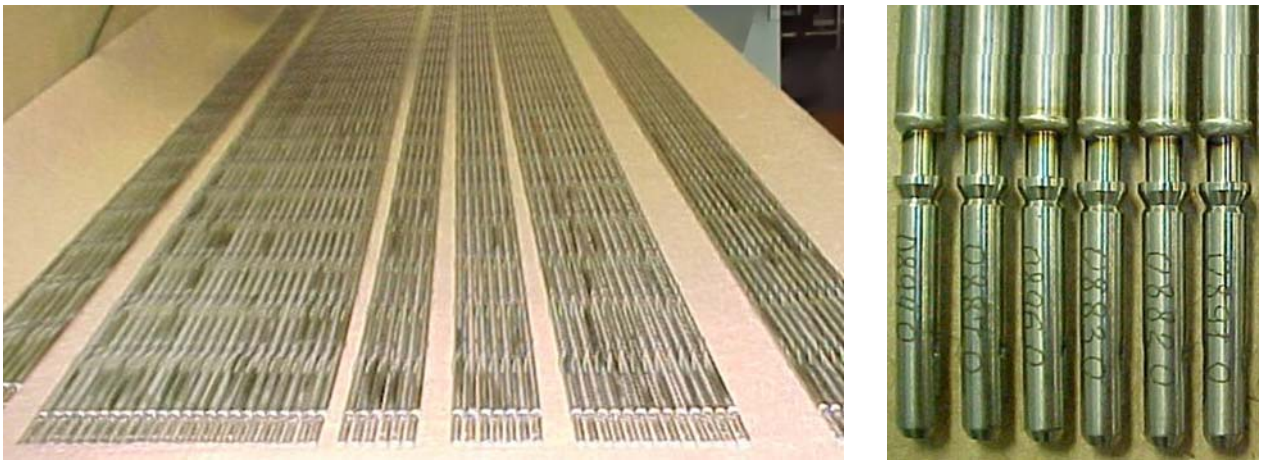
To prepare the production of the vibro-packed MOX-fuel and to ensure the MBIR initial loading and further refueling, the first experiment was performed to improve the method for producing granulated plutonium dioxide by the volume precipitation technique. As a result of the experiment, the first experiment performed with the use of the Chemical and Technological Division equipment, 4670 grams of granulated plutonium dioxide were produced and two batches weighing 965.0 and 920.8 g, were sent to master the technology for producing vibro-packed MOX fuel pins for the MBIR reactor.

The work was done to fabricate three experimental fuel assemblies containing MBIR fuel pins with MOX-fuel as a mechanical mixture UO_2+$UPuO_2$+PuO_2+U; the irradiation tests began.
When manufacturing the MBIR fuel pins with MOX-fuel having up to 40 % of PuO_2, the acceptability of the uranium metal powder (getter) produced by the plasma spraying technique was ascertained.

The efficiency of the use of the zirconium heat insulator as an additional getter in the fuel pins was acknowledged in experiments (full model patent No. 117699); fixing devices made of zirconium alloys are recommended to be used as an additional getter in fuel pins with oxide fuel (useful model patent No. 145011).

Fabrication and examination of BN-800 fuel pins

In 2014, the work was continued to justify the possibility of using MOX fuel pins in the BN-800 hybrid core (Fig. 3.32). The work was performed under the Contract between JSC “SSC RIAR” and JSC “Rosenergoatom Concern” “Post-irradiation examination of the EFA and EFA fuel pins with vibro-packed mixed oxide fuel after irradiation in the BN-600 reactor” (Contract No. 9/4812-D as of June 19, 2014).



a b

Figure 3.32. Fuel pins (a) for the BN-800 hybrid core and their marking (b)

The above-mentioned EFA is one the tree fuel assemblies fabricated with the use of the advanced technologies in the Chemical and Technological Division in 2010. It was successfully irradiated in the BN-600 reactor under conditions similar to the design conditions to operate fuel pins with vibro-packed mixed fuel in the BN-800 reactor. Figures 3.33 and 3.34 present the automated machine to fabricate fuel assemblies and the process to assemble a fuel pin bundle.

Figure 3.33. Automated machine to fabricate fuel assemblies

Figure 3.34. Fuel pin bundle assembling

To prepare the EFA fuel pins for the PIEs, the Vicond2 software was used to calculate expectable macro effects. The software is used as a tool to investigate and design fast neutron reactor vibro-packed fuel pins. Computational modeling of fuel pins was performed in accordance with the fuel pin specifications, FA passport data and input data on the BN-600 actual operating conditions provided by the staff of the Beloyarskaya NPP. The purpose of the calculations was to determine the FA performance range as well as to perform an objective assessment and adjustment of the Vikond2 software.

Under the Contract, the results of the PIEs were summarized and recommendations were developed on further use and improvement of the technique to fabricate vibro-packed MOX fuel pins.

Improvement of the fuel pins fabrication technique (layer-by-layer filling of granulate into the mixer, specific techniques to mix granulate, filling of granulate into the fuel pin cladding, vibro-packing and other improvements) ensured a good performance (serviceability) of the fuel pins.

It was recommended that further R&D in the field of MOX fuel pins and their use in fast neutron reactors be performed in the following areas:

- Fabrication and use of a labeled getter (uranium and Mn-54 alloy) or a light getter (uranium-zirconium alloy) to allow the uniformity of the getter distribution along the fuel meat to be controlled by non-destructive techniques;
- Mastering the technique of synchronous batching while filling the fuel meat granulated components into the fuel pin cladding for axial profiling of the fuel meat composition.

3.4. INTERNATIONAL COOPERATION

JSC “SSC RIAR” implements international activities through direct sales, integrated scientific and technical collaboration in international projects and organizations, and through information exchange.

The target audience of the sales market are customers interested in comprehensive research in the field of irradiation testing and post-irradiation examinations of experimental samples of nuclear fuel and structural materials of the advanced reactors cores, users of radionuclide products of standard industrial, scientific-technical and medical application, and international organizations aiming at coordinating the cooperation and developing the common views in issues concerning key aspects of the nuclear engineering development. Therefore, the consumer market has a narrow focus, is limited in number of permanent participants, is rather stable and conservative.

Used instruments and forms of cooperation are as follows:

- Joint research under contracts (direct sales);
- Participation in the work of international organizations;
- Work in technical committees and working groups, annual plenary and expert meetings;
- participation in international projects;
- international conferences, forums, workshops, exhibitions;
- schools, trainings, technical visits;
- information exchange.

INTERNATIONAL COOPERATION WITH KEY PARTNERS

Our product range formed according to the specifics of main RIAR activities. The competitiveness of the products is based on the RIAR unique reactors and research facilities.

The key areas of cooperation are as follows:

- nuclear reactor physics and engineering, irradiation techniques, problems of research reactor conversion;
- reactor material science, techniques to test materials and components of nuclear reactors;
- safety of nuclear reactors and atomic energy;
- radiochemistry and fuel cycles, advanced research in the area of closed nuclear fuel cycle;
- radionuclide sources and chemicals, development of techniques to produce radionuclides for nuclear medicine;
- upgrades of the nuclear material physical protection, control and accounting system under the program of international technical assistance.

In the reporting period, joint research on irradiation testing of nuclear fuel and structural materials of the advanced reactor cores was continued under previously concluded contracts. Our traditional partners, leading international companies which can perform competitive research and development in the field of new materials and technologies for both future nuclear reactors and nuclear engineering, are as follows:

1. **TerraPower Company (USA).** Since May 2012, RIAR has been implementing the contract "Study of radiation resistance of TWR reactor structural materials under high-temperature irradiation in the BOR-60 reactor". The plan is to perform the experiments till 2020. In 2014, RIAR started the next stage of cooperation – research in the field of fuel materials irradiation. The feasibility study contract is signed for nearly two years due to the difficulties in manufacturing and delivering such fuel.

2. **Korea Atomic Energy Research Institute (KAERI).** In 2014, the contract under the tripartite agreement between the Korea Atomic Energy Research Institute, JSC "SSC RIAR" and FSUE "RFNC-VNIIEF" to perform preliminary work and post-irradiation examinations of the uranium-zirconium metallic fuel under reactivity-initiated accident conditions was successfully completed. Following continuous multi-stage negotiations, the work started to perform the large-scale testing of fuel elements and structural materials. In 2014, two contracts were signed to preliminary elaborate designs of irradiation rigs and irradiation scenarios and to irradiate structural materials in the BOR-60 reactor.

A draft contract on irradiation of fuel elements is under discussion and agreement and expected to be signed in 2015. To implement this contract, the logistics schemes are to be elaborated to bring the experimental FAs and fuel pins to the Russian Federation from South Korea.

3. **"AREVA" Company (France).** Irradiation testing of the zirconium alloy samples in the BOR-60 reactor and post-irradiation examinations are continued under the current contract. The second joint project under which the work is being performed aims at developing a technique to investigate stress corrosion cracking of the Inconel-718 samples under irradiation.

4. **Atomic Energy and Alternative Energies Commission (CEA, France).** The work is performed under the current contract to study radiation resistance of the fast reactor structural materials. More than twenty year experience in cooperating with the French colleagues speaks of the necessity of separating the functions and performing comparative investigations for the effective final result. Therefore, particular attention is paid to the storage conditions of the samples irradiated and tested under previous contracts and the possibility of exchanging the samples. In 2014, three documents were signed in this respect.

5. **US Department of Energy, Argonne National Laboratory (USA).** Under the framework of the Implementing Agreement between the State Atomic Energy Corporation "ROSATOM" and US Department of Energy on cooperation in performing research to study the possibility of converting Russian research reactors into low-enriched uranium fuel, a Framework Agreement and three Work Orders were previously signed between JSC "SSC RIAR" and Argonne National Laboratory to perform feasibility studies and safety analysis of the MIR research reactor to evaluate the technical possibility of its conversion into low-enriched uranium fuel. In 2014, a fourth work order was signed which should complete the investigations and show the final result.

The second area of cooperation is irradiation testing of the IRT-3M type EFA containing low-enriched uranium-molybdenum fuel under the tripartite contract between Argonne National Laboratory, JSC "SSC RIAR" and JSC "TVEL". As per the contract, much of the work of the present stage is focused on JSC "NZKhK" (TVEL's area of responsibility) where the EFAs should be fabricated.

FORMS OF INTEGRATED COOPERATION

Events performed by the International Atomic Energy Agency

RIAR specialists attended the events such as:

- Meetings of the Iran's Nuclear Program Resolution Commission as technical consultations on possible modifications of the Iranian heavy-water reactor IR-40;
- Meeting of the working group to develop a document "Catalog on characteristics and possibilities aimed at developing innovative nuclear energy systems and technologies";
- Inspection visit to the research reactor "Mariya" (Poland) and Expert Meeting under the project "Enhancing Use and Safety of Research Reactors through Networking, Coalitions and Shared Best Practices";
- Regional workshop "Condition Based Maintenance and Preventive Maintenance" under the project "Strengthening the Potential of NPP Ageing Management to Extend Their Operation";
- International conference "Reduced Enrichment for Research and Test Reactors";
- Technical meeting to plan conversion of ^{99}Mo production from highly-enriched uranium to low-enriched uranium;
- International conference "Enhanced Utilization of Zero Power Reactors and Subcritical Assemblies";
- Training courses on radioactive waste management.

Events performed by the Nuclear Energy Agency of the Organization for Economic Cooperation and Development

Russia became a member of the Nuclear Energy Agency within the Organization for Economic Cooperation and Development, the intergovernmental organization comprising 31 member countries, from January 1, 2013.
Approximately 90 per cent of the worldwide NPP set power came from the OECD NEA Member States. The Agency assists participating Member-States in maintaining and developing scientific, technological and legal backgrounds for the safe, environmentally sound and economically viable use of atomic energy for the peaceful purposes. Russia's joining the OECD offers greater opportunities for promoting Russian nuclear technologies to the world market and making decisions on both future parameters of the nuclear energy development and effective protection of Russian interests, enables ROSATOM's organizations to fully use extensive and useful information, which includes data on reactor-material properties and calculation codes.

The executive (working) bodies of the Organization are seven technical committees and more than seventy working and expert groups incorporated into these Committees. The Nuclear Energy Agency of the Organization for Economic Cooperation and Development is also a technical secretariat of the "Generation-IV" Program.

RIAR experts cooperated with

- Delegation of the "Generation –IV" Secretariat headed by Mr. K. Matsumoto, the head of the NEA Data Bank, during their visit to Russia to identify areas of mutual interest and to get acquainted with the Russian research facilities;
- Contact persons of the NEA Data Bank;
- NEA Radioactive Waste Management Committee;
- Working group of the Nuclear Science Committee on scientific issues of the fuel cycle;
- Working group of the Nuclear Development Committee on Reliable Supply of Medical Radioisotopes.

Events performed by the CIS Member-States Commission on the Peaceful Use of Atomic Energy

In 2014, JSC "SSC RIAR", being the base organization of the CIS countries on the information exchange on nuclear research facilities operation and safety improvement, hosted the following events:

- International conference "Safety of Nuclear Research Facilities";
- Meeting of the deliberative body of the base organization of the CIS countries on the information exchange on safety of nuclear research facilities;
- CIS Research Reactor Coalition annual regional workshop.

RIAR PARTICIPATION IN INTERNATIONAL PROJECTS, SYMPOSIA AND CONFERENCES

In 2014, RIAR employees participated in the following projects:

- Russian-French working group "Sacsess-Pyrosmani" in the framework of coordinated projects between the ROSATOM SC and the European Atomic Energy Community;
- Steering Committee of the European Working Group "Hot Laboratories and Remote Handling";
- Russian-European project "ExoMars" to investigate the Mars and other bodies of the Solar System by robotic tools with the use of the neutron spectrometer FRIEND.

In 2014, RIAR employees attended the following events:

- Scientific Conference "New Materials for Innovative Development of Nuclear Power Engineering" devoted to the 50th anniversary of the RIAR Reactor Materials Testing Complex; scientists from the USA, Japan, South Korea, China, Germany, Norway, Hungary and Kazakhstan were invited;
- Annual Congress of the European Association of Nuclear Medicine;
- International Conference "Light-Water Reactor Fuel Performance";
- International Symposium "Contribution of Materials Investigations and Operating Experience to LWRs' Safety, Performance and Reliability" (Fontevraud–8);
- International Conference "Asian Nuclear Prospects: Safe and Sustainable Nuclear Systems for the Future (South Korea);
- 8th International Conference on Isotopes – the 8th ICI (USA);
- 17th Radiochemistry Conference "RadChem–2014" (Czech Republic).

PRACTICAL STUDIES, SCHOOLS, TECHNICAL VISITS

In 2014, RIAR employees were sent for training and practical studies to:

- The Summer School on Actinide Science "TALISMAN – CEA Marcoule Summer School 2014 and Plenary meeting" (France);
- The Institute of Nuclear Physics, the Uzbekistan Academy of Sciences, to familiarize themselves with the experience in calculating nuclear reactor fuel cycles according to international rules; the trip was performed through the Presidential Program for Training Engineers in 2014.

In 2014, the following representatives of the foreign delegations visited JSC "SSC RIAR" to participate in the technical tours:

- A team from the Institute of Nuclear physics, the Uzbekistan Academy of Sciences under the IAEA Program "Production of Radioisotopes in Nuclear Reactors;
- A team from "The Paks Nuclear Power Plant" (Hungary) and "Hungarian Electric Networks ERBE" to learn from the work of the RIAR Reactor Materials Testing Complex;
- A team from Germany to learn from the work of the Department of Radionuclide Sources and Chemicals;
- A team from Germany to get acquainted with RIAR activities (in the framework of the Quality Day in the Ulyanovsk Region);

RIAR employees gave technical advice to adjust the equipment and sodium technology operations for the fast neutron reactor CEFR (China). At different times, more than one hundred Chinese specialists were trained at the training simulator and BOR-60 reactor.

57 foreign delegations from 22 countries represented by 166 experts visited JSC “SSC RIAR” in 2014. More than 120 RIAR employees went abroad to 25 countries throughout the world; more than 100 experts attended 40 Russian hosted international events.

MAJOR EVENTS AND ACHIEVEMENTS

The major Company achievements in the field of international cooperation are presented in Fig. 3.35.

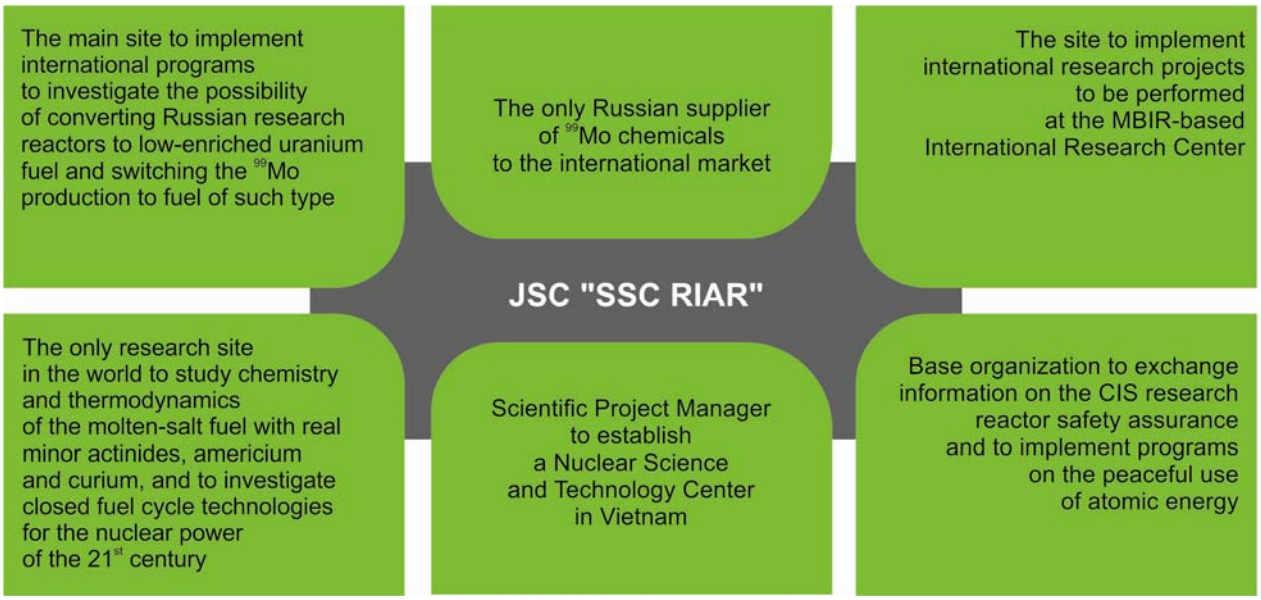


Figure 3.35. Major RIAR achievements in the international cooperation

36 scientific and technical reports were sent to the Customers on paper and electronic media in the framework of 25 current R&D contracts.

RIAR obtained more than sixty export licenses of the Federal Service on Technical and Export Control, seven decisions from the Center of Independent Identification Expertise, fourteen decisions were obtained from the Export Council of the State Atomic Energy Corporation ROSATOM.

Despite the political instability in the world and related sanctions, JSC “SSC RIAR” fulfilled all obligations under the contracts.

4

SUSTAINABLE DEVELOPMENT ACTIVITIES

Responsibility for the work results
is a basis for the effective work
of each employee and the whole industry

Artyom V. VARIVTSTEV,
Senior Researcher,
Research Reactor Complex
Grantee of the Russian Federation President's Scholarship

4.1. PUBLIC STANCE IN THE AREA OF SUSTAINABLE DEVELOPMENT

THE KEY PERFORMANCE INDICATORS OF THE HIGHEST GOVERNING BODY AND TOP MANAGEMENT IN RELATION TO ECONOMIC, ECOLOGICAL AND SOCIAL GOALS

Key performance indicators ensure business continuity of the organization, increase of employees' salary and provision of social guarantees to the employees.

The key performance indicators map comprises team, production and functional indicators established by the functional departments of SC ROSATOM. In the Top Management map, the financial and economic indicators make no less than 40 per cent of the total volume of key performance indicators. Examples of non-financial indicators may be the functional key performance indicator "No infringements of INES level 2 and higher", which performance is evaluated by lack of the mentioned infringements, and the indicator "The share of recent graduates under the age of 35 in the supervised organization".

With the start of new projects to establish the poly-functional radiochemical research complex and the multi-functional fast research reactor, 11 new high-tech workplaces were created in JSC "SSC RIAR" during the reporting year. These are the examples of implementing the key performance indicator "Creation of high-tech jobs".

The list of key performance indicators for the top management includes indicators related to the ecological environmental impact. The Director of RIAR is assigned responsibility for the environmental performance of the company. Top Management's responsibility for minimizing the environmental impact is also shared among the Chief Engineer and Deputy Directors. Responsibility for observing all requirements of the environmental laws is with the Chief Environmental Engineer of the company.

RELIABILITY AND SAFETY OF NUCLEAR REACTORS OPERATION

Reliability and safety of nuclear reactors operation are provided by means of specific activities. They include:

- Upgrading of the RIAR process equipment;
- Maintaining the existing regulations in production and technological process and during research reactors operation.

Ensuring accident-free, safe and sustainable operation of RIAR reactors is an essential condition for carrying out RIAR activities. JSC “SSC RIAR” conducts regular monitoring, performs a wide range of engineering activities to ensure faultless operation of nuclear research facilities, complies with all standards and considers all changes to the current Russian laws. In 2014, accident-free operation of RIAR nuclear research reactors was provided.

JSC “SSC RIAR” maintains a Radiation Safety Assurance System. The system functions in full compliance with the existing legislative, regulatory and legal acts of the Russian Federation, sanitary rules, standards, specifications, regulations, instructions and other documents. The key aspects of the System are as follows:

- Radiation monitoring;
- Control for release of radioactive substances to the environment;
- Maintaining the response forces on high-readiness;
- Maintaining additional resources.

More detailed information on nuclear and radiation safety risks can be found in Section 2.6. “Risk Management”, Chapter 2 “Corporate Governance”. Issues regarding occupational safety are described in Section 4.4. “Occupational Health and Safety” herein.

MINIMIZING THE ENVIRONMENTAL IMPACT

To minimize environmental risks (to indemnify environmental harm and damage), JSC "SSC RIAR" practices environmental insurance and funds reservation and elaborates Environmental Protection Plans. RIAR brought into force *the Environmental Policy*, which objective is to ensure such level of safety at the enterprise that the near- and long-term impact on the environment, personnel and population allows the natural systems to be conserved and their integrity and life-sustaining functions to be supported. The Company's integrated approach to the environmental impact management envisages full accountability and transparency of RIAR's environmental performance.

To achieve the objective and put into practice key principles of the Environmental Policy, JSC "SSC RIAR" assumed obligations to implement and maintain best environmental management practices according to international and national Environmental Management standards.

Improvement of the Environmental Management System and its certification for compliance with requirements of international standard ISO 14001 is an effective way to confirm RIAR commitment to environmental protection and an opportunity to increase RIAR competitive ability and develop interaction with stakeholders and general public.

The year 2014 was marked with the following events:

- Information and experience-sharing workshop "Retraining of Internal Management Systems Auditors under ISO 9001:2008 (GOST ISO 9001-2011) and ISO 14001:2004";
- Information and experience-sharing workshop "Integrated Management Systems: Quality, Ecology, Occupational Health and Labour Safety (ISO 9001:2008, ISO 14001:2004, OHSAS 18001:2007)";
- Face-to-face and online courses for managers and decision-makers of environmental protection. The courses were held in DETI NRNU MEPhI and titled "Environmental Policy, Safety and Environmental (Radiation) Monitoring at Nuclear Power Facilities".
- Diagnostic audit to assess conformance of the RIAR Management System to ISO 14001:2004 requirements. The audit was performed by Intersertifika TBK, LLC.

As compared to 2013, the amount of the generated waste decreased by 70.08 per cent in 2014 (Table 4.1).

Table 4.1

Dynamics of generation of various hazard classes waste

Class of hazard	Mass of waste generated per year, t		Reduction of waste mass, t / %
	2013	2014	
Class I	1.208	0.63	0.578/47.85
Class II	2.297	15.762	0/0
Class III	10.854	6.6	4.254/39.19
Class IV	222.924	96.457	126.467/56.73
Class V	1668.508	450.733	1217.78/72.99
Total	1905.791	570.182	1335.61/70.08

A comparison of data for 2013 shows that pollutant emissions decreased 5 times (by 80.32 per cent) in 2014. More detailed information on the emissions composition can be found in Table 4.2. Reduction of emissions is related to the reduction of emission sources as a result of a spinoff of several RIAR divisions, such as Heat and Power Station and Vehicle Fleet.

Table 4.2

Emissions of pollutants in to the air

Pollutants	Mass of pollutant emissions per year, t		Reduction of waste mass, t / %
	2013	2014	
Solid	13.596	12.408	1.188/8.74
Gaseous and liquid:	226.142	34.777	191.37/84.62
Including: Sulfur dioxide	48.463	22.487	25.976/53.6
Carbon oxide	49.191	4.025	45.166/91.82
Nitrous oxides (as NO_2)	118.893	3.257	115.64/97.26
Carbohydrates (without volatile organic compounds)	0.000	0.000	0.00/0.00
Volatile organic compounds	7.945	3.369	4.576/57.6
Others	1.650	1.639	0.011/0.67
Total	239.738	47.185	192.55/80.32

As compared with data from 2013, volume of the pollutants discharge with the storm sewage is on the decrease by 21.25 per cent (Table 4.3). Reduction of pollutants discharged with the storm water resulted from repairs performed by the Research and Engineering Service, reduction of on-site emissions discharged by “Alyanstransatom” company and decommissioning of the Suburban Operation Center.

Tablea 4.3

Pollutants discharge in water

Sewage water discharge	Mass of pollutants discharge per year, t		Reduction of waste mass, t/%
	2013	2014	
1	63.801	52.9749	10.8261/16.97
2	1.1826	0.6275	0.5551/46.94
3	7.8754	3.7744	4.101/52.07
Total	72.859	57.3768	15.4822/21.25

According to the data obtained by the Radiation Monitoring Laboratory belonging to the Environmental Protection Department, the mean year concentration of radionuclides in the air and sewage in the RIAR sanitary zone is 6–7 times lower in comparison to the values determined for population in NRB-99/2009.

DECENT WORKING CONDITIONS AND LABOUR SAFETY

At present, JSC “SSC RIAR” has accepted for execution an Integrated Action Plan to prevent personnel injury during construction and installation work at ROSATOM’s sites and elaborated its own Action Plan

to prevent personnel injury during construction and installation work performed in RIAR subdivisions and on its territory. Requirements of the integrated Action Plan to prevent personnel injury during construction and installation work at ROSATOM's sites are applicable to all entities of the ROSATOM Corporation. The purpose of implementing the integrated Action Plan is to ensure high level of operating culture, to reduce to the minimum industrial injuries and occupational illness, to protect health of RIAR employees, to increase labour productivity, additional motivation and to enhance work attractiveness.

In 2014, based on the results of the regional phase of the All-Russia competition "Russian Organization of High Social Efficiency'" (Protocol No. 03 of October 6, 2014;), JSC "SSC RIAR" was recognized the winner of the regional phase in the nomination category "For hampering industrial injuries and occupational illness in production companies" (Fig. 4.1).


ПРАВИТЕЛЬСТВО УЛЬЯНОВСКОЙ ОБЛАСТИ

ДИПЛОМ

НАГРАЖДАЕТСЯ

открытое акционерное общество «Государственный научный центр – Научно-исследовательский институт атомных реакторов»

победитель

областного этапа всероссийского конкурса «Российская организация высокой социальной эффективности» в 2014 году

в номинации

«За сокращение производственного травматизма и профессиональной заболеваемости в организациях производственной сферы»

Figure 4.1. Diploma of the Winner of the Regional Competition in the nomination category "For hampering industrial injuries and occupational illness in production companies"

TERRITORY ELABORATION

JSC "SSC RIAR" is one of the enterprises which play a crucial role in the local economy. The key strategic objectives brought forward by the ROSATOM State Corporation cannot be solved without improving the competitive advantages of Ulyanovsk Region in the Russian market and require due attention and efforts not only on the part of RIAR Management, but also on the part of Dimitrovgrad Administration. Such situation is typical for other ROSATOM's enterprises located in various regions of the country.
So, for a number of years the ROSATOM State Corporation consistently works to support and elaborate territories where ROSATOM's enterprises operate since this allows a number of strategic undertakings to be solved and ROSATOM's competitive advantages in the Russian and international markets to be improved. Interaction with local communities is developed on the basis of the ROSATOM's general strategy. The strategy entails an active collaboration with the government authorities and general public, generation and financial support of social and humanitarian projects which aim to achieve specific goals in specific territories.

In 2012, a set of documents on cooperation between the ROSATOM State Corporation and Russian regions on which territories atomic energy sites are located were signed.
As a result of these agreements, the cities have new, large-scale opportunities for the targeted additional funding of socially significant projects due to increase in tax payments transferred from ROSATOM's enterprises to the regional budgets of the RF since 2013. It should be noted that these agreements were concluded only with those regions on which territory

nuclear power plants or administrative-territorial units of nuclear industry are located. The only exception is the Ulyanovsk Region. This reflects that the ROSATOM Management pays much attention to the development of the territory where JSC "SSC RIAR" is located since the assigned ambitious objectives for RIAR development require major improvements of the infrastructure of Dimitrovgrad and bringing it into compliance with the highest world standards.

In the Ulyanovsk region, as part of the Cooperation Agreement No. 55-DP as of November 30, 2012, concluded between the ROSATOM State Corporation and the Ulyanovsk Region Government, a program was adopted to develop the infrastructure of the municipal entity "City of Dimitrovgrad". The program was launched at the expense of additional interbudgetary transfers from the regional budget of the Ulyanovsk region (the Ulyanovsk Region Government Order No. 488-P as of October 23, 2013).

The program is to be implemented in the years 2013–2016 and envisages a number of activities in the following areas:

- **Healthy lifestyle:** actions in this area are oriented to the development of the sport infrastructure in the city to increase the number of people involved in sport activities.

- **Education and Culture:** the activities in this area aim at creating:

  – a networking cooperation system for educational institutions of all types to ensure development of the human capacity;

  – an up-to-date library center to improve the informatization of the society and provide its sustainable intellectual development;

  – cultural facilities.

- **Construction and rehabilitation of roads in the surrounding areas.**

- **Housing and utilities sector, beautification of the city:** actions in this area aim at:

  – supplying in full volume water for the citizens of the west part of the city;

  – elaborating the engineering infrastructure and city landscape;

  – supporting privileged categories of citizens;

  – ensuring safety of the population;

  – updating existing facilities and increasing their production capacity to collect, remove and dispose solid household garbage and bulky waste generated in the city.

The Program is funded at the expense of additional interbudgetary transfers from the Ulyanovsk region budget and makes up RUB 680.5 million, of which:
121.88 million rubles were allocated in 2013,
142.95 million rubles – in 2014,
243.26 million rubles – in 2015 and
172.5 million rubles will be allocated in 2016.

NUCLEAR INNOVATION CLUSTER IN DIMITROVGRAD, ULYANOVSK REGION

Nuclear Innovation Cluster in Dimitrovgrad, Ulyanovsk region, was established in 2010 and is seen as a key instrument for the Dimitrovgrad and Ulyanovsk region development. The Cluster was developed through the active role of all stakeholders: the Dimitrovgrad Administration, Government of the Ulyanovsk region, ROSATOM State Nuclear Energy Corporation, Federal Medical and Biological Agency under the RF Ministry of Health and Social Development, "AKME-Engineering" company.

The relevance of the Nuclear Innovation Cluster is to foster an integrated infrastructure oriented to generation, packaging, commercialization and establishment of innovation projects in the area of nuclear engineering and medicine. The Cluster's core is JSC "SSC RIAR".

At present, the Cluster participants have been added with organizations which form and develop the Cluster's base areas of study. These organizations include large state-owned and private companies, educational institutions, small and mid-sized businesses as well as State Authorities. As of the end of 2014, 31 organizations enter the Cluster. Currently, an intense work is being carried out to attract new participants who can ensure a further development of the Cluster.

In 2012–2014, with the active collaboration of the Ulyanovsk Region Government, Dimitrovgrad Administration and the RF Ministry of Economic Development, the Program for Nuclear Innovation Cluster Development for 2013–2020 was elaborated and approved (the Ulyanovsk Region Government Order No. 623pr as of September 12, 2013).

Key projects of the Nuclear Innovation Cluster

1. Construction of the Federal High-Tech Center of Medical Radiology. The project is implemented as part of the State Program "Establishment of the Federal Centers of Medical Radiologic Technology" in compliance with the Order from President Vladimir Putin as of November 10, 2005. The plan exists for the Center to be brought into service in 2017. The designed capacity of the Center is as follows: to accommodate 18.000 hospital patients, to provide 17.000 diagnostic studies and 15.000 therapeutic measures as well as to support more than 115.000 ambulatory patients per year. Total investments in the Project are estimated at more than 19 billion rubles; the social and economic benefits from implementing the project will exceed 31.5 billion rubles per year.

2. **Construction of the research and production unit to develop and manufacture radiopharmaceuticals and healthcare products.** This is one of the most promising projects; it involves manufacture of common use medications. The problem of access to the fresh reactor-grade isotopic materials needed to produce medical isotopes and radiopharmaceuticals can be successfully solved with the unique RIAR reactors and Radiochemical Laboratory. In 2014, the special organization belonging to the Cluster, in cooperation with the Ulyanovsk Technology Transfer Center, and with the assistance of the ROSATOM experts and specialists from the Federal Medical and Biological Agency as well as other interested parties, formulated the concept of creation of the research and production unit to develop and manufacture radiopharmaceuticals and healthcare products. The concept was presented at the meeting of the Cluster Committee in October, 2014.

3. Establishment of the Molybdenum-99 production. This is one more successful project implemented in JSC "SSC RIAR". The project makes it possible to cover 100 per cent of the ^{99}Mo need in the internal market and to take up to 20 per cent of the world market. In December 2010, the first process units of the ^{99}Mo production line were put into operation. At present, RIAR performs work to launch the second stage of the ^{99}Mo production line.

4. Construction of the Multipurpose Fast Research Reactor (MBIR). The project is implemented in compliance with the Federal Target Program "Nuclear Power Technologies of New generation for 2010–2015 and until 2020".

5. Construction of the Polyfunctional Research Radiochemical Complex. The Project is also implemented in compliance with the Federal Target Program "Nuclear Power Technologies of New Generation in 2015–2020 and until 2020".

The role of the Nuclear Innovation Cluster in the development of innovative infrastructures in the small and mid-sized businesses

In 2012, the independent non-commercial organization "The Center for Development of the Nuclear Innovation Cluster in Dimitrovgrad, Ulyanovsk Region" was created to assist the Cluster participants to bring their new products to market and to develop small innovative companies. While formulating the concept of the Organization's engineering activities, special attention was paid to the development of small and mid-sized business enterprises. The concept suggests that an up-to-date Multiple-Access Center to be established to provide engineering services with the use of absolutely unique in Russia equipment which can be used in nuclear and machine building industries as well as in private sector. Such a center is seen as an essential condition for establishment of cooperative relations between small and mid-sized businesses. Accumulation of the services provided, specialists, scientific and educational institutions together with the complex of process equipment allows a pilot production site to be created to ensure much progress for small and mid-sized business enterprises which work to study application of new materials in the nuclear industry, to develop both production methods for products used in nuclear power installations (operational and under construction) and samples of innovative products. The Center for Development of the Nuclear Innovation Cluster in Dimitrovgrad, Ulyanovsk Region, assists in the development of innovative business enterprises. As part of the Cluster, a number of small innovative enterprises have been created and operate. They are:

- "Modern Technologies Innovative Company", LLC – the enterprise specialized in the development and production of medical self-solvable intravascular implants.
- "Atomtechservis", LLC – the company producing high-density ceramics made from non-metal powders. The ceramics have homogeneous microstructure and high values of boron stress-strain properties. They can be used in the fast reactor control and protection systems.
- "TestGen", LLC – the company performing research in the field of molecular genetic diagnostics. The products can be used in molecular biology, medicine, agriculture and animal industry.

Media Support and Promotion of Nuclear Innovation Cluster

In 2013, the Information Center of the Nuclear Innovation Cluster in Dimitrovgrad was created to quickly and fully inform the public about the Cluster development. The Information Center is a multifunctional ongoing information and technical complex which aims to provide a united information space for communication

between the member companies, to develop cross-cluster cooperation, to meet the needs of the population in obtaining information and to create an effective feedback system.

Development of International Cooperation

As part of the international cooperation, the independent non-commercial organization "The Center for Development of the Nuclear Innovation Cluster in Dimitrovgrad, Ulyanovsk Region", along with the "France Clusters" company (France), is implementing an educational program-forum-seminar (discussion platform) of the areal innovative clusters of atomic, aviation, biotechnological and medical nature. The first step of the program was successfully accomplished in December 2014 in Dimitrovgrad.
As to the engineering activities, the cooperation with Japan is actively developing: the Japanese specialists provided training for the employees of the Center for Development of the Nuclear Innovation Cluster in Dimitrovgrad, Ulyanovsk Region, in the operation of the unique equipment which constitutes material and technical facilities of the modern Multi-Access Center for small and mid-sized business enterprises. Further training is being negotiated now.

A cooperation agreement with the ROSATOM State Corporation was signed to strengthen cooperation and broaden partnership when implementing joint projects of the Cluster organizations.

Development of the professional improvement and personnel training system

The development of the Nuclear Innovation Cluster will require a great number of highly-qualified specialists (more than 4 thousand people). The ROSATOM State Corporation and FMBA of the RF Ministry for Healthcare and Social Development started preparing proposals to solve personnel problem. Dimitrovgrad branch of the higher profession-oriented education institution (DETI NRNU MEPhI) was created; agreements on specialist training were signed with the leading Cluster participants.

DETI NRNU MEPhI annually prepares 1800 higher education professionals and 900 specialists with a specialized secondary education diploma.

Since 2013, Children's Nuclear Medical Academy exists owing to the JSC "SSC RIAR" and DETI NRNU MEPhI efforts.

PUBLIC STANCE IN THE AREA OF SUSTAINABLE DEVELOPMENT AND STAKEHOLDER ENGAGEMENT

In the reporting year, JSC "SSC RIAR" continued participating in the project related to the Institute's public stance on the issues related to corporate social responsibility. The project aims at creating Trust Translation Channels through interactions with the stakeholders and in compliance with the requirements of the AA 1000 SES international standard.

As to the stakeholder engagement process, JSC "SSC RIAR" realizes its responsibility for creating mutually beneficial, partnership and public relations on the basis of a regular and constructive dialogue and adheres to the following basic principles:

- Respect and consideration for the interests, views and preferences, inclusive the respect for history, culture, traditions, the way of life

and heritage of the people living within the territory of RIAR operation;

- Openness and transparency;
- Trust and sincerity;
- Full compliance with the laws;
- Consideration of Russian and international standards;
- Keeping the stakeholders informed in a timely manner;
- Regular stakeholder engagement;
- Careful performance of obligations.

JSC “SSC RIAR” aims at ensuring the highest level of openness and transparency in its activities and the stakeholder engagement works towards this purpose (more detailed information can be found in Chapter 5 “Enhancement of the Public Reporting System and Stakeholder Engagement).

JSC “SSC RIAR” communicates with all stakeholders and furnishes them with the information on all aspects of RIAR activities as well as speedily responds to demands and wishes of all stakeholders.

RIAR Management implements consistently principles of the corporate information policy: timeliness and accessibility of the disclosed information, its accuracy and completeness and also maintains a proper balance between the Company’s transparency and its commercial interests. For the purpose of the successful implementation of the transparency policy, RIAR uses all currently available forms of communication: the integrated public annual report, Internet, questionnaires, press conferences, public dialogues, consultations, arrangement of stakeholders’ on-site visits, etc.

RIAR tasks in the field of Personnel Management issue from the strategic goals of the enterprise and ambitious objectives set by the ROSATOM State Corporation in the belief that JSC “SSC RIAR” is the best site to implement such large-scale projects as the construction of a multipurpose fast research reactor and polyfunctional radiochemical research complex. Such belief can only mean that ROSATOM feels certain that RIAR and its specialists have key competences needed to construct and operate such facilities and provide knowledge-based services both in the national and world markets. To achieve these goals, RIAR needs a united team of highly professional and enthusiastic specialists; oriented to high labour productivity when every employee understands his responsibility for the work results. The main tasks of the RIAR Staff Service are to attract the best, to retain the experienced, to constantly maintain and develop professional competences.

Research Institute of Atomic Reactors sets the mission to become one of the most attractive employers in the region and, in the longer term, in the country, mostly for the graduates of higher and secondary vocational education establishments. As part of joint activities agreements, RIAR is actively cooperating with 25 higher education institutions and secondary vocational training schools of Dimitrovgrad, Ulyanovsk and Novovoronezh. At present, 251 learners are admitted and trained by higher education establishments of the Russian Federation specifically for RIAR, in a targeted manner. During the reporting period only, RIAR accepted 368 students for practical training and pre-graduation practice.

In 2014, RIAR employed best of the best graduates of the regional specialized institutions of higher education. RIAR is also becoming attractive for graduates of Moscow State University, the Russian Chemistry and Polytechnics University named after D.I. Mendeleev, Moscow Engineering and Physics Institute, Samara State Aerospace University and others. What attracts young people? It is an interesting and meaningful job, opportunities to build a rewarding career and to improve the professional level as well as the possibility of defending PhD theses. Currently, 29 young RIAR employees are engaged in post-graduate studies. Researchers are the key group of the RIAR staff; they ensure the required level of research and development in all main scientific and technical areas.

One of the RIAR priorities is maintenance and enhancement of all employees' proficiency. In 2014, approximately 1500 RIAR employees were trained and enhanced their professional and managerial competences. For this purpose, scientific competitions and professional skills contests are held and detailed in this Report.

In 2014, RIAR initiated a housing program. In our opinion, affordable housing is one of the most important elements to attract and retain the specialists. We thank all those who helped and are helping RIAR to implement the housing program, namely, the ROSATOM State Corporation and S.I. Morozov, the Governor of the Ulyanovsk Region Government. As late as in 2015, 135 RIAR employees will be able to move to the new apartments. Forty five more families will own new apartments in the first quarter of 2016.

Of course, we still face many unsolved challenges. The annual evaluation of the RIAR employees' engagement is one of the instruments to determine weaknesses and strengths in the RIAR life cycle. We understand that the system of financial and non-financial motivation of RIAR employees should be further adjusted and the link between the contribution of each employee to the achievement of goals (performed research-manufactured product) and their remuneration level should be clear to each employee. Resolving these issues is the main activity for 2015. The survey findings show that RIAR employees like their jobs, like people they work with, like to participate in the corporate events and a major part of the RIAR employees do not want to change the job. It means that the RIAR team is workable and the Institute has a great future. Only as a single team, we are able to overcome all difficulties, to solve all challenges and achieve the goals challenged by our State, ROSATOM State Corporation and RIAR itself.

4.2. SOCIAL POLICY AND STAFF MANAGEMENT

The main RIAR value is a team of highly professional specialists through which RIAR is making considerable progress for many years. For this very reason, maintaining the high quality of the employee potential, staff training and development, motivation, arrangement of social programs, social responsibility are considered to be the most important constituents of the RIAR social policy and reflected in the Collective Labour Agreement which cover all RIAR employees.

As at December 31, 2014, the total number of RIAR staff was 3937 persons of which 3935 persons had a full-time job and 2 persons were on short time work.

As compared to 2014, the staff number decreased by 14 per cent as a result of withdrawal of non-core assets planned for 2014. The average age of staff is 46 years; percentage of the employees up to 35 is 26 per cent. From 3937 RIAR employees, 1965 persons (49.9%) are graduates of higher educational establishments, of them 815 persons (20.7%) have higher industry-specific education.
More detailed staff age and professional competence information is given in Fig.4.2–4.8.
In 2014, the staff turnover was 2.91 per cent, which is 30.55 per cent less than in 2013.

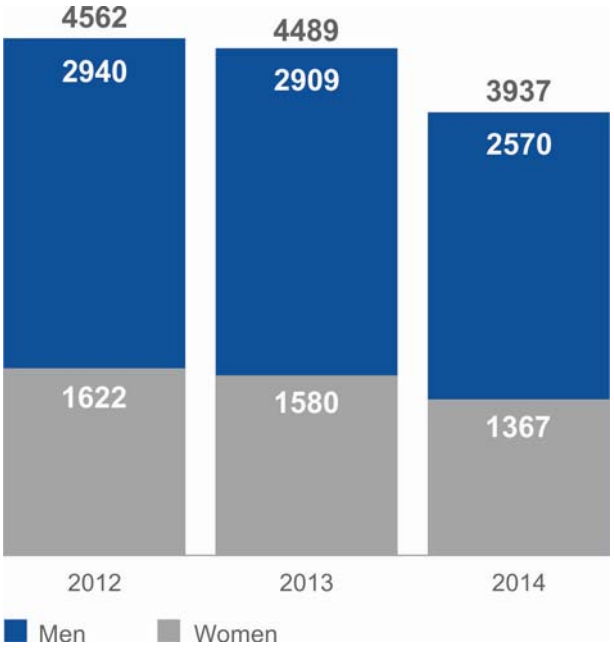


Figure 4.2. Dynamics of the staff number for years 2012–2014 broken down by gender

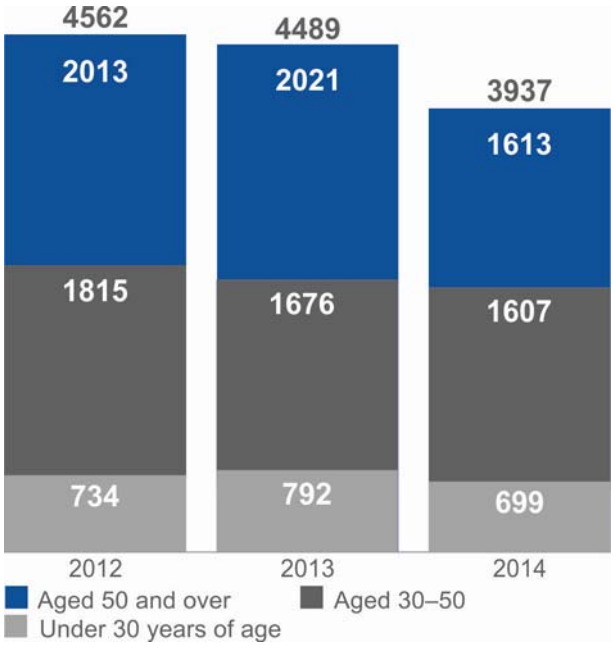


Figure 4.3. Dynamics of the staff number for years 2012–2014 broken down by age

In 2014, 115 employees had the right to the child care leave, among them is one man. All 115 persons exercised the right.

36 persons returned to work after the child care leave: one man and 35 women.
33 female-employees have been working

after return from the child care leave during 12 months.

12 employees retired during the child care leave: one man and 11 women.

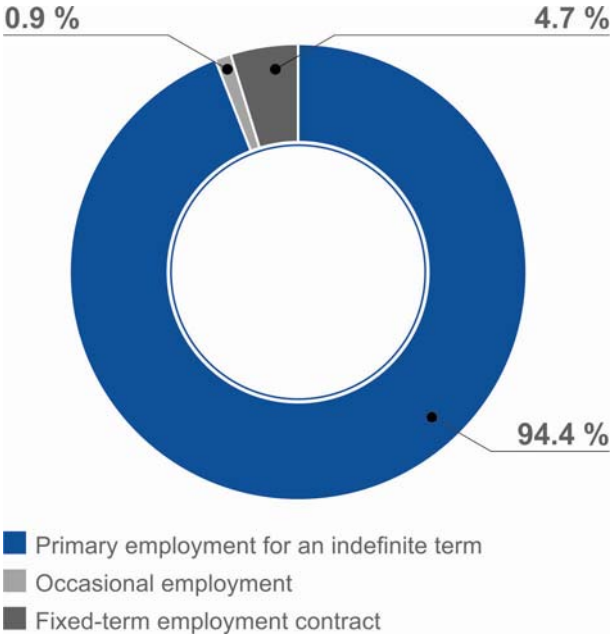


Figure 4.4. Total workforce broken down by employment contract

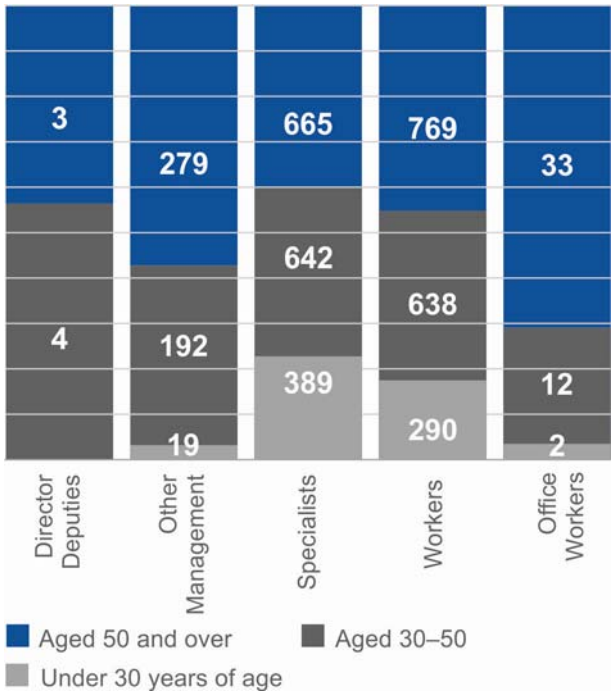


Figure 4.5. Staff composition and structure broken down by categories and age

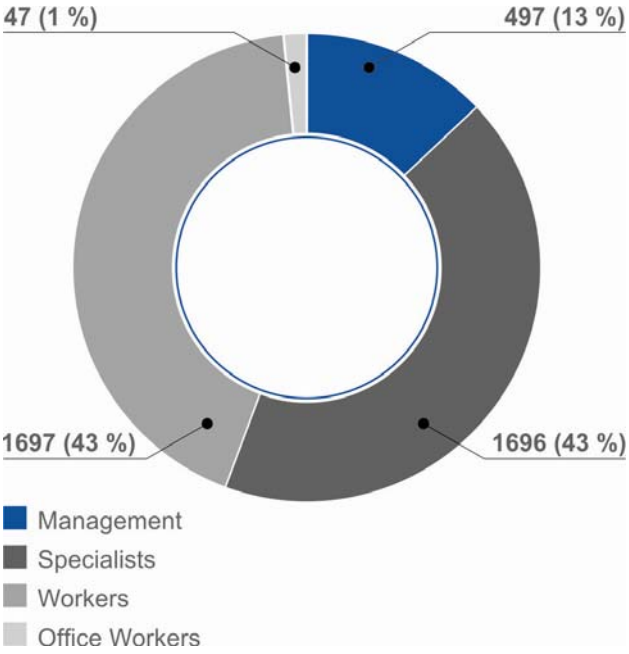
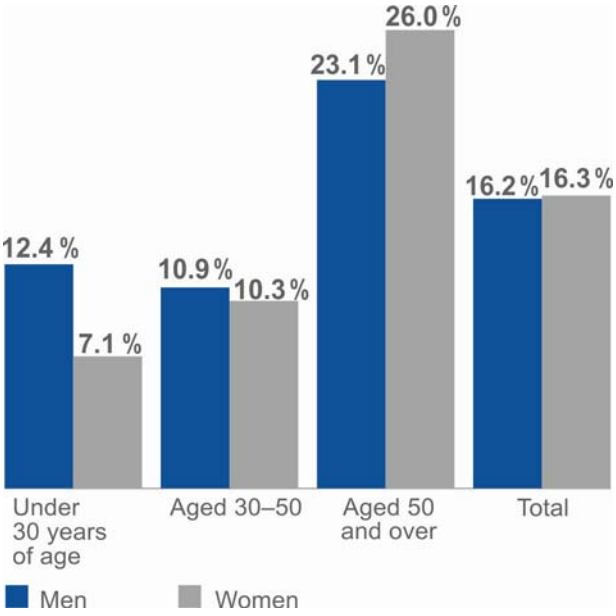


Figure 4.6. Staff number broken down by categories

Figure 4.7. Average age of employees of various categories



According to the Labour Legislation, the minimum period to inform the employees of the significant operational changes is specified in the Collective Labour Agreement and makes up 2 months.

Figure 4.8. Dismissed personnel by age and gender

REMUNERATION

One of the main principles of the RIAR remuneration system is to ensure equal opportunities for various age and gender groups. Differences in basic salaries of some worker groups relate to the fact that positions held by male and female workers were of different grades in 2014 (Table. 4.4).

Table 4.4

The relation between basic salaries of men and women

Category	Ratio of basic salary of women to basic salary of men by years, %	
	2013	2014
Workers	87.3	87.7
Specialists	87.8	88.5
Management	86.2	87.1

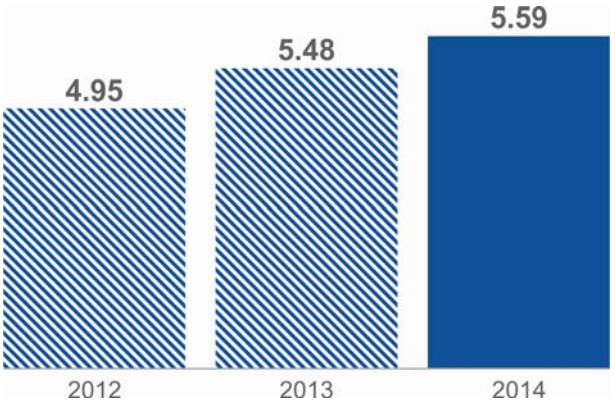


Figure 4.9 Change of the decimal coefficient

As economists and sociologists say, one of the most important indicators of the social tension in a collective is a decimal coefficient which characterizes level of differentiation in the pattern of remuneration of 10 per cent of high-paid employees to 10 per cent of low-paid workers. Data on the decimal coefficient dynamics are presented in Fig. 4.9. According to the world practice, the decimal coefficient in the range from 4 to 6 is considered optimal for the existence and development of the Organization.

SOCIAL POLICY IMPLEMENTED BY JSC “SSC RIAR”

To implement the ROSATOM’s single social policy and improve living standards of the RIAR’s employees, RIAR approved and successfully practises social stipulations the basic of which are specified in the Collective Labour Agreement for 2014-2017 adopted at the Conference of the Company employees on July 25, 2014. The Collective Labour Agreement for 2014-2017 is valid for all RIAR employees and percentage of employees covered by social programmers is 100 per cent.

To implement the social obligations, RIAR annually allocates funds to provide financial assistance for the employed and retirees, to partially pay permits for children’s health camps, to make payments in case of old-age retirement and invalidity, to provide services under the voluntary medical insurance program, to hold socio-cultural and sporting gatherings, etc. The scheme of social spending in 2014 is presented in Table 4.5.

Table 4.5

Social spending breakdown

Spending	Actual spending, thousand rubles
Lump sum payments (holiday and retirement payments)	10385.36
Financial assistance:	7638.0
- workers	3961.5
- retirees, veterans of the Great Patriotic War and home front workers	3676.5
Support for veterans’ organizations	468.3
Improving health of the employees’ children	824.1
Socio-cultural and sports events	1652.5
Social infrastructure support	36502.11
Housing improvements	700.2
Taxes for social spending	4302.9
Other social spending	23.8
Voluntary medical insurance	1804.32
Spending to support primary trade union organization	936.24
Total social spending	84200.0
Per employee	18.1
Healthful and dietary meals	55932.6

An effective system of interaction with the primary trade union organization is set up in RIAR. It contributes to the implementation of the single balanced policy aimed at representing and protecting the rights and legitimate interests of RIAR employees. In 2014, the RIAR primary trade union organization turned 55 years old. During this time, RIAR Management is actively cooperating with the RIAR trade union and many problems vital for the enterprise have been handled jointly.

The Russian Trade Union of Employees in the Nuclear Power and Industry awarded Tatyana Bogatova, Deputy Director for Staff Management and Social Development, with II Degree lapel pin “For Interaction and Social Partnership”.

In 2014, spending for social support of unemployed pensioners and financial assistance of RIAR employees was 23 per cent higher than in 2013 mainly owing to the growth in the financial assistance amounts. In accordance with the Collective Labour Agreement for 2014–2017, amounts of payments to support families and children were increased: within the framework of the action “Help to make ready for school” – 6 times; multi-child families and families with disabled children – 4 times, employees who are on leave to care children between the age of 1,5 and 3–2 times. Social spending per employee also increased – from 17.8 to 18.1 thousand rubles.

In late 2014, in order to attract and retain young specialists, to improve living conditions of young and highly-professional specialists and to motivate them for the long-term employment, RIAR started the Housing Improvement Program. Construction of a new residential neighborhood in Mendeleev Street began. The project is implemented with the support of V.V. Pershukov, Deputy Director General-Chief Innovation Officer of the ROSATOM SC, with the direct participation of S.I. Morozov, the Governor of the Ulyanovsk Region, and the Dimitrovgrad Administration. In October 2014, an agreement on the mutual interest and need to implement the project was signed with S.I. Morozov, the Governor-the Chairman of the Ulyanovsk Region Government, and agreements were reached to involve regional budget funds for the construction of the utilities system. The Housing Improvement Program offers young and highly-professional specialists to purchase housing on favorable conditions. In spite of the fact that the average price per square meter in the city is 36 thousand rubles, the price is set as 28 thousand rubles for square meter and assistance is also foreseen for the employees who enter the mortgage crediting program. Interest-free loans are provided for the initial payment on mortgage loans (300 thousand rubles for young and 150 thousand rubles for highly-professional specialists) or partial compensation of the mortgage interest rate is provided (10 per cent to young and 7 per cent to highly-professional specialists). The additional condition in granting the interest-free loan is the possibility to carry over the loan return to two years and to defer maturing up to 10 years. Under the Program, 180 families will improve their housing in 2015.

To improve health of the RIAR employees who need sanatorium or preventive treatment for health reasons, RIAR annually conducts activities for rehabilitation of RIAR employees and unemployed pensioners in the industry-sponsored sanatorium. In 2014, 438 employees and 164 unemployed pensioners received medical treatment in the industry-sponsored sanatorium, 104 permits to the children’s health camps were compensated.

In 2014, the voluntary medical insurance agreement was signed with SOGAZ insurance company and 1000 RIAR’s employees working in harmful or especially harmful working conditions had the opportunity to receive free medical services in health clinics of Dimitrovgrad, Ulyanovsk Region and Russia.

CORPORATE CULTURE AND SOCIAL POLICY

To create the internal organizational and industry–specific corporate culture, RIAR accepted corporate values of the ROSATOM State Corporation (Fig. 4.10).

To integrate industry-wide values into the working process and personal relationships between staff members, RIAR held a competition of presentations in which employees could illustrate their vision of ROSATOM values and demonstrate how they are applicable to work and everyday life. They could use any creative strategies and methods for visualization of their ideas. Within the competition, the Commission received 6 presentations in which RIAR employees demonstrated the application of the ROSATOM values in different areas of life: “Rosatom values in the Indian dance”, “Rosatom values are RIAR’s values”, “Rosatom values in proverbs and sayings”, “Rosatom values in the Company’s calendar”, “Rosatom values: pictograms” and “Rosatom values in the Institute”. Pieces of work were submitted in the form of presentations, audio and video files. As a result, all the participants were awarded with commemorative diplomas and gifts with the corporate symbols.

To involve the staff into the activates related to the development and analysis of the strategy, policy and RIAR plans in the area of staff management, the practice was introduced to hold meetings of focus-groups on various directions (for example, formulation of the Company and industry-specific values, estimation of the level of engagement) . 150 RIAR employees participated in the questioning of this type.

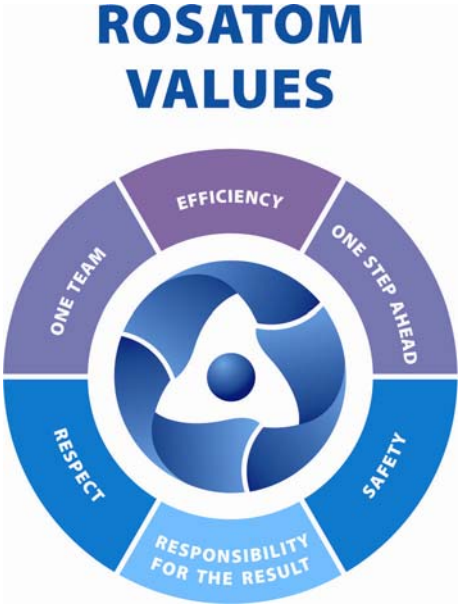


Figure 4.10. Corporate values of the ROSATOM State Corporation

The example of the innovative approach to the enhancement of personnel-related processes can be Information Days. Information Days are quarterly meetings of the RIAR Management with the employees to brief the workers about the current situation in RIAR and in the industry, to answer the questions and to arrange the feedback. The program of the Information Day includes the following: a video clip with the address of ROSATOM Director General Sergey Kirienko with the information about major events, stages of key projects, work done during the reporting period and objectives set for the divisions; an on-line questioning to evaluate work done by the RIAR Management; special trainings for the mid-level managers to draw up quality plans on employee engagement.

It should be noted that these methods allow the staff awareness of the activities performed both in RIAR and industry to be strengthened and the quality of the plans and strategies to be improved.

To put into proactive innovative methods and support a creative approach to the work as well as to provide the employees with the opportunities stimulating their engagement, RIAR annually holds the Conference of Young RIAR Specialists. During the conference, the young specialists present reports in various areas of investigations. Best employees are awarded with commemorative diplomas and monetary prizes.

A bright example of the event aimed at improving the young employee engagement was the youth forum “The Energy of Generations”. The forum took place in September 2014 and became a traditional event. The forum is held in cooperation with DETI NRNU MEPhI and the autonomous non-commercial organization “The Center for Development of the Nuclear Innovation Cluster in Dimitrovgrad”. For three days, young RIAR scientists, DETI NRNU MEPhI students, employees of the ROSATOM enterprises attended the forum. They participated in the flow “Innovation Leader” (Fig. 4.11).

Figure 4.11. Participants of the Youth Forum “The Energy of Generations”

The Forum Program included addresses from officials and guests, among them V.A. Pershukov, ROSATOM Deputy Director – Head of Innovation Management Block, S.V. Pavlov, RIAR Director, S.I. Morozov, the Ulyanovsk Region Governor. During the Forum, thematic round tables, business role-playing games, scientific quests (Fig. 4.12), discussions with experts, trainings and team building games (Fig. 4.13) were held. The forum participants had a unique opportunity to not only strengthen their knowledge in various fields, but also communicate in an informal atmosphere with the RIAR and ROSATOM Management (Fig. 4.14).

Figure 4.12. Participants of the Scientific Quest

Figure 4.13. Participants of the Team Building Game

Figure 4.14. Participants of the Youth Forum "The Energy of Generations" and RIAR Management

Figure 4.15. Participants of the Brain Quiz "What? Where? When?"

"Miss Atom" beauty contest was held in December, 2014. This is one more event organized in cooperation with DETI NRNU MEPhI and the autonomous non-commercial organization "The Center for Development of the Nuclear Innovation Cluster in Dimitrovgrad". 11 participants fought for the title of the most beautiful girl, among them were students from the DETI NRNU MEPhI institute and technical college and RIAR female employees. Being on stage, the contestants tried not only to show their various talents, but also to emphasize the importance of the ROSATOM values. As a result of the competition, all the participants were awarded diplomas and gifts and offered the audience an unforgettable soiree filled with beauty and creativity.

RIAR employees participate actively in various events; among them are different festivals organized at the regional and city levels: the Science Day, the City Day, the campaign "The City is proud of them", various scientific conferences, public hearings, etc. In 2014, on the initiative of the RIAR Youth Board, the brain quiz "What? Where? When?" was launched (Fig. 4.15). Initially, it was held within RIAR only. But the initiative was supported by Dimitrovgrad citizens and many teams ready to participate in the competition emerged in Dimitrovgrad.

As a result of the citywide tournament, the winners were awarded honorary prizes and diplomas (Fig. 4.16). The plan for the future is to organize the tournament at the regional level.

Figure 4.16. Awards for the Winners of the Brain Quiz "What? Where? When?"

RIAR arranges and hosts corporate events, gala evenings and ceremonies recognizing the best RIAR employees. These events are an integral part of the corporate social policy implemented in RIAR. RIAR corporate special events are as follows: the Day of Atomic Industry's Employee, RIAR birthday, the Power Worker's Day. To celebrate these events, RIAR annually arranges gala evenings to honor the best employees who received industry, regional and city awards. They are also awarded with RIAR prizes and memorable gifts with the corporate symbols. Various creative crews from the Volga region cities are invited

to participate in these events. The events aim at creating a favorable social climate among the RIAR employees, sense of community and sense of worth, and, in other words, provide moral encouragement for the RIAR personnel. The reporting period was rich in various cultural events such as exhibitions, installations, concerts and performances. They were held in the RIAR Scientific and Cultural Center.

In 2014, RIAR arranged an Entertainment Day for children. The event "I will color the entire world" was devoted to the International Children's Day. Children of RIAR employees, school pupils and children from the City Public Organization for Invalids "Preodolenie" participated in the event. As part of the event, a children's drawing-on-asphalt contest (Fig. 4.17) and a festive concert were held. All participants were awarded with memorable diplomas, stuffed toys and sweets. RIAR has plans to also arrange such festivals in the future.

Figure 4.17. Children's drawing-on-asphalt contest

RIAR, along with the RIAR Veteran's Council, annually arranges special events devoted to the Victory Day and the Elderly People Day and organizes festal dinners. Veterans annually receive gifts for the anniversary dates and holidays. The participation of the Veteran's Council in the RIAR life is always welcomed. RIAR Management respects their wide professional and personal experiences. There is a tradition in RIAR to help families of the Veterans who are former RIAR staff members. Every year, on the eve of the Victory Day, RIAR employees go to the city cemetery to visit the tombs of the Veterans of the Great Patriotic War and the tombs of the home front workers who worked for the RIAR welfare at different times. The objectives of the visits are to maintain the tombs in a proper condition and to lay flowers. RIAR Management also participates in the events and annually visits the graves of the former employees who were Veterans of the Great Patriotic War and made a significant contribution to the RIAR development. Veterans and pensioners often visit RIAR divisions both in everyday life and on holidays. This is done to support the continuity of generations and to share experience.

In late 2014, the first New Year Reception by RIAR Director was held to improve the employee engagement and to reward the employees according to their merits. Best RIAR employees working in all spheres of the scientific and production process were invited. In a festive atmosphere, the guests shared their success stories, experience and knowledge acquired in RIAR.

PERSONNEL ENGAGEMENT

The key indicator of the perception among the RIAR staff of their employment is an annual engagement survey. The survey is performed by an independent consulting company. 19 engagement factors are distinguished. Each factor is associated with one question and the answer allows the degree of satisfaction with each factor to be determined. The degree of satisfaction with the factors influences the overall engagement in the company. Employees who participate in the survey are chosen in a random basis and the number of selected persons annually amounts to 20 per cent. In 2014, 835 persons from 15 RIAR divisions were surveyed. Below are the results on the engagement and satisfaction factors for the three years (Table 4.6).

Table 4.6

Results of the survey carried out among the RIAR personnel

Indicator	Percentage by year, %		
	2012	2013	2014
Engagement	36	51	73
Satisfaction	36	53	64

The "Self-sufficiency" factor characterizes the level of authority and employees' involvement in the managerial decision making and it is consistently improving during the last three years. The growth is seen for the factors "Career Opportunities" and "Education and Development". For example, 57 per cent of the surveyed employees consider their career opportunities attractive (Table 4.7).

The factor "Colleagues" evaluates the psychological climate in the team. The factors "Line Managers" and "Recognition" regulate the Staff – Management relations. The positive dynamics is seen for all these factors: 70 per cent of the surveyed employees consider that the direct managers provide enough support needed to achieve success (managers set goals, guide, ensure the work execution, etc).

Satisfaction with social background (comforts and services, remuneration and labour safety) is measured by the factors "Employee Benefits", "Working Conditions", "Wages" and "Resouces".

The positive dynamics for these factors can be explained by the implementation of 2012–2014 Engagement Plan which includes repairs of the social premises, equipment retrofit, elaboration of corporate social programs, etc. The engagement factors "Agreement of the Employer's Image", and "The Employer's Reputation" determine satisfaction with the activities of the RIAR and ROSATOM Management and RIAR's image as an Employer. The growth on these factors makes up 12 and 16 per cent per year, respectively. In 2014, some measures were taken to make the Top Management activities more transparent and perspicuous for the employees: Information Days, meetings with the staff, cultural events with participation of top-ranking officials, provision of the possibility of asking questions in on-line mode.

Table 4.7

Survey results according to engagement factors

Factor	Comparison across years, %		
	2012	2013	2014
Top Management	17	28	48
Line Managers	58	62	70
Colleagues	59	62	74
Value of employees	17	25	48
Job content	55	59	75
Satisfaction with the results	56	61	76
Self-sufficiency	41	43	62
Resources	18	26	44
Processes	26	33	50
Remuneration	9	19	35
Employee benefits	20	33	48
Recognition	22	37	48
Career opportunities	14	27	47
Education and development	27	40	57
Feedback	50	54	68
Employer's reputation	31	44	60
Agreement of the Employer's Image	26	36	58
Work-life balance	46	53	68
Working conditions	50	52	73
Policies and procedures	22	26	73

RIAR Management uses the survey results to produce annual plans on the engagement improvements.

While planning, RIAR leaders seek to take into account all comments and suggestions to rectify the RIAR processes.

NON-MONETARY INCENTIVES AND CHARITY

To improve the personnel motivation, RIAR employees are annually honored with awards of different types: internal, citywide, regional, industry specific and government.
RIAR employees are nominated to various awards in accordance with the approved regulations and on the occasion of corporate professional holidays (Table 4.8).

An increasing number of awards received by the RIAR employees in 2014 is primarily related to the fact that the reporting year was rich in jubilees. For example, the year 2014 marks the 45th anniversary of the BOR-60 reactor start-up, 30th anniversary of the RBT-10/2 reactor start-up and 50th anniversary since the RIAR Radiochemical Unit was put into operation.

Table 4.8

RIAR employees awarded

Types of awards	Comparison across years		
	2012	2013	2014
Industry specific orders, medals, merit badges, titles of honor, merit certificates and grateful letters	146	163	315
Federal and regional medals, merit certificates and public titles of honor	17	41	42
Citywide titles of honor, merit certificate, grateful letters	84	23	112
RIAR titles of honor, merit certificates, grateful letters	955	841	943
Awards and encouragement of other authorities	–	9	8

JSC SSC RIAR regularly renders charitable assistance (Table 4.9). In 2014, a contest of socially significant projects was held among the non-profit organizations in Dimitrovgrad. The main objective was to support initiatives of non-profit organizations to create and maintain a comfortable social environment in the areas where nuclear industry facilities operate. The winner was the public organization of invalids “Preodolenie” (Copability).

Table 4.9

Charitable assistance data

Addressee	Amounts , thousand rubles		
	2012	2013	2014
Orphan asylum “Planeta”(Universe)	40	50	–
Public organization of invalids “Preodolenie”(Copability)	–	150	100
Charitable aid for the refugees from the Ukraine	–	–	100
Wrestling Federation	120	30	–

PROVISION OF QUALIFIED STAFF

The implementation of key projects aims at developing the Institute and requires highly professional staff. So, RIAR Management pays much attention to staffing. Ensuring the supply of highly professional young specialists to RIAR is a complex task and long-lasting systematic efforts are needed in various RIAR sub-divisions and services.

The Youth Programs and the mentoring system are still in use in RIAR. In 2014, *Regulations for practical training of students of educational institutions in RIAR* were developed, approved by Order and put into practice.

The activities among the youth involve communications with schoolchildren for them to be professionally oriented and understand prospects of higher and secondary vocational education in specialties most popular in RIAR. These communications are held in Dimitrovgrad and Ulyanovsk as Open-Door Days in the DETI

NRNU MEPhI, Ulyanovsk State University and Ulyanovsk State Technical University. RIAR Management, officials from the Personnel Department and Internal and External Communications Office often participate in these events. Such work with the youth will allow RIAR to be staffed with the local population. For this very purpose, RIAR arranges excursions. Annually, 600–700 pupils and students from Dimitrovgrad, Ulyanovsk and the nearest regions (Samara and Penza, the Republic of Tatatrstan) visit the Institute.

The Information Center of the Nuclear Innovation Cluster in Dimitrovgrad is also meant to improve the effectiveness of the communications and efforts in the field of the future care paths of the students. The Information Center was opened as part of DETI NRNU MEPhI in 2013. JSC SSC RIAR is known to be a major actor of the Nuclear Innovation Cluster in Dimitrovgrad.

A Children's Nuclear Medical Academy has been operating successfully in Dimitrovgrad since 2009. It aims at in-depth practical-oriented study of such subjects as physics, chemistry, information technologies and foreign languages. The Academy is intended to develop the individual's motivation to knowledge and art, to provide additional possibilities and to satisfy children and juveniles' learning needs in the sphere of out-of school activities and leisure. The content of lessons at the Children's Nuclear Medical Academy goes beyond the frame of the school curriculum and allows the pupils' knowledge to be broadened, the schoolchildren to be attracted to research work and the school knowledge to be adapted in practice to the up-to-date technology and research methods. The teachers of the Academy are RIAR scientists, representatives of the higher education institutions of Dimitrovgrad, Ulyanovsk, Moscow and Russia's leading scientists.

The main indicator characterizing the RIAR work with the youth is sending the Dimitrovgrad school graduates for targeted training to the leading institutions of higher education in the country for them to get higher professional education on specialties popular in RIAR (Resolution of the Government of the Russian Federation of June 9, 2010, No. 421 "On state plan to prepare scientific workers, specialists and labour force for the enterprises of the defense-industrial sector for 2011–2015". In 2014, 39 school graduates from Dimitrovgrad were sent for targeted training to 16 higher education institutions in Russia. 110 pupils studying at schools in Dimitrovgrad and Ulyanovsk region are in the application for the targeted training in 2015. Government-financed places are apportioned for the sent graduates (the Order of the Ministry of Education and Science of July 9, 2014, No. 736 "On setting the task of the state plan to prepare specialists for the enterprises of the defense-industrial sector for 2011–2015 for higher education institutions overseen by the Ministry of Education and Science for training under educational programs of higher education (bachelor's degree, specialists and master's degree) for 2015". For the RIAR employees, the targeted training is performed in accordance with Annex 9-1 "The ordinance about sending the young RIAR employees for training (on-the-job training) to the higher education institutions of the Russian Federation" to the Collective Labour Agreement for 2014–2017 which was accepted at the conference of the RIAR employees on July 25, 2014 and approved by the Board of Directors (Protocol No. 252 of December 12, 2014). At present, 13 RIAR employees are on-the-job targeted training and the tuition fee is covered in full or partially depending on their academic performance. As of the end of 2014, 251 students have been sent by RIAR to the Russian higher education institutions for the targeted training.

An important component to solve the problem of RIAR staff targeted training is a comprehensive cooperation with the higher education institutions. Despite RIAR's participation in the education programs, such cooperation involves joint scientific and technical

activities. As of today, 32 joint activity agreements and contracts have been signed with 25 higher education institutions. Among them are:

- Federal State Autonomous Educational Institution of Higher Professional Education "National Research Nuclear University – Moscow Engineering Physics Institute" ;
- Dimitrovgrad Engineering and Technical Institute – the NRNU MEPhI branch;
- Obninsk Institute of Atomic Energy – the NRNU MEPhI branch
- Seversk State Technological Institute – the NRNU MEPhI branch;
- Federal State Budgetary Educational Institution of Higher Professional Education "Moscow State University named after M.V. Lomonosov";
- Federal State Autonomous Educational Institution of Higher Professional Education "The Ural Federal University named after the first President of Russia B.N. Yeltsin";
- Federal State Budgetary Educational Institution of Higher Professional Education "Tomsk Polytechnic University";
- Federal State Budgetary Educational Institution of Higher Professional Education "Ulyanovsk State University";
- Federal State Budgetary Educational Institution of Higher Professional Education "Ulyanovsk State Technical University";
- Federal State Budgetary Educational Institution of Higher Professional Education "Kazan State Power Engineering University";
- Federal State Autonomous Educational Institution of Higher Professional Education "Kazan (Volga Region) Federal University";
- Federal State Budgetary Educational Institution of Higher Professional Education "National Research University – Moscow Power Engineering Institute";
- Federal State Budgetary Educational Institution of Higher Professional Education "Nizhniy Novgorod State Technical University named after R.E. Alekseev";
- Federal State Budgetary Educational Institution of Higher Professional Education 'Russian State University of Tourism and Service";
- Federal State Budgetary Educational Institution of Higher Professional Education "Ivanovo State Power Engineering University named after V.I. Lenin";
- Technological Institute-branch of the Federal State Budgetary Educational Institution of Higher Professional Education "Ulyanovsk State Agricultural Academy named after P.A. Stolypin";
- Federal State Budgetary Educational Institution of Higher Professional Education "The Chuvash State University named after I.N. Ulianov";
- Federal State Budgetary Educational Institute ion of Higher Professional Education 'The Siberian State Aerospace University named after Academician M.F. Reshetnev";
- The Ulyanovsk branch of the Federal State Budgetary Educational Institution of Higher Professional Education "Moscow State University of Technologies and Management named after K.G. Razumovskiy".

In 2013, a Memorandum of Cooperation was signed between JSC "SSC RIAR" and DETI NRNU MEPhI to improve the quality of education, to share experience and advanced knowledge, to implement joint projects and to strengthen relations between the RIAR young specialists and the students. On September 19–21, 2014, RIAR and DETI NRNU MEPhI, with the support of the Ulyanovsk Region Government, prepared and carried out the youth forum "The Energy of Generations". 120 students and young RIAR specialists attended the forum. The forum is expected to be industry-oriented since 2015 and attended by the young people of the Ulyanovsk region and nuclear industry.

RIAR's interests being taken in full account, long-term agreements were concluded with the Federal State Budgetary Educational Institutions of Higher Professional Education

"Ulyanovsk State University", "Ulyanovsk State Technical University" and "Togliatti State University" for them to perform contract-based targeted training of competent specialists for the ROSATOM enterprises.

The following areas of cooperation are now being developed with the higher education institutions:

1. Organization and conducting vocational practice of all types in RIAR: trained practice, production practice, research practice and pre-graduation practice.

In 2014, 368 students of higher education institutions had practice in RIAR; among them are 240 students of DETI NRNU MEPhI and 63 students of colleges. As a result, 25 students of various institutions were offered jobs in RIAR

2. Involving RIAR leading scientists in teaching activities (lecturing to students, conducting labs and tutorial classes).

Whereas in 2013 only 36 RIAR employees worked as lecturers in Dimitrovgrad Engineering and Technical Institute and 7 employees worked in Ulyanovsk State University, in 2014–2015 the number has risen to 38 and 8, respectively. To enhance learning and implement targeted training, basic specialized departments have been created and successfully operate in these universities. They are headed by the RIAR employees S.V. Pavlov (DETI NRNU MEPhI) and V.D. Risovany (USU). RIAR leading scientists are also invited to the board of examiners and certifying commissions and it makes it possible to control the quality of training.

3. Participation in the Institute management (DETI NRNU MEPhI).

5 RIAR employees are the members of the Academic Board of DETI NRNU MEPhI. They are:

- S.V. Pavlov, RIAR Director;
- V.V. Kalygin, Deputy Director for Science and Innovations;
- V.D. Risovany, RIAR Research Advisor;
- R.A. Kuznetsov, Head of the Department for Radionuclide Sources and Products ;
- V.A. Krasnoselov, Chief Advisor.

4. Joint research and development.

Joint research projects provide a unique opportunity to involve students in research and development RIAR is interested in.

Implementation of joint projects allows RIAR to have a steady stream of young professionals.

In 2014, RIAR employed 40 young professionals-graduates from 15 higher education institutions (mostly from Dimitrovgrad Engineering and Technical Institute, the MEPhI branch), among them 14 graduates who learnt under targeted training programs.

A ratio between the total expenses to support industry-specific higher education institutions to the number of young professionals graduated from them and employed is 86.3 thousand rubles per person.

The key RIAR personnel providing the high level of research and development in main areas of RIAR activities are highly qualified specialists: 90 persons hold academic degrees, among them 12 employees are Doctors of Science. In 2014, RIAR employees defended two doctoral dissertations. Highly-qualified specialists allow the RIAR production facilities to be operated and research to be performed at a high level, as illustrated by the data on papers published and conferences, symposia, exhibitions and fairs attended (Table 4.10).

Table 4.10

Data on papers published and events attended

Indicator	Number
Total number of papers in peer-reviewed scientific publications	49
Number of papers published in journals:	46
International	23
Russian	23
Number of published books, monographs, textbooks	1
Conferences, symposia, workshops, etc.:	123
Russian	97
International	26
in the CIS countries	1
Number of oral papers presented at conferences, symposia, workshops, etc.	54
Russian	44
International	10
In the CIS countries	2
Exhibitions and fairs:	6
Russian	5
International	1

STAFF DEVELOPMENT

Presented in Table 4.11 are the average hours of training per year per employee and by employee category, including the mandatory training, and the average training costs per employee by employee category, excluding the mandatory training.

Table 4.11

Average hours and expenses for training

Indicator	Category	For the trained personnel	Relative to the average staffing number	
			Employees within the category	RIAR staff
Average hours of training per employee, h	Managers	42,6	12,6	0,83
	Specialists	62,7	22,0	9,0
Training costs, thousand rubles	Managers	29,6	7,66	0,5
	Specialists	15,5	2,18	0,89

Professional appraisal of the RIAR Managers, specialists and workers is performed to determine if staff members are fit for the positions occupied, to increase the efficiency and improve business qualification, to strengthen the role

of the financial interest in the outcomes and to further improve recruitment and arrangement of the staff. The procedure and dates to carry out the professional appraisal are determined by the *Regulation on the Procedure to perform the RIAR staff Professional Appraisal*. When conducting annual professional appraisals, we use a corporate competency model developed by the ROSATOM SC and the professionalism assessment criteria developed in RIAR for each category of employees: managers, specialists, industrial and office workers.

Formation and development of the personnel reserve within the Company and industry offer a wide range of opportunities for career growth and professional development in RIAR, allow the performance motivation and involvement into profession to be improved, contribute to retention of unique specialists, talented and promising employees, lower dependency on the labour market (Table 4.12).
The personnel reserve serves as a primary source to fill vacancies and newly-established management positions in the Company. External candidates are recruited for the management positions if there is no worthy candidate in the personnel reserve. A multi-level management personnel reserve is being created in RIAR to plan the career of the key employees. The following corporate programs are being developed: “Heritage of Rosatom”, “Rosatom’s Scjool of Leadership”, “Capital of Rosatom”, “Talents of Rosatom”:

- programs “Heritage of Rosatom” and “Rosatom’s School of Leadership” (the highest level of reserve) are intended for the high level management, so called “Top-1000” level. Four RIAR managers are being trained under these programs: S.V. Pavlov, I.A. Knyazkin, T.V. Bogatova and A.L. Petelin;
- program “Rosatom’s Capital” (middle management level) is intended for the mid-level executives. One manager is being trained under this program: D.A. Kornilov;
- program “Rosatom’s Talents” (the initial level) is intended for promising specialists and line managers. Three specialists are being trained under the program: M.A. Solovyov, S.S. Poglyad, A.V. Varivtsev.

Table 4.12

Formation and development of the personnel reserve

Indicator	Value
Percentage of employees, %: for whom RIAR performs periodical professional and career development assessments	100
Appointed to open posts from the reserve list	100
Number of employees in the reserve list, men	29

The creation of the united personnel reserve system resulted in the change of attitude towards leadership in the industry. Programs for personnel reserve development allow the participants to improve their motivation and change their beliefs and behaviours, they give instruments for the management skills to be enhanced and personal and professional growth to be provided.

ALEXEY L. PETELIN

Chief Engineer

In 2014, as in the previous years, the primary goal of the Chief Engineer's staff was to ensure safety in operating RIAR facilities related to use of atomic energy, in particular nuclear research reactors.

Despite high capacity utilization factors, the number of disturbances did not exceed annual average for the past five years; nuclear safety parameters at nuclear reactors and nuclear hazardous sites involved in nuclear fuel cycle were kept. The system to control and account nuclear materials, products and waste functioned perfectly. The audits performed by the Rostekhnadzor Commission acknowledged the nuclear safety situation in RIAR satisfactory and being in compliance with the regulatory documents.

As for the radiation safety, our key objectives are as follows: to comply with the radiation dose limits, to optimize personnel radiation exposure, to maintain the existing level of gas-aerosol emission activity and, based on the regulatory documents, to provide methodical support and equipment for the radiation hazardous sites. In 2014, no cases were registered when the radiation dose limits were exceeded. Allowable emission threshold was not exceeded for all sources, either. In the frame of the 8th Russia National Conference "Ecology and Manufacture. Prospects of Environmental Protection Economic Mechanisms Development" (St. Petersburg, 2014) and based on the results of the competition RIAR was awarded a gold medal in the nomination "100 Best Organizations of Russia: Ecology and Ecological Management". The medal is acknowledged with a diploma and is considered to be a recognition of RIAR achievements in the field of environmental protection and environmental production safety provision.

The scheduled maintenance and repair of nuclear research reactors were performed in full scope. In accordance with the Federal Norms and Rules, much work was done to extend the lifetime of reactors BOR-60 and MIR as well as spent nuclear fuel storage facility and to obtain licenses permitting their further operation. A license was obtained to continue the AST-1 facility decommissioning till the end of 2019; the RBT-10/1 reactor was successfully decommissioned and written off the Rostekhnadzor register. Significant work was performed to bring the sites of use of atomic energy into the compliance with up-to-date safety requirements, to replace the equipment to increase its operational reliability and resistance to external hazards; the benefit of research performed was improved as well as the energy efficiency. The task on reducing the energy consumption in 2014 was fulfilled: in the reporting period, the energy saving was 25.7 per cent as compared to 2009.

In 2014, the activities were continued to maintain and improve emergency preparedness of the civil defense system in RIAR, to prevent and mitigate emergencies, to enhance the material and technical infrastructure. Special mention can be made of two projects: establishing the special-purpose Crisis Center in RIAR which was put into operation in 2014 and is used for personnel exercising and training, and updating the local alarm system which was also brought into effect.

An important constituent of the RIAR activities to provide comfortable and safe working conditions for the employees was a special assessment of 574 workplaces. The assessment was performed in 2014 in accordance with the amendments in the RF Labour Legislation. RIAR work in this direction was much appreciated: RIAR was awarded the first place in the Russia National Award (regional stage) “Russian Organization of High Social Efficiency” in the category “For hampering industrial injuries and occupational illness in production companies”.

4.3. ENVIRONMENTAL SAFETY

TOTAL ENVIRONMENTAL PROTECTION EXPENDITURES AND INVESTMENT

In 2014, the activities JSC SSC RIAR performs to mitigate and prevent negative impact on the environment and to wisely use natural resources were focused on the following: air protection, protection and sparing use of water resources, including collection and purification of sewage water, waste management, rehabilitation of soil and surface water, ensuring radiation safety of the environment. The actual expenditures on the RIAR environmental activities in 2014 are presented in Table 4.13.

Table 4.13

Environmental activity expenditures

Area of the environmental activity	Volume of expenditures, million rubles
Current cost	105.330
Incl. operational costs for:	101.113
Air protection and climate change prevention	45.204
Sewage water collection and purification	0.554
Waste management	24.003
Rehabilitation and protection of soil, surface and underground water	10.820
Ensuring radiation safety of the environment	18.806
Other environmental activities	1.726
Payments for environmental services :	4.217
Sewage water collection and purification	1.823
Waste management	0.061
Rehabilitation and protection of soli, surface and underground water	0.120
Ensuring radiation safety of the environment	1.585
Other environmental activities	0.628
Capital expenditures (protection and sparing use of water resources)	34.610
Total	139.940

In 2014, the total weight of the materials that are waste recycled or reused in RIAR was 2.5 t (used oil products (technical oil waste)). Percentage of recycled materials is 0.0025 per cent of total amount of the materials used in production in 2014.

Data on the use of the materials, their weight or volume are given in Table 4.14. Data on energy consumption and primary sources are presented in Tables 4.15–4.16.

The share of purchased or used materials which stability was certified by a third party is 100 per cent.

Table 4.14

Quantity of the materials used

Product type	Indicator value
Rolled steel, t	35
Tubes, m	3700
Overalls, pcs.	89012
Protective equipment, pcs.	19153
Diesel fuel, t	97
Oils and lubricants, kg	46615
Petrol, l	140600
Filter elements, pcs.	758
Isolation valves, pcs.	489
Commercial gas, t	3
Paper products, t	9
Chemicals agents, t	100
Chemicals , kg	5337
Ion exchange resins, m^3	3

Table 4.15

Direct energy consumption data

Energy source type	Amount	Energy, × $\times 10^4$ GJ	Total, thousand rubles
Electric power, thousand kW·h	118219.0	42.56	191031.7
Thermal power, Gcal	129251.0	54.11	133867.6
Natural and associated, thous. m^3	0.0	0.00	0.0
Heating oil, t	517.0	1.85	5837.1
Diesel fuel, t	132.0	0.56	10616.8
Gasoline, t	101.0	0.44	2760.7

Table 4.16

Indirect energy consumption data

Energy source type	Amount	Energy, × $\times 10^4$ GJ	Total, thousand rubles
Electric power, thousand kW h	35956.8	129.42	66020.5
Thermal energy, Gcal	56914.6	23.83	79360.1
Natural and associated gas, thous. m^3	0.0	0.00	0.0
Heating oil, t	0.0	0.00	0,0
Diesel fuel, t	89.0	0.38	7158.3
Gasoline, t	69.0	0.30	1886.0

Introduction of energy efficient technologies allows the RIAR dependence on non-renewable sources of energy to be shortened and the environmental impact resulted from energy production and conversion to be reduced. There is a growth in production and a decrease in energy output ratio in RIAR. Table 4.17 presents data on the amount of energy savings in 2014 resulting from reduced energy consumption and increased efficiency (modernization of the manufacturing processes, equipment replacement and readjustment, changes in the staff bahaviour) as compared with the base period of 2009 and the 2015 target for energy savings (colored blue in the Table). In 2014, the actual energy saving was 25.7 per cent as compared with 2009. The data presented were obtained by measuring energy consumption.

Table 4.17

Energy consumption

Energy source type	Energy consumption by years		Reduction in energy consumption per year as compared with the base period*			
	2009	2014	2011	2012	2013	2014
Thermal energy, thous. Gcal	170.7	128.6	6.1 (3.6)	7.1 (4.2)	17.1 (10.0)	42.1 (24.7)
Water, thous. m^3	8365.4	6599.4	1252.9 (15.0)	294.5 (3.5)	1203.2 (14.4)	1766 (21.1)
Electric power, thous. kW h	166242.0	129114	10046.4 (6.0)	15142.4 (9.1)	26302.0 (15.8)	37128.0 (22.3)
Sewage, thous.m^3	5114.9	2647.8	1732.2 (33.9)	1750.6 (34.2)	2698.7 (2.8)	2467.1 (48.2)
Actual energy saving as compared with the base period , %	–	**25,0**	7.8	9.04	16.3	25.7

* Given in brackets are values expressed as percentages.

The power supply system in RIAR includes generation and consumption of energy resources both produced by the RIAR facilities and purchased from third parties. The Program of Energy Saving and Energy Efficiency Improvement in RIAR in 2013–2017 makes provisions for organizational and technical arrangements which are being implemented in RIAR. In 2013 and 2014, such organizational arrangements as preservation of unused buildings and constructions, use of another heating system, change of the temperature schedule, adjustment of the heating networks and a widespread replacement of windows allow the annual savings to be 37 thousand Gcal for heat and 212 thous. m^3 for cold water. In 2013, thirteen commercial units to account energy consumption in RIAR were installed to meet the requirements of the *Regulations for commercial accounting of thermal energy, heat carriers* approved by Government Decision No. 1034 of November 18, 2013.

In 2014, a ROSATOM automated energy efficiency management system was put into operation in RIAR. The energy saving program has direct connection with other RIAR investment projects. For example, as part of the efforts to upgrade the principal electric power substation, replacement of the air circuit breakers with the sulfur-hexafluoride ones will allow the annual energy savings to be 104025 kW·h.

Elements of the Energy Management System are being implemented at the enterprise. Each year, specialists from the Energy Department show their competence and go through retraining in specialized educational institutions. In 2014, an employee from the Economics Department graduated from the institute, majoring in “Energy Management”. Based on the results of the first energy audit performed in RIAR, recommendations were developed on low- and mid-budget investment projects to reduce unproductive expenses and to improve energy efficiency in RIAR; the work to implement these measures began. The Energy Saving Program for 2013–2017 and Power Certificate were developed.

Indirect energy consumption by the Suppliers involves equipment manufacturing through subcontracts, use of vehicles for business trips of RIAR employees, staff transport to and from work, delivery of cargo, use of road-construction equipment, etc. In 2014 278.7495 tons of gasoline and diesel fuel were used for business trips, delivery of cargo and road building (Table 4.18). To reduce indirect energy consumption, the use of best available technologies and modern road-building machinery is expected to ensure lower emissions of polluting substances. The number of business trips is expected to be reduced, too.

Table 4.18

Fuel consumption, t

Fuel type	Quarter of the year 2014				Fuel consumption per year
	I	II	III	IV	
Gasoline (A-80, 92, 95)	52.136	5.972	5.826	6.5783	70.5123
Diesel fuel	88.603	25.286	33.0	61.3482	208.237

The total area of RIAR land is 3251.195 hectares, of which 104.87 hectares are owned, 1.67 hectares are under lease and 3144.65 hectares are in use. All lands are located on the territory of Melekessky district, Ulyanovsk region. RIAR controls a water use area on which territory the Cheremshan State Hydrological Reserve of region significance is located. The total area of the reserve is 2902 ha, it is of high conservation status and serves to protect fish stocks. The reserve is located in the north-east part of the Cheremshan bay waters of the Kyibyshev Reservoir in Melekessky district, Ulyanovsk region. The coordinates of its center are 49°51'3 E. and 54°14'9 N. The reserve serves as a breeding and feeding ground for many fish species and is used to preserve and recover the commercial fish stock in the Kyibyshev Reservoir.

Based on the results of the long-term monitoring, the impact of the organization's discharges of water and run-offs is insignificant and do not cause pollution of the habitats and change of the biological diversity. But, because of sewage discharged directly into the bay, the Reserve is still vulnerable.

On the territory around RIAR and within the impact area, 360 species of higher vascular plants were found, of which 12 species are listed in the Red Book of the Ulyanovsk region. The animal world includes 400 species of vertebrate and invertebrate animals. The reptiles and amphibians fauna includes 16 species, of which 2 species are listed in the Red Book of the Ulyanovsk region. The bird fauna includes 183 species: 32 species are listed in the Red Book of the Ulyanovsk region and 13 species are included into the Russian Red Book.
Water ecosystems are the rivers Erykla, Sosnovka, the Cheremsham bay of the Kyibyshev Reservoir. The list of fish inhabiting these pieces of water includes more than 30 species, of which 2 species are listed in the Red Book of the Ulyanovsk region. The invertebrate fauna is rather rich. One of the largest groups of the invertebrate animals is insects. The list of most frequent insects includes 270 species. Some insects are listed in the Red Book of the Ulyanovsk region and 2 species of butterflies are listed in the Russian Red Book.

No significant impact on biodiversity of the specially protected natural areas is observed from RIAR activities, products and services. RIAR activities could have the greatest impact on biodiversity in the water use area which is designated for sewage discharge and located in the specially protected natural area of the regional significance-the State Ichthyologic Reserve "Cheremshanskiy". The annual sewage discharge in the water use area is 3024 thousand m^3 and contains 52.974 t of pollutants.

To manage the biodiversity impact, RIAR implements various measures: cleaning the territories from unauthorized dumps, foresting, cleaning protective sanitary zones in the Cheremshan bay of the Kyibyshev Reservoir, and cleaning the other reservoirs.

The plan is to purchase farm-grown juvenile fish to put it into the bay, to use mechanical sewage treatment, to lay up-to-date storm water and sewage drains to reduce discharge of the polluted water into the water body. The nesting sites for the white-tailed eagles (pine forests in the RIAR forest district of the Cheremsham flood land) are expected to be a specially protected natural area or protective measures will be taken to preserve the nests. For example, RIAR has plans to stop woodcutting in this district. RIAR policy in the field of biodiversity management also involves continuous monitoring of the environment and periodical assessment of the environmental impact and ecological risks.

Table 4.19 presents data on the total amount of the withdrawn water with a breakdown for sources. The water intake data were obtained using both readings of the metering devices and the information provided by the water suppliers.

The water source significantly affected by RIAR withdrawal of water is the Cheremshan bay of the Kyibushev Reservoir located on the Volga River. This is the case of summer low-water periods. Significant impact is not seen during normal periods. In the area of subsoil use, a cone of depression appears when extracting drinking water.

Table 4.19

Data on the total amount of the withdrawn water

Water source	Location	Water consumption, thous. m^3
Surface water used to supply technical water and cool	The Cheremshan bay of the Kyibyshev Reservoir	10620.73
Underground water used for drinking and household and practical needs; from another water-supply system	"RIAR-Generation" Ltd.	248.06
	Suburban command point "Fakel" (Flame)	3.44
Sewage from other organizations	"RIAR-Generation" Ltd	–
Total	–	10868.79

Water is used multiply in production processes in RIAR. Volume of the reused water is 219 thous. m^3 per year. Recycling water supply systems as closed cycles (for example, to cool nuclear installations) are used in several production divisions and water is added periodically to compensate evaporation losses. Some operating procedures which need water cooling use a flow-through system as follows: a surface water body (water intake)-a cooled installation-a surface water body (water discharge). Both recycling water supply systems and flow-through systems use service water from the surface water body the Cheremsham bay of the Kuibyshev Reservoir. In 2014, water consumption in recycling water supply systems and flow-through systems was 265376 thous. m^3. In the reporting period, the share of recycled (recirculation) water in the total withdrawn water is 2000 per cent. In 2014, volume of the recycled water flowed through the RIAR cooling towers made up 95.7 per cent from the total water used for production. Water discharge from the soil system to the city's treatment facilities was 1003.08 thous. m^3. RIAR uses separate sewers to drain sewage water: an industrial storm sewer, a household sewage and special-purpose sewer lines for water contaminated with radionuclides. Sewage water contaminated with radionuclides goes to the storage facility suitable for underground disposal (isolation) of liquid radioactive waste.

JSC "SSC RIAR" discharges storm water into the inland fresh water system which is a part of the Volga River Basin. Data on the sewage water discharges in 2014 are given in Table 4.20.

Table 4.20

Sewage water discharges

A receiving water body	Sewage water discharge, thous. m^3
The Cheremshan bay of the Kyibyshev Reservoir	3024.00
The Erykla River	12.36
The Bolshoy Cheremshan River	3.10
Total	3039.46

The data in the Table were calculated strictly in accordance with the procedures approved as prescribed by Law and with the use of water intake meters. Sewage water discharge outside the RIAR territory is performed through the discharge outlets.

Table 4.21 presents data on the sewage water and receiving water bodies' quality. The data are based on the results of both the production control to evaluate the content of the pollutants in the sewage and sewage flow metering.

Table 4.21

The average of contaminant concentration in the water of surface water bodies

Indicator	Place to carry out controls						Maximum allowable concentration*, mg/dm^3
	The Cheremshan bay		The Erykla River		The Bolshoy Cheremshan River		
	Background cross section	Discharge cross section	Background cross section	Discharge cross section	Background cross section	Discharge cross sectiona	
Concentration of, mg/dm^3: Suspended substances	13.0	9.8	10.7	23.0	18.4	15.9	10.25
Dry residues	533	418	248	509	516	832	1000
Ammonium ions	0.48	0.35	0.33	0.08	0.20	0.70	0.5
Nitrate ions	4.0	0.15	6.1	0.92	2.15	7.4	40
Nitrite ions	0.079	0.011	0.078	0.008	0.024	0.296	0.08
Sulphates	117	82	0.000	72	122	165	100
Chlorides	19.7	28.2	1.47	60	15.2	190	300
Iron (total)	0.12	0.22	0.37	0.07	0.23	0.153	0.1
Copper	0.0015	0.0016	0.0005	0.0037	0.0012	0.0032	0.001
Zinc	0.0011	0.000	0.000	0.004	0.001	0.0112	0.01
Chrome (total)	0.000	0.000	0.000	0.011	0.000	0.000	–
Synthetic surfactants-anions	0.008	0.017	0.012	0.031	0.008	0.017	0.5
Phosphates (for P)	0.151	0.127	0.072	0.083	0.080	0.175	0.065
Oil products	0.026	0.035	0.541	0.42	0.019	0.039	0.05
BOD_{full}, mgO_2/ dm^3	2.9	12.0	4.6	1.5	4.3	5.7	3.0
Hydrogen value, ea. pH	7.9	8.0	7.7	7.9	8.2	7.7	6.5–8.5
Oxidation, mgO_2/ dm^3	4.3	8.4	6.7	1.7	4.3	1.5	7.0
Temperature, °C	9	18	12	24	15	12	–

*For water bodies of the fish economy

The sewage water discharge to the Cheremshan bay of the Kyibyshev Reservoir is performed through the system of interconnected pits where the water is partially purified. The discharge into the Erykla River is performed after water purification from oil products and suspended substances. Before being discharged into the Bolshoy Cheremshan River, the sewage water is purified with the use of biological techniques. There is no radioactive contamination in the sewage water discharged into the Cheremshan bay of the Kyibyshev Reservoir. The amount of pollutants discharged in 2014 is given in Table 4.22.

Table 4.22

Amount of discharged polluting substances, t/year

Names of substances	Place to discharge water		
	The Cheremshan bay	The Erykla River	The Bolshoy Cheremshan River
BOD $_{full}$	26.914	–	0.018
Suspended substances	–	0.124	0.049
Dry residues	–	–	2.579
Ammonium nitrogen	–	–	0.002
Nitrate-anion (NO_3^-)	–	–	0.023
Nitrite-anion (NO_2^-)	–	–	0.001
Sulphate-anion (SO_4^{2-})	–	–	0.512
Chlorides (Cl^-)	25.704	0.498	0.589
Iron (Fe^{3+}, Fe^{2+})	0.302	–	0.0005
Copper (Cu)	0.0003	0.00003	0.00001
Zinc (Zn^{2+})	–	0.00004	0.00004
Chrome (total)	–	–	–
Chrome (Cr^{3+})	–	0.0001	–
Chrome (Cr^{6+})	–	–	–
Synthetic surfactants	0.027	0.0003	0.00005
Phosphates (for P)	–	–	0.001
Oil products	0.027	0.005	–
Total	57.376		

The main greenhouse gases (in terms of their impact on the heat balance of the Earth) are evaporated water (H_2O), carbon dioxide (CO_2), methane (CH_4), nitrogen oxide (N_2O) and ozone (O_3). RIAR emits 652 thous. m^3 of evaporated water per year. The water vapour is generated in the cooling towers of the nuclear research installations.

Anthropogenic halogenated hydrides, nitrogen oxides, perfluocarbons, hydrofluorocarbons, sulphur hexafluorides (SF_6) as well as freon are potentially able to contribute to the greenhouse effect. The sources of freon in RIAR are industrial refrigerating systems using freon-12 and freon-22 in the amount of 10 and 45 kg, accordingly. Emissions of carbon dioxide

and methane are possible with heat generation as a result of fuel combustion in the boiler house (natural gas, oil fuel and diesel fuel). Calculation data on the direct greenhouse gas emissions in 2014 are given in Table 4.23. There are no data available on the indirect greenhouse gas emissions.

Table 4.23

Greenhouse gas emissions

Names of substances	Substance code*	Emissions amount, t
Carbon dioxide	–	–
Methane	0410	–
Nitrogen oxide (I)	0304	0.682
Carbon oxide	0337	4.025
Carbon tetrachloride	0906	0.006
Freon-12	–	0.001
Freon-22	–	0.0045

* Based on the Order of the Federal State Statistics Service of the Russian Federation No. 540 dated August 29, 2014 "On approval of the statistical tools to arrange the Federal statistical monitoring of the agriculture and environment"

RIAR air emissions in 2014 contain carbon tetrachloride. Data on the release of the ozone-depleting substance in 2014 are given in Table 4.24. Other ozone-depleting substances were not detected.

Table 4.24

Ozone-depleting substance emissions

Indicator	Emissions amount, t	
	Per year	Equivalent CFC-11
Carbon tetrachloride (CCl_4)	0.005726	0.006299

The emissions data were calculated in accordance with the calculation techniques approved as prescribed by Law and with the use of the balance method and the specific indicators method. On average, 96 per cent of emissions passed through the purification facilities are purified. The 2014 data on the NO_x, SO_x air emissions and emissions of other significant pollutants are given in Table 4.25. Their type and amount are also presented.

Persistent organic pollutants determined by the Stockholm Convention about Persistent Organic Pollutants are absent in the RIAR air emissions. In 2014, burst and accidental air emissions did not happen.

Table 4.25

Air pollutant emissions

Indicator	Class of hazard	Emission amount per year, t
Gaseous and liquid:	–	34.503
Incl:		
Sulphur dioxide	III	22.487
Carbon oxide	IV	4.025
Nitrogen oxides (in terms of NO_2)	III	3.257
Volatile organic compounds	–	3.375
Solid:	–	12.682
Incl. dust:	–	3.300
Non-organic	III	0.008
Abrasive	–	1.933
Wood	–	1.278
Textolite	–	0.002
Suspended substances	III	0.042
Fuel oil ash from heat power plants (in terms of vanadium)	II	0.037
Total	–	47.185

As a result of RIAR production and economic activities, 50 types of production and consumption waste are generated that are Class I–V waste. The waste is mainly categorized as the low-hazard and scarcely hazardous waste referred to IV and V class of hazard. In 2014, the percentage of Class IV and V waste from the total waste was 17 per cent and 79 per cent, accordingly. Amount of the production and consumption waste broken down by hazard classes and management types are given in Table 4.26. JSC SSC RIAR did not receive production waste from other organizations and did not send waste to other organization for their decontamination.

Table 4.26

Amount of production and consumption waste by hazard classes and the type of waste management

Waste type	Waste amounts by hazard classes, t					
	I	II	III	IV	V	Total
Generated within the year (waste generation norm, per year)	0.630 (6.924)	15.762 (5.1)	6.600 (64.313)	96.457) (510.831)	450.733 (7510.797)	570.182 (8097.965)
Used in RIAR as fuel	–	–	2.500	–	–	2.500
Transferred for use		15.762	2.500	28.070	366.388	412.720
Disposed at the waste landfill (limit on waste disposal)	– (–)	– (–)	– (–)	68.387 (375.716)	83.845 (7323.391)	152.232 (7699.107)
Stored in RIAR	0,630	–	2.150	–	0.50	3.280

Data on the amount of waste transferred to be used by third parties and disposed at the waste landfill were obtained from the metal scrap receipt-transfer certificates and waste transfer certificate. Data on the amount of the generated, used and decontaminated waste, as well as waste stored at the RIAR facilities were obtained from the internal waste record-keeping system. The administrative penalty for non-compliance with the environmental laws and regulations in 2014 were imposed on RIAR once. The penalty amount was 13 thousand rubles. Non-monetary sanctions for non-compliance with the environmental laws and regulations were not imposed on RIAR in 2014. In 2014, charges for the negative impact on the environment were 377.0 thousand rubles, of which for air emissions – 133.0 thous. rubles (35 per cent), discharges to water bodies – 123.0 thous. rubles (33 per cent), waste disposal – 121.0 thous. rubles (32 per cent). The “polluter pays” charges are given in Table 4.27.

Table 4.27

Payments for negative impact on the environment

Type of payment	Payment amount, thous. rubles.
Payments for allowable emissions (discharges) of pollutants:	
To the water bodies	3.0
To the air	6.0
Payments for excess emissions (discharges) of the pollutants:	
To the water bodies	120.0
To the air	127.0
Payments for production and consumption waste disposal	120.0
Incl. ground disposal	0.0
Payments for disposing more production and consumption waste than permitted	1.0
Incl. ground disposal	0.0
Total	377.0

4.4. OCCUPATIONAL HEALTH AND SAFETY

During the last two years, the occurrence rate of industrial injuries is reducing in RIAR. In 2011, four labour accidents occurred, in 2012-five accidents and in 2013 – one accident. There was one labour accident in RIAR in 2014 and it was classified as a minor industrial accident. Since 2002, there are no fatalities in RIAR. In 2014, labour accidents and professional illness did not occur with the contractors and subcontractors conducting activities at the RIAR site. Data presented in Table 4.28 characterize positively the effectiveness of RIAR efforts to ensure safe and healthy conditions of work and prevent occupational injuries in RIAR. In 2014, based on the results of the regional phase of the Russia National competition "Russian Organization of High Social Efficiency" (Protocol No. 03 of October 6, 2014), JSC SSC RIAR became the winner (first place) of the regional phase in the category "For hampering industrial injuries and occupational illness in production companies".

Table 4.28

Data on occupational injuries in 2013–2014

Injuries	JSC SSC RIAR		Subcontractors	
	2013	2014	2013	2014
Rate of injury	0.028	0.027	0	0
Occupational illness rate	0	0	0	0
Lost days rate	1.13	0.99	0	0
Absence rate	8.37	7.42	0	0

In 2014, as part of educational, training and advice programs implemented in RIAR and thanks to the program on industrial injury risk prevention and control, 68 RIAR employees received safety and health training. The cost of the training was 190 thousand rubles.

HEALTH AND SAFETY IN THE OFFICIAL AGREEMENTS WITH TRADE UNIONS

Health and safety issues are of the greatest priority in both the *Industrial Agreement on Atomic Energy, Industry and Science for 2015–2017* and *RIAR Collective Labour Agreement for 2014–2017* (Table 4.29).

Table 4.29

Health and safety issues covered in the Industrial Agreement and Collective Labour Agreement

Document	Health and safety issues	Reflection in the official document
Industrial Agreement on Atomic Energy, Industry and Science for 2015–2017	Compliance with the recommendations of the International Labour Organization	In the whole text of the Agreement
	Measures or Management Structures to address the challenges	Section 12
	Obligations in relation to the target performance standards or level of the applied practical approaches	Section 6
	Health and Safety	Section 5
RIAR Collective Labour Agreement for 2014–2017	Individual protective equipment	Item 5.9
	Joint Health and Safety Committees comprising representatives of both management and employees	Annex 5-3 Item 5.8
	Health and safety assessment of work places	Item 6.6
	Involvement of employees' representatives into the health and safety inspections, audits and investigation of accidents	Annex 5-3 Item 12.3
	Education and training	Annex 9-1
	Right to abandon hazardous job	Item 10
	Complaint mechanism	Annexes 3-2; 5-3; 5-6; 11-1
	Periodical inspections	Item 13.3
	Medical treatment	Item 5.4

EMPLOYEES' HEALTH CONTROL

Annually, RIAR employees go through periodic medical examinations. Medical examinations are performed strictly in compliance with Order of the Ministry of Healthcare and Social Development of the Russian Federation No. 302n of April 12, 2011 "On approval of the lists of harmful and/or hazardous occupational factors and works which require mandatory pre-work and periodic medical examinations and the procedure for conducting pre-work and periodic medical examinations of the workers engaged in heavy work and work in harmful and /or dangerous labour conditions".

In 2014, 3048 RIAR employees who worked in contact with harmful and/or dangerous substances and occupational factors underwent medical examinations.

RIAR occupational safety activities were performed in compliance with the both Industry Agreement on Atomic Energy, Industry and Science for 2012–2014 and Collective Labour Agreement. In accordance with the system of the three-stage administrative-public control, RIAR developed schedules of activities to control health and safety. The activities are as follows:

- checks to examine compliance with the requirements for health, radiation, industrial and fire safety;
- meetings with representatives of the departments in which the above checks were held;
- inspections performed by safety specialists.

PERSONNEL EXPOSURE CONTROL

In 2014, personal dosimetry covered 2414 RIAR employees (the group A personnel). A comparison can be made with the year 2013 – 2454 employees and 2012 – 2403 employees. Average annual effective doses for the group A personnel are given in Table 4.30.

Table 4.30

Effective dose to personnel

Year	Average annual effective dose, mSv
2001	2.15
2002	2.38
2003	2.10
2004	2.38
2005	1.80
2006	2.24
2007	2.42
2008	2.47
2009	2.45
2010	1.98
2011	2.60
2012	2.29
2013	1.91
2014	2.27

As compared to 2013, one can see an increase of the average annual effective dose. This is mainly attributable to the increased amount of work performed by the reactor staff.

In 2014, the dose limits specified by the Radiation Safety Standard NRB-99/2009 were not exceeded: the radiation exposures were less than 1 mSv for 58 per cent of the group A personnel, 13 per cent of the staff received 1–2 mSv, and 15 per cent – 2–5 mSv. These data are in compliance with the similar ratios across the industry.

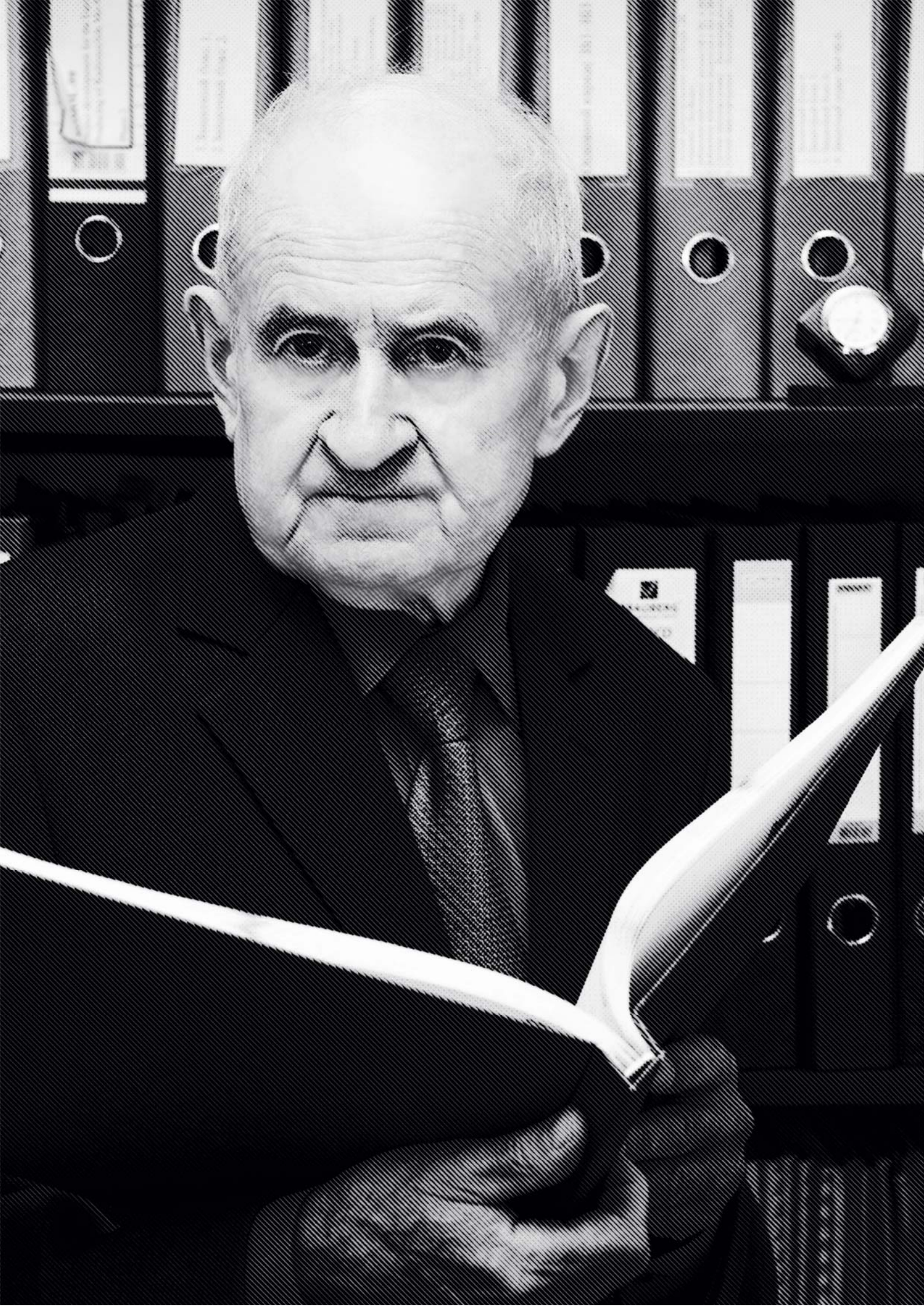
Based on the results of the personal dosimetry, the personal life-time risk associated with the occupational exposure was calculated using the ARMIR-5 software. The absolute majority of the employees (98.92 per cent) are in the zone of radiation risk less than 10^{-3}. Compared to the value (10^{-3}) specified by the Radiation Safety Standard NRB-99/2009, an increased personal life-time risk is seen for 26 employees only, or 1.02 per cent of the RIAR staff. In 2014, a special-purpose medical examination of these employees was arranged and the results did not show radiation-induced illnesses.

IMPROVEMENT OF THE REACTOR FLEET SAFETY AND EFFICIENCY

Implementation of the project “Improvement of the RIAR Reactor Fleet Safety and Efficiency” involves continuing modernization of the RIAR reactor facilities which retrofits are needed not only because of the physical ageing of the equipment, but also because of the new requirements of the Federal Norms and Rules to ensure safe operation of the facilities related to use of atomic energy. As part of the above project, in 2014 the following work was done to improve safety and efficiency of the RIAR reactor installations:

- Assessment of the building structures of the MIR, SM, RBT-6 and RBT-10/2 reactors to evaluate their remaining service-life. The work was done by the specialists of the Leading Institute VNIPIET, St. Petersburg;
- Installation and connection of the MIR and RBT-10/2 emergency cooling pumps, feeding units and radioactive drain units to the emergency diesel generators;
- Procurement of the equipment to replace the RBT-10/2 control and protection system;
- Replacement of the exhausted accumulator battery in the SM and RBT-6 uninterruptible power system;
- Procurement of the compressor assembly to improve the SM and RBT-6 radiation safety; initiation of installation works;
- Equipping the SM and RBT-6 reactor buildings with radiation portal monitors to improve the occupational safety.

As a result of work implemented under the project in 2014, the safety level of research nuclear reactors was improved, including nuclear, radiation and fire safety; the production processes were updated and the measuring tools were refurbished.



5

ENHANCEMENT OF THE PUBLIC REPORTING SYSTEM AND STAKEHOLDER ENGAGEMENT

The sine qua non of success
in work is continuous knowledge improvement,
initiative, high responsibility
and good fellowship with colleagues

Yan N. GORDEEV,
Radioisotopes and Radiochemicals Division,
Chief Specialist,
in 2014 awarded a Slavsky Badge of Honor

Galina L. PAVLOVA

Head of the Internal and External Communications Office, Spokesperson

During four years JSC “SSC RIAR” has been issuing the annual reports and enhancing the annual public reporting system. We make it a point to build mutually beneficial partnership with stakeholders, in particular by reporting. For us it is important that our business and social partners are aware of the scope of RIAR activities and contribution to resolving the urgent issues of the Russian and world’s nuclear power science, engineering and medicine. The Public Report of JSC “SSC RIAR” is another way to provide more details about RIAR to its customers and suppliers as well as to a wide audience. Without any doubts, the integrated public annual reports play an important role in creating the image of the enterprise, the common corporate identity, and increasing the level of engagement and commitment of the employees.

This reporting year we keep on paying much attention to enhancement of the RIAR public reporting system, and we have achieved good results: the Annual Report 2013 took the third place in the Best Public Reporting System category. Following the results of the 2014 annual survey on corporate transparency of the largest Russian companies conducted by the Russian Regional Network on Integrate Reporting the Report of JSC “SSC RIAR” entered the group of four best reports among 721 companies in the category “Systematic Approach to Public Reporting Processes”.

We clearly understand the necessity of enhancing continuously both our approach to reporting and the quality of reports. We conduct dialogues with stakeholders that contribute to our understanding of what kind of information about RIAR is appealing to the public and our colleagues today. The integrated Annual Report is an efficient open channel of communication with all stakeholders that contribute to our development, enhancement and further issuance of reports that will be more interesting for us and for the public. This Report is the fruit of labor of a large team of close-knit like-minded fellows that feel pride for the Institute and nuclear power industry. When developing the Report we always make it a point to convey this feeling to the readers by providing the information about the results of RIAR activities to the maximum extent and making the Report available, remarkable and memorable.

5.1. ENHANCEMENT OF THE PUBLIC REPORTING SYSTEM

In 2011 a public stance of the Institute on sustainable development was set forth in order to provide transparency of the JSC "SSC RIAR" activities and purposes to stakeholders. More detailed information is given in the Annual Reports 2011–2013 (http://www.niiar.ru/?q=annual_report). During these years an efficient sustainable public reporting system has been developed (Fig. 5.1), and since 2013 a regulatory system of public reporting has been created (see the Annual Report 2013).

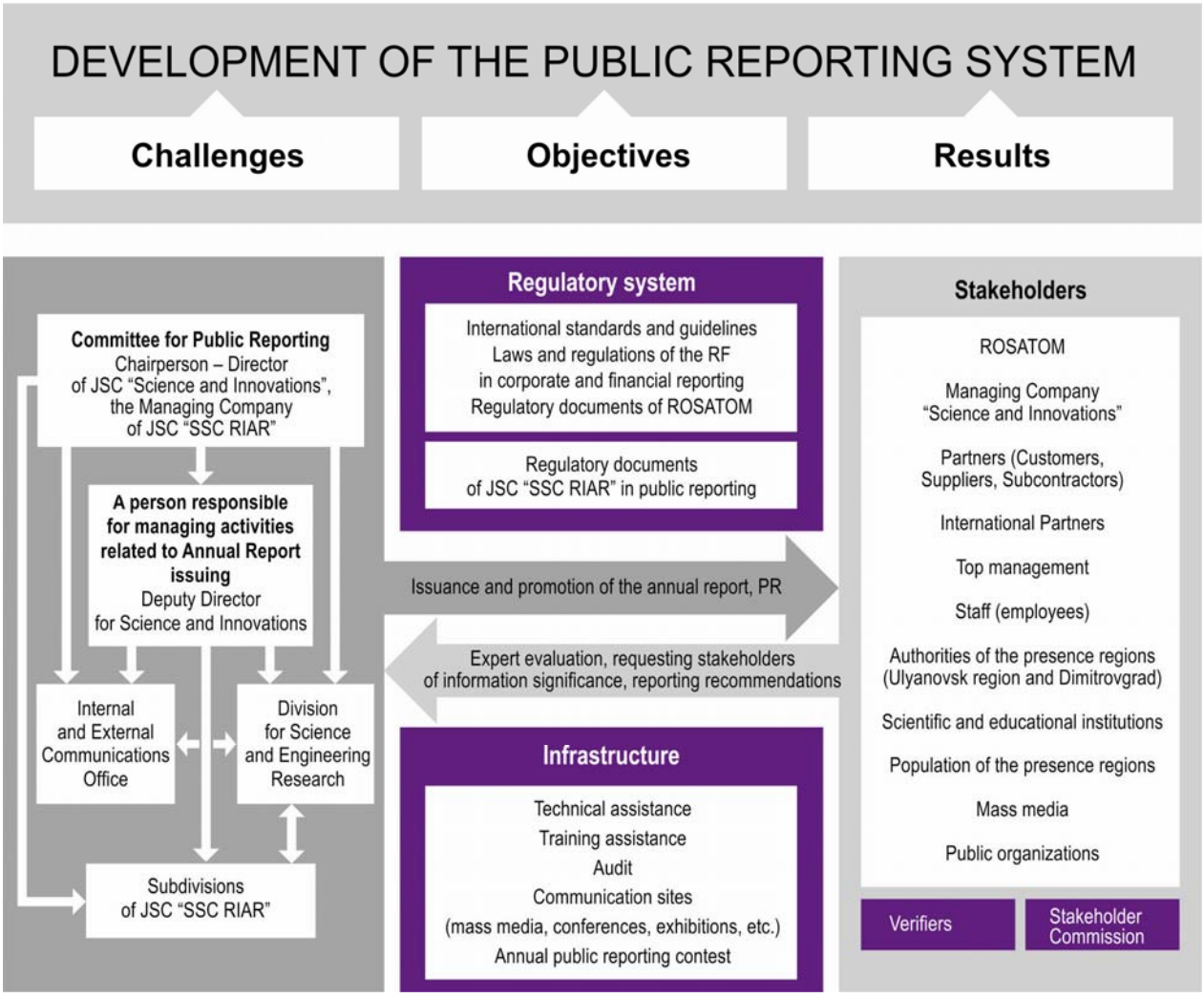


Figure 5.1. Schematic representation of the public reporting system

Functioning of the JSC "SSC RIAR" public reporting system is provided by a number of subdivisions. The main functions are distributed between the Committee for Public Reporting of JSC "SSC RIAR", the Division for Science and Engineering Research of the Office for R&D Activities, and the Internal and External Communications Office.

The regulatory system of public reporting

1. Provision on the Stakeholder Commission in Public Reporting of JSC “SSC RIAR”.
2. Provision on the Committee for Public Annual Reporting of JSC “SSC RIAR”.
3. Standard of Enterprise STO 086-202-2014 “The Quality Management System of JSC “SSC RIAR”. The Annual Report Issuing Procedure”.

More than sixty specialists of JSC “SSC RIAR” are involved in the Report development including those responsible for source data release.

In the course of Report issuing a great deal of work has been done both by the RIAR specialists and stakeholder representatives. The members of the Committee for Public Reporting express their gratitude to those who have shown their interest in RIAR activities and read this Report.

COMMITTEE FOR PUBLIC ANNUAL REPORTING OF JSC “SSC RIAR”

The Committee is a permanent organizational unit of the RIAR public reporting system. The main objective of the Committee is to arrange and coordinate public reporting in JSC “SSC RIAR” in compliance with the current international and Russian requirements in corporate reporting.

The key objectives of the Committee are as follows:

- to develop and manage the public annual reporting system in JSC “SSC RIAR”, to enhance and maintain it in accordance with changes in the international and Russian requirements in corporate reporting;
- to set objectives, tasks and priority topics for the annual reports, and set forth the public stance of JSC “SSC RIAR” on the disclosed information;
- to take decisions on annual report issuing and supervise their implementation;
- to provide organizational and resource support of the activities related to Report issuing;
- to enhance stakeholder engagement.

The key functions of the Committee and arrangement of its work are given in detail in the *Provision on the Committee for Public Annual Reporting of JSC “SSC RIAR”.*

STAKEHOLDER COMMISSION IN PUBLIC REPORTING OF JSC “SSC RIAR”

In accordance with the *Provision on the Stakeholder Commission in Public Reporting of JSC “SSC RIAR”, Order of Director #* 64/241-P *as of March 19, 2014* approved the composition of the Commission and schedule of its activities involving stakeholders for the period of issuing the Annual Report 2014.

The given Provision was developed to coordinate interaction of all sides and structures interested in public annual reporting of JSC “SSC RIAR” in order to evaluate the relevance and completeness of the disclosed information, develop recommendations on improvement of the Report quality and the public reporting system. This Provision describes the status, objectives, functions and the work procedure of the Commission. The Commission includes representatives of the key stakeholders of JSC “SSC RIAR”. The membership of the Commission is revised annually at the Meeting of the Committee for Public Reporting.

The objectives and functions of the Stakeholder Commission in Public Reporting are as follows:

- to evaluate the relevance and completeness of the disclosed information;
- to evaluate the balanced and reasonable view of results with reference to sustainable development (including both positive and negative experience);
- to develop recommendations on improvement of the public reporting quality;
- to take part in the development of a schedule of activities in public reporting with the involvement of stakeholders;
- to supervise the fulfillment of RIAR commitments to stakeholders undertaken following the results of report campaigns;
- to discuss draft regulatory documents of JSC “SSC RIAR” in public reporting and provide recommendations on their follow-up revision;
- to provide public oversight of the reporting processes including those related to involvement in dialogues and public consultations with stakeholders.

DESIGNATED SUBDIVISIONS

The Division for Science and Engineering Research is responsible for Report issuance and development of the public reporting system. This Division has the following objectives:

- to develop the Annual Report concept;
- to issue the draft Report and its final revision;
- to consider stakeholder proposals and comments of the Committees in Public Reporting of JSC “SSC RIAR” and ROSATOM, and improve the reports based on these suggestions and comments;
- to create a system of local regulations and administrative documents in public reporting of JSC “SSC RIAR”.

The objectives of the Internal and External Communications Office in public reporting are as follows:

- to hold dialogues with stakeholders in the course of Report issuing and public hearings on the draft Report;
- to hold the public verification of the Report;
- to develop plans of activities involving stakeholders;
- to create a dummy layout of the Report (editing, formatting, proof-reading, design, graphical data processing, publishing package, etc.);
- to promote the Report of JSC “SSC RIAR” among the key groups of stakeholders and make it available for the competitions of annual reports held in the nuclear power industry and other public reporting competitions.

ACHIEVEMENTS OF THE ANNUAL REPORT 2013

• The *seventh* place in the overall standing of the public reporting contest held among ROSATOM enterprises;

• The *third* place in the category "Best System of Public Reporting" in the public reporting contest held among ROSATOM enterprises;

• The *thirty-fourth* place among 721 competitors in the final rating based on the results of the 2014 annual survey on corporate transparency of the major Russian companies conducted by the Russian Regional Network for Integrated Reporting;

• Following the results of the survey conducted by the Russian Regional Network for Integrated Reporting JSC "SSC RIAR" entered the list of the best *four* enterprises in the category "Systematic Approach to the Public Reporting Processes."

2014 RESULTS

In the reporting year the following set of corporate documents in public reporting was developed and approved:

• Standard of Enterprise STO 086-202-2014 "The Quality Management System of JSC "SSC RIAR". The Annual Report Issuing Procedure";

• Provision on the JSC "SSC RIAR" Stakeholder Commission in Public Reporting;

• Order "On Organization of Work related to 2013 Report Issuing";

• The 2013 Report concept;

• The Statement of Work for 2013 Report issuing;

• A schedule of activities related to 2013 Report issuing;

• A schedule of activities related to further development of the public reporting system of JSC "SSC RIAR" for 2014–2015;

• Order "On Approval of the JSC "SSC RIAR" Stakeholder Commission Members";

• A schedule of events involving stakeholders for the period of 2014 Report issuing.

A level of stakeholder engagement in Report issuing has been increased due to establishment of the Stakeholder Commission, and a list of the key stakeholder groups has been extended.

2015 AND MEDIUM-TERM PLANS ON FURTHER DEVELOPMENT OF THE PUBLIC REPORTING SYSTEM AND IMPROVEMENT OF THE REPORT QUALITY

In order to further develop the public reporting system and improve the report quality it is planned to accomplish the following action items:

- to move gradually to GRI 4.0;
- to enhance the quality of the information issued in accordance with the international integrated reporting standard;
- to further develop stakeholder engagement;
- to enhance the public reporting system of JSC “SSC RIAR”;
- to improve staff expertise in public reporting;
- to participate in public and integrated reporting competitions and improve the achieved positions;
- to analyze the best practices of Russian and foreign annual reporting, to use the information of analytical reports provided by the Russian Regional Network for Public Reporting;
- to enhance Report promotion methods (direct mail, information distribution at the conferences, exhibitions, business meetings, etc.);
- to release Report issuing rules;
- to update corporate documents in public reporting;
- to develop the system of source data acquisition and processing, and assign personal responsibility for provision of information;
- to start earlier the reporting campaign (July – September);
- to introduce comments of the RIAR top management;
- to use the Report as a reference and analytical source by the RIAR staff;
- to provide feedback, i.e. to obtain the information about the quality and usefulness of the Report (employee surveys, interviews with the top management).

5.2. GROUPS OF STAKEHOLDERS

The system of interaction with each group of stakeholders affects and will affect significantly the development of JSC "SSC RIAR". Therefore, consideration of stakeholder interests in strategic planning is an important condition of sustainable development.

The development of the forms and methods of stakeholder engagement leads to realignment of the key groups of stakeholders that results in occurrence of another group of stakeholders – the Managing Company "Science and Innovations" (Table 5.1).

Table 5.1.

Stakeholders and their interests

Stakeholders	A matter of interest
ROSATOM	Compliance with the nuclear power industry development strategy; corporate management; project management quality; compliance with the deadlines, keeping within the budget; sustainable development; innovations; investments
JSC "Science and Innovations"	Coordination of assets and research activities; development prospects
Partners (customers, suppliers, subcontractors)	Fulfillment of treaty obligations; compliance with the deadlines, keeping within the budget; development prospects; building projects; high product quality; efficient collaboration; new contracts based on the Institute development prospects
International partners	Innovative development; sustainable cooperation; implementation of joint projects
Top management	Development strategy of the Institute; human resources and social policies; sustainable development
Staff (employees)	Results and achievements of the Institute; human resource and social policies; personnel training and development prospects; fair wages
Authorities of the presence regions – Ulyanovsk region and Dimitrovgrad	Environmental and radiation safety; infrastructure development; tax payments; employment; social and charitable programs; combination of interests in the development of the Institute and region
Scientific and educational institutions	Provision of competent staff; collaboration in science and education
Population of the presence regions	Employment, development prospects; nuclear and industrial safety, environmental protection
Mass media	Openness and availability of information about the RIAR activities; key events
Public organizations	Nuclear and industrial safety; environmental impact; environmental protection activities; social responsibility

In 2014 based on the results of the survey conducted among the key groups of stakeholders a ranging chart was updated representing correlations between them and JSC "SSC RIAR" (Figure 5.2).

Figure 5.2. Impact of stakeholders on JSC "SSC RIAR"

Figures 5.3 and 5.4 show a review of changes in cross impact of stakeholders and JSC "SSC RIAR" over the period of Report issuing.

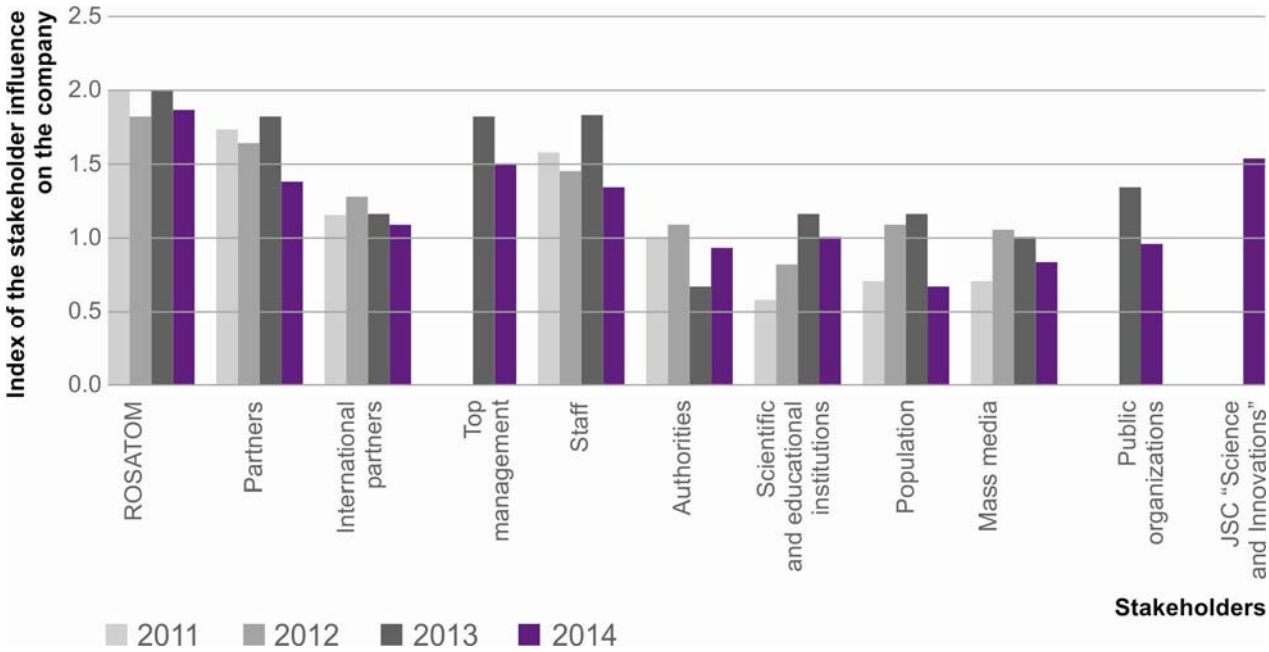


Figure 5.3. Stakeholder impact on JSC "SSC RIAR" for the period of 2011–2014

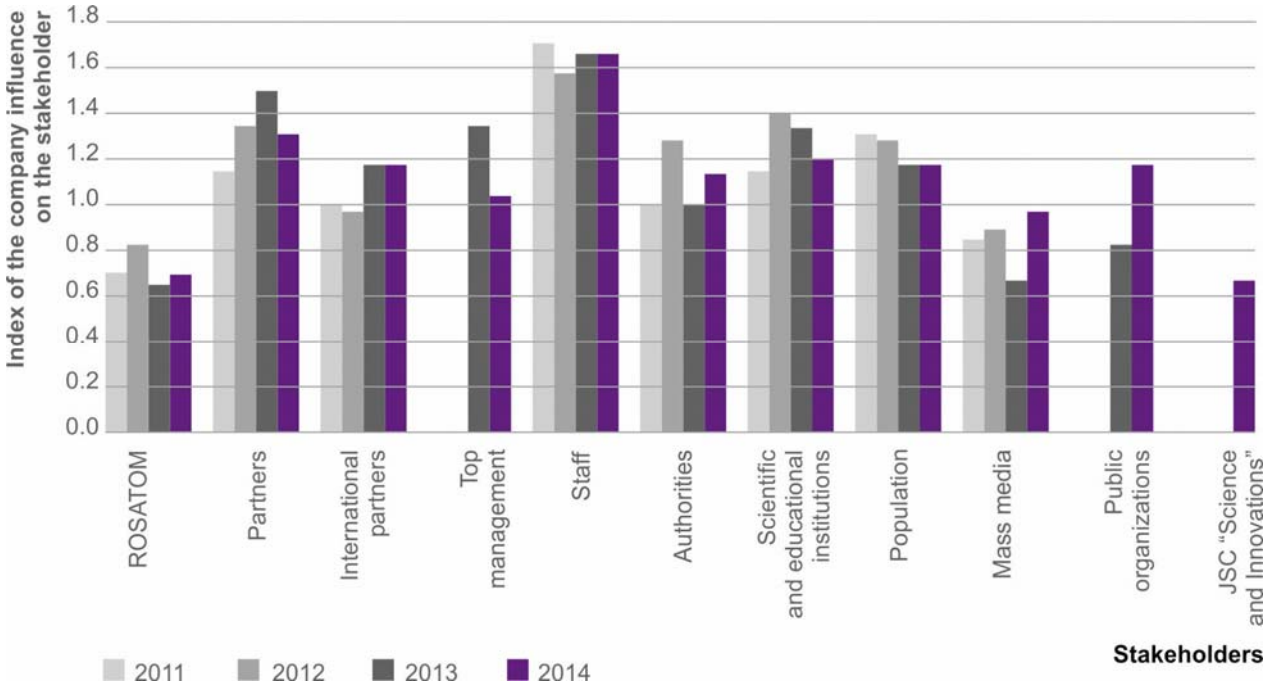


Figure 5.4. JSC "SSC RIAR" impact on stakeholders for the period of 2011–2014

An increase in JSC "SSC RIAR" impact on mass media and public organizations is explained by increased transparency, disclosure and public acceptance of the Institute activities.

5.3. STAKEHOLDER ENGAGEMENT IN REPORT ISSUING

Stakeholders were engaged in all stages of Report 2014 issuing: from the development of its concept to discussions of the final draft. They had a chance to give their requests, recommendations and ask questions.

During the Report issuing period the following activities were conducted where representatives of all groups of stakeholders were involved (see Section 5.2. "Groups of Stakeholders" of this Chapter):

- Discussion of the Report concept (in absentia, 20 attendees);
- Dialogue: "Involvement of JSC "SSC RIAR" in the priority topics of ROSATOM and resolving the issues of federal importance" (24 attendees);
- Dialogue: "A Man of Labor" (24 attendees);
- Public consultations on the draft Report 2014 (in absentia).

JSC "SSC RIAR" informs regularly its target audiences about all significant events related to the primary activities of RIAR by using external and internal websites, press releases to mass media, publishing articles and interviews with the Administration of JSC "SSC RIAR" in nuclear power industry editions and other editions.

REPORT 2014 CONCEPT

First, the Report concept was discussed in absentia. The discussants were the members of the Committee for Public Reporting and the Stakeholder Commission of JSC "SSC RIAR".

The Report concept was presented to the discussants based on the survey conducted among internal and external stakeholders. The survey data were used to select the priority topics of the Report, update the groups of stakeholders, draw up a ranging chart reflecting the interdependence of stakeholders and JSC "SSC RIAR", and take into account the wishes of the respondents related to Report issuing and enhancement of the public reporting system.

The discussants stated their recommendations that allowed further development and improvement of the Report concept.

DIALOGUES: “INVOLVEMENT OF JSC “SSC RIAR” IN THE PRIORITY PROJECTS OF ROSATOM AND RESOLVING THE ISSUES OF FEDERAL IMPORTANCE”, “A MAN OF LABOR”

The dialogues were held on February 16, 2015 at the Slavsky Conference Center, Dimitrovgrad. The attendees of the dialogues were as follows: Dimitrovgrad and Ulyanovsk authorities, RIAR employees and trade union, representatives of scientific and cultural institutions, population, public organizations, and mass media.

Presentations were made on the priority topics of the Report including a report made by Director of JSC “SSC RIAR” Sergey V. Pavlov “The Priority Trends of Research and Production Activities of RIAR in 2014”.

While discussing these presentations the top management of RIAR presented the information about the results of the reporting year, future plans, and retrospective of RIAR development.

The members of the public highly appreciated the quality of the presented information and the level of the event organization. In addition, they voiced several recommendations to improve the final draft of the Report and stakeholder engagement.

PUBLIC CONSULTATIONS ON THE DRAFT REPORT

The draft Report with included comments voiced by stakeholders in the course of the dialogues was distributed on June 17, 2015 among stakeholders for them to introduce their proposals. There were no comments or proposals on the Report content.

INCLUSION OF STAKEHOLDER PROPOSALS

In the course of the dialogues on the priority topics of the Report thirteen proposals and recommendations have been voiced (Table 5.2).

Table 5.2.

Requests and proposals on information disclosure voiced by stakeholders in the course of the dialogues

Requests / proposals	Implementation
To give more detailed information about RIAR development prospects	The information is provided in the following Sections of the Report: 1.4. Key Competencies. Products and Rendered Services, 1.5. Position of JSC "SSC RIAR" in the Russian Nuclear Industry, 1.6. Mission, Strategy and Prospects, 3.2. Innovative Activities, 3.4. International Cooperation
To present the information about RIAR collaboration with international partners	The information is provided in Section 3.4. International Cooperation
To disclose the key competencies of JSC "SSC RIAR"	The information is provided to a full extent in Section 1.4. Key Competencies. Products and Rendered Services
To reflect long-term RIAR staffing	The information is provided in Section 4.2. Social Policy and Staff Management
To provide the information about collaboration with higher educational institutions and implementation of joint projects	The information is provided in Section 4.2. Social Policy and Staff Management
To pay attention to employee engagement	The information is provided in Section 4.2. Social Policy and Staff Management
To provide the information about the housing program "Akademgorodok"	The information is provided in Section 4.2. Social Policy and Staff Management
To present the information about the Center for Development of the Nuclear Innovation Cluster in Dimitrovgrad, Ulyanovsk region	The information is provided in Section 4.1. Public Stance in the Area of Sustainable Development
To provide more detailed information about the results of research and production activities of the Institute	The information is provided in Sections: 3.2. Innovative Activities, 3.3. Results of the Key Activities
To focus on staff training and collaboration with higher educational institutions	The information is provided in Section 4.2. Social Policy and Staff Management
To disclose safety issues	The information is provided in Sections: 4.3. Environmental Safety, 4.4. Occupational Health and Safety
To provide the information about the role of the public reporting system of JSC "SSC RIAR" in issuing the Annual Report. To present the results of its functioning	The information is provided in Section 5.1. Enhancement of the Public Reporting System
To provide more information about stakeholder engagement	The information is provided in Chapter 5. Enhancement of the Public Reporting System and Stakeholder Engagement

5.4. STATEMENT ON THE PUBLIC VERIFICATION OF THE REPORT

INTRODUCTION

The Administration of Joint Stock Company "State Scientific Center – Research Institute of Atomic Reactors" (hereinafter referred to as JSC "SSC RIAR") suggested us to verify the Public Annual Report 2014 (hereinafter referred to as the Report) in terms of the completeness and relevance of the information with reference to the issues most important to stakeholders. In doing so, we and our representatives were given an opportunity to take part in discussion of the Report concept (in absentia), direct dialogues and public consultations on the draft Report from November 2014 till June 2015 and express openly our view on the discussed problems.

REPORT EVALUATION

Our statement is based on a comparative review of two Report 2014 revisions (the draft Report used in public consultations and the final draft Report), and a review of the information obtained in the course of the dialogues and consultations, i.e. presentations, protocols, tables containing stakeholder comments and comments made by the RIAR Administration and employees. In the course of the public verification of the Report we did not check the data acquisition and processing system and did not investigate in a special way the data and management processes. The credibility of the actual information provided in the Report was not the matter of the public verification.
All the attendees of public hearings had an opportunity to express openly their opinion and received no reward from JSC "SSC RIAR" for their involvement in the public verification.

EVALUATIONS, COMMENTS AND RECOMMENDATIONS

All of us have a positive evaluation of the Report 2014, its format and the scope of the provided information. JSC "SSC RIAR" has prepared an informative and well-arranged document that meets our expectations. It is particularly important that the Report has been issued on a voluntary basis and is a good example of implementing a principle of transparency and openness of JSC "SSC RIAR".
It shows both a high level of information disclosure and readiness to hold an open dialogue with stakeholders concerning different issues related to different trends of RIAR activities including those on safe operation of research reactors and other facilities.
We understand that the Administration of JSC "SSC RIAR" is targeted at constructive collaboration with stakeholders.
We are not aware of any facts that could cast doubt on the credibility of the information provided in the Report.

We believe that in the course of public consultations and other activities related to the public verification of the Annual Report involving stakeholders JSC "SSC RIAR" has provided detailed information about the strategic objectives and development orientation points, activity results over the reporting

period, and involvement in the town development, and fully reflected all fields of its activities.

The indisputable value of the Report is that it is used in issuing international standards (GRI Sustainability Reporting Guidelines (Global Reporting Initiative, version G3.1)), and its integrated nature enables disclosing comprehensively the information about the RIAR primary activities in 2014 in terms of sustainable development. A decision made by the Administration of JSC “SSC RIAR” to issue the Report both in Russian and in English was evaluated favourably. It was particularly noted that compared to other public reports of ROSATOM enterprises the Report of JSC “SSC RIAR” is an official edition: it was assigned an ISBN, UDC, the information was edited which ensures the high quality of the published information and meeting all editing standards.

We evaluate the disclosure of information in the Report as sufficient both in terms of applying international standards in public reporting and taking into account stakeholder comments voiced in the course of Report issuing. We believe it is the integrated report that should present the official view of the RIAR Administration on all key significant issues and trends of activities.

Following the results of our review we made the following conclusions.

INFORMATION RELEVANCE

In our view, all the topics important to stakeholders are provided in the Report both in terms of the RIAR primary activities and social and environmental aspects of sustainable development. The most important information to understand the development prospects of JSC “SSC RIAR” is provided in the Sections related to the Institute strategic development, its unique competitive advantages and growth prospects; improvement of efficiency in managing finance, risks, staff, economic, social and environmental impacts, and safety in implementing different projects. We are not aware of any other issues important to stakeholders that JSC “SSC RIAR” should have included in the Report.

COMPLETENESS OF PROVIDED INFORMATION

In our view, the Report provides complete information required for stakeholder deep insight into the current state and prospects of JSC “SSC RIAR” development. The priority topics of the Report are as follows: “Involvement of JSC “SSC RIAR” in the priority projects of ROSATOM and resolving the issues of federal significance” and “A Man of Labor”. We believe that the Report covers completely the priority topics.

RIAR RESPONSE TO PROPOSALS AND RECOMMENDATIONS OF STAKEHOLDERS

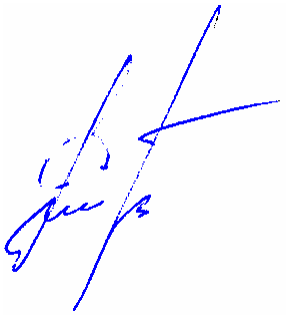
We believe that JSC “SSC RIAR” has shown considerable progress in arrangement of stakeholder engagement and development of public reporting. In the course of Report issuing four events have been held involving stakeholders. We think it is a good practice that stakeholder engagement began prior to issuing the Report, i.e. at the stage of the concept development. Stakeholders were given an opportunity to voice their proposals and recommendations on information disclosure and development of the public reporting system.

JSC “SSC RIAR” showed a responsible approach to the implementation of the ROSATOM policies in public reporting and constructive approach to the stakeholder proposals.

A good illustration of the RIAR response to stakeholder comments is that some initial data were updated and elaborated. For instance, to meet the requests and wishes of stakeholders the following Sections were revised and supplemented: “Social Policy and Staff Management”, “Enhancement of the Public Reporting System”, “Public Stance in the Area of Sustainable Development”, etc.

In addition, JSC “SSC RIAR” made commitments to further enhance the public reporting system. In the course of Report issuing JSC “SSC RIAR” has shown readiness to response sensibly to the wishes and proposals of stakeholders. We hope that JSC “SSC RIAR” will keep on implementing consistently the principles of responsible corporate behavior in its activities by further developing the public reporting system and stakeholder engagement.

APPROVALS PAGE
OF THE PUBLIC VERIFICATION
OF THE JSC “SSC RIAR”
ANNUAL REPORT 2014

JSC “Science and Innovations”, Director General ”		Alexei V. Dub
JSC “Science and Innovations”, Deputy Director General – Scientific Supervisor of Physics and Power Engineering Block		Vladimir D. Risovany
JSC “SSC RIAR”, Chief Engineer		Alexei L. Petelin
JSC “SSC RIAR”, Deputy Director for Science and Innovations		Vladimir V. Kalygin
Independent noncommercial organization “Center for Development of the Nuclear Innovation Cluster in Dimitrovgrad, Ulyanovsk region”, Director		Albert N. Gataullin
Sosny R&D Company, Scientific Supervisor		Valerii P.Smirnov
JSC “SSC RIAR”, Chairperson of the Trade Union		Igor A. Kungurtsev
Governor and Head of the Government of Ulyanovsk region		Sergey I. Morozov
Head of Municipal Administration of Dimitrovgrad		Nikolai A. Gorshenin

Ulyanovsk State University, Deputy Head for Research Management		Vladimir M. Plottsev
Dimitrovgrad Engineering and Technological Institute – a branch of National Research Nuclear University “MEPhI”, Head		Ivan A. Sagan
“Dimitrovgrad” newspaper, Economics Unit, Editor		Svetlana E. Knyaginina
“Dimitrovgrad” newspaper, Editor-in-chief		Dmitrii V. Shikov
Organization of Veterans of War and Labor in Dimitrovgrad, Chairperson		Alexander D. Voronin

6
APPENDIX

Feedback questionnaire

You opinion about the Public Annual Report of JSC “SSC RIAR” is very important for us. Please, fill in the questionnaire below.

1. What group of interested parties do you refer to?

- ☐ ROSATOM, JSC “Atomenergoprom”
- ☐ Partners (customers, suppliers, subcontractors)
- ☐ Personnel of JSC “SSC RIAR”
- ☐ Federal, regional and local authorities
- ☐ Regulatory bodies
- ☐ Educational Institutions
- ☐ Resident population
- ☐ Mass media

2. Did you find out anything new about JSC “SSC RIAR”?

- ☐ Yes
- ☐ No

Your comments .....

.....

3. Could you get information you were interested in?

- ☐ Yes
- ☐ No

Your comments .....

.....

4. What section was the most interesting for you?

Your comments .....

.....

.....

5. How satisfied or dissatisfied are you with the objectiveness and reliability of data presented in the Report?

- ☐ Very satisfied
- ☐ Satisfied
- ☐ Dissatisfied
- ☐ No opinion

6. How satisfied or dissatisfied are you with the Report exposition?

- ☐ Very satisfied
- ☐ Satisfied
- ☐ Dissatisfied
- ☐ No opinion

7. How satisfied or dissatisfied are you with the Report design?

- ☐ Very satisfied
- ☐ Satisfied
- ☐ Dissatisfied
- ☐ No opinion

8. How satisfied or dissatisfied are you with the Report significancy?

- ☐ Very satisfied
- ☐ Satisfied
- ☐ Dissatisfied
- ☐ No opinion

9. What do you find the most prominent advantage of the Report?

Your comments .....

.....

.....

10. What is the most prominent disadvantage of the Report ?

Your comments .....

.....

.....

11. What information should the Report be added with?

Your comments .....

.....

.....

Please, send the filled questionnaire to:

- by post: 433510, Russian Federation,
  Ulyanovsk region, Dimitrovgrad-10;
- by fax: +7 (84-235) 3-58-59;
- by e-mail: adm@niiar.ru

INFORMATION EDITION

JSC “SSC RIAR” ANNUAL REPORT 2014

Edited by Natalia Chertukhina.
Designed by Victor Nedashkovsky and Maria Murzina.
Desktop published by Ludmila Nikishina.
Translated by Larisa Bolotova, Olga Artamonova, Olga Vinokurova.

Passed for printing 28.08.2015. Font “Arial”, «Bebas».
Format 60×84/8. Circulation 100 copies. Order No. 665.

Dummy layout prepared by JSC “SSC RIAR”
433510, Dimitrovgrad-10, Ulyanovsk region, Russia.