ROSATOM [360]

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From the North Pole to the Stratosphere

In August, the seventh international Arctic expedition, the Icebreaker of Knowledge, came to a close. It brought together high school and vocational school students from Russia and 22 countries around the world.

The Icebreaker of Knowledge science outreach initiative has been held since 2012. Over six seasons, more than 400 young people have visited the North Pole, with competition reaching around 1,400 applicants per spot.

To join the expedition, participants had to pass a rigorous selection process that included online tests, a video assignment, in-person semifinals, and an in-person final in Moscow. This year, over 73,000 Russian high school and vocational school students aged 14 to 16 from all regions of the country took part in the Icebreaker of Knowledge initiative. They competed in three tracks. The Explorer track is intended for future researchers, scientists, and science communicators. The Creator brings together future engineers and designers. The Master track, which was included in the program for the first time this year, is for future highly skilled professionals. Following three stages of the open competition, 27 individuals from all eight federal districts of Russia were selected as winners.

The expedition also included the winners of the international selection — one representative from each of 22 countries across Europe, Asia, Latin America, and Africa — as well as winners of international and national olympiads and competitions.

Science amidst the ice

The seventh expedition departed from Murmansk on August 4. As in previous years, the vessel that took expedition members to the North Pole was the 50 Let Pobedy (50 Years of Victory) nuclear icebreaker, captained by Ruslan Sasov.

The highlight of the program was the launch of a high-altitude platform station into the stratosphere. Designed for environmental monitoring of the Arctic, it was developed through joint efforts of the Murmansk Arctic University, the Stratonautics Laboratory, Harbin Institute of Technology, and the Environmental Defenders Foundation. The platform station is equipped with a suite of sensors and an experimental multispectral camera. The platform was launched for the first time in the area of the Franz Josef Land archipelago, rose to an altitude of more than 15 km, traveled over 100 km, and successfully landed at a designated point on Hooker Island. After landing, the device was delivered back on board the nuclear icebreaker 50 Let Pobedy by the crew and inspectors of the Russian Arctic National Park. One of the experiments focused on testing stable communications at high latitudes. The collected data will help scientists monitor conditions along the Northern Sea Route, assess the impacts of climate change, and observe marine animal populations.

In addition, a flash mob dedicated to the Year of

Unity of the Peoples of Russia was held at the North Pole. The flash mob participants walked in an international circle dance around the top of the Earth. It was held to a live performance by the music band AY YOLA from Bashkortostan.

Also, following tradition, the expedition members took the “shortest journey around the world.” This tradition was started by the sailors who first reached the North Pole aboard the Arktika nuclear icebreaker in 1977. During the stop at the Pole, the expedition members also watched the northernmost stand-up comedy show prepared by Vika Zhang, a social media influencer with over a million followers.

Along the route, the expedition members enjoyed a packed educational program. Every day, experts — scientists, engineers, and senior executives from Rosatom — delivered lectures and held master classes. “At Rosatom, every day we work on things that only yesterday seemed like science fiction — from quantum technologies to biofabrication. That is why it is especially important for us to show these things to young people in person, and it is wonderful that this can be done right on board the nuclear icebreaker “50 Let Pobedy”. During the expedition, the children saw that Russian science is about the future and about real technologies that change people’s lives for the better,” – noted Egor Plakhotnyuk, expert of the Icebreaker of Knowledge scientific and educational expedition, and project head at the Laboratory of Genomic Technologies and Tissue Engineering of the Research Institute of Technical Physics and Automation. The students also received career counseling on professional development in the nuclear industry.

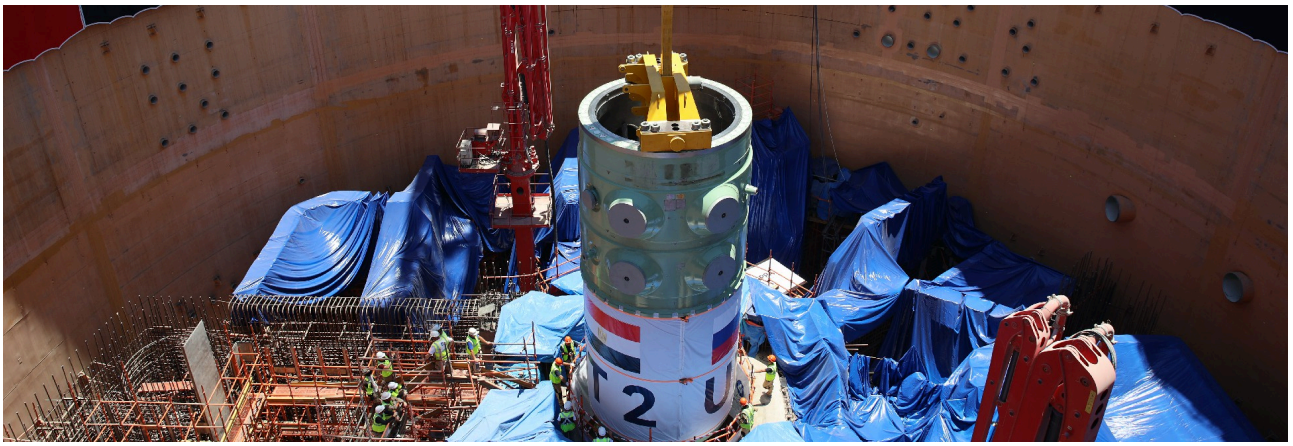
And, of course, the most mesmerizing part of the voyage was observing the Arctic’s unique natural environment day after day. The expedition members marveled at giant icebergs. On Franz Josef Land, home to a nature reserve, they watched a massive seabird colony — a towering cliff teeming with Arctic birds. Along the route, they also encountered a polar bear, the animal that is often called the “King of the Arctic.”

“We have successfully completed the seventh voyage of the Arctic expedition “Icebreaker of Knowledge”. The crew always treats this project with special care: such voyages truly contribute to the development of the younger generation. The smartest and most talented young people take part in this expedition — and once again, we were convinced of that. Many of them dreamed of visiting the North Pole and seeing polar bears, and I am very glad that Rosatom and our crew helped make that dream come true,” — said Ruslan Sasov, Captain of the nuclear icebreaker 50 Let Pobedy.

Photo by: Private Institution “Communications Centre”

News from El Dabaa

The installation of one reactor vessel and the start of manufacturing for another mark the key July milestones at Egypt's El Dabaa Nuclear Power Plant, currently under construction by Rosatom. The scope of bilateral cooperation between Rosatom and Egypt continues to expand. Beyond nuclear energy, joint interests now encompass water desalination, nuclear medicine, additive manufacturing, energy storage, and digital and quantum technologies.



The installation of the reactor pressure vessel at Unit 2 was marked by a major ceremony attended by Rosatom Director General Alexey Likhachev, Russian Ambassador to Egypt Georgy Borisenko, Egyptian Prime Minister Mostafa Madbouly, and Egypt's Minister of Electricity and Renewable Energy, Dr. Mahmoud Esmat.

"Our El Dabaa construction project is progressing at an excellent pace. Seven months ago, we installed the reactor vessel for Unit 1, and today we are completing the same operation for Unit 2. This is a major milestone for both the power unit and the entire project. We can now proceed to the next key stage, the welding of the primary coolant piping," Alexey Likhachev said.

The VVER-1200 reactor vessel, weighing more than 340 tons, was manufactured at Atommash, Rosatom's production facility in Volgodonsk, Russia and shipped to El Dabaa in a special cover ornamented with modern scientific imagery of the atom stylized as traditional Russian folk art. The reactor arrived at the site in May.

Work begins on Unit 4

On the eve of the reactor installation ceremony, Rosatom's manufacturing division began producing the reactor vessel for El Dabaa Unit 4. Steel workpieces weighing over 65 tonnes are being machined on specialized equipment to ensure a perfect fit. The next stage involves anti-corrosion cladding. This protective layer enhances the steel's strength, ensuring the reactor can operate safely and reliably for decades.

Russian manufacturers are also producing the reactor vessel for El Dabaa Unit 3, along with 12 steam generators for Units 2, 3, and 4, primary coolant pumps, and primary coolant piping. Equipment for the Egyptian nuclear power plant is being produced using a new technology that ensures the uniformity of steel at the joints connecting the primary coolant pumps to other primary circuit components. This improves weld integrity and, consequently, the overall operational reliability of the power unit.

Plant-wide progress

At the El Dabaa site, Rosatom is constructing four units equipped with Russian-designed Generation III+ VVER-1200 pressurized water reactors. Rosatom will supply nuclear fuel for the entire operational lifespan of the plant and assist its Egyptian partners with personnel training during the first 10 years of operation. Additionally, the Russian corporation will construct storage facilities and supply casks for spent nuclear fuel.

"Work is now underway simultaneously at all four units. The construction site employs over 25,000 workers daily, more than 18,000 of whom are Egyptian nationals. This workforce is expected to reach 30,000 in the near future. Together with our Egyptian partners, we are making every effort to ensure the site is ready to receive the first shipment

of nuclear fuel in the first half of 2027 and to bring the units online in 2028," Likhachev noted.

Beyond energy

The Egyptian government and Rosatom are discussing cooperation that extends well beyond nuclear power. A key non-energy initiative is the construction of a nuclear medicine center in Egypt, with an agreement to this effect signed on June 17 of this year.

The baseline design for the center includes a radiopharmaceutical production facility equipped with a cyclotron, a molecular imaging department featuring PET and SPECT scanners capable of conducting up to 30,000 scans annually, and a radionuclide therapy department that can treat up to 400 patients per year. The center will improve access to advanced medical care in Egypt and position the country as a destination for medical tourism.

Rosatom is also in discussions with the Egyptian government regarding seawater desalination projects for agriculture and resort areas, as well as the local assembly of batteries and energy storage systems. "I was particularly encouraged by the interest of Egyptian scientists in collaborating with us on quantum technologies. The relevant agreements between government agencies have already been drafted," Likhachev stated.

Photo by: JSC Atomstroyexport

Quiz: Generation IV Systems

We have previously covered fast and molten salt reactors, and in particular, their use for the transmutation of minor actinides — highly radioactive, long-lived isotopes produced during the irradiation of nuclear fuel. This is what Rosatom is focusing on as part of its program to develop Generation IV systems. Now, we invite our readers to test their knowledge on this topic.

1. What distinguishes the Generation IV reactor systems being developed by Rosatom from other reactors and systems?

A) They operate exclusively on plutonium-239.
B) They supplement nuclear power plants with solar and wind energy.
C) They are designed with a focus on enhancing safety, closing the nuclear fuel cycle, reducing the volume of radioactive waste, and maximizing the use of energy contained in natural uranium.
D) They produce electricity, heat, commercial and medical isotopes, coolant, and fuel within a single industrial facility.
E) The reactor can use different types of fuel and different coolants.

2. What is the BREST-OD-300 reactor?

A) A water-cooled water-moderated thermal power reactor.
B) A lead-cooled fast neutron reactor.
C) A gas-cooled reactor.
D) A lead-bismuth fast neutron reactor.
E) A molten salt reactor.

3. What is the main goal of Rosatom's Proryv (Breakthrough) project?

A) To build a maximum-power reactor with minimum dimensions.
B) To test passive cooling technologies for fast reactors.
C) To develop a fast reactor for the production of medical isotopes.
D) To implement and test a system for operating a nuclear power unit without operator intervention.
E) To develop reference Generation IV nuclear energy systems for large-capacity nuclear generation facilities.

4. What does the term "fast reactor" mean?

A) A reactor that starts up and shuts down quickly.
B) A reactor in which fast (high-energy) neutrons participate in the chain reaction.
C) A reactor with an accelerated accident response system.
D) A reactor that can be built in a record short time.
E) A reactor with an accelerated coolant circulation system.

5. Why does the BREST-OD-300 reactor use lead as a coolant?

A) Lead is cheaper than water.
B) Lead is a high-boiling, radiation-resistant, low-activation coolant that is inert in contact with water and air and does not require high pressure in the circuit.
C) Lead glows in the dark when irradiated, making it easier to monitor coolant dynamics in the reactor.
D) Lead has minimal corrosive and erosive effects on structural materials and offers the highest thermal conductivity and heat capacity parameters among alternative coolants.
E) Lead absorbs almost all neutrons, making the reactor subcritical.

6. What is the environmental advantage of a closed nuclear fuel cycle?

A) It completely eliminates carbon dioxide emissions.
B) It eliminates the need for natural uranium mining and drastically reduces the potential biological hazard of nuclear waste.
C) It eliminates the need for uranium enrichment.
D) It allows nuclear power plants to be built without an exclusion zone.
E) It eliminates the need for reactor cooling systems.

7. How is the "inherent safety" ensured in Generation IV nuclear energy systems?

A) Through the absence of active and passive safety systems.
B) Through the maximum use of the fundamental chemical properties of materials and the physical laws governing processes, combined with passive safety systems.
C) It is a status granted by the regulatory authority.
D) It is a construction technology using exclusively natural materials.
E) It is a principle of operating the power unit without the on-site staff.

8. What do the BN-1200M reactor (Beloyarsk Unit 5) and the BREST-OD-300 reactor have in common?

A) They are located in the same region.
B) They plan to use fuel made of uranium and plutonium oxides.
C) They plan to use molten salt as a coolant.
D) Both reactors are advancing Generation IV systems.
E) They have nothing in common.

9. Why is Rosatom building spent nuclear fuel (SNF) reprocessing facilities?

A) To burn SNF and use the ash to manufacture fuel pellets.
B) To recycle valuable energy products, reduce the SNF accumulation, and decrease the volume of radioactive waste sent for final disposal.
C) To produce medical and commercial isotopes.
D) To convert radioactive isotopes into stable elements through chemical reactions.
E) To manufacture metal ingots from fuel rod claddings and structural materials.

10. What role does Rosatom play in the development of Generation IV reactor systems?

A) It engineers Generation IV reactor systems for customers worldwide.
B) It equips operating power units with spent fuel reprocessing and fuel fabrication/refabrication modules.
C) It conducts scientific research and transfers the intellectual property to other organizations.
D) It upgrades fast reactors in France and Japan for their subsequent restart in line with Generation IV system logic.
E) It develops and implements new reactor and fuel technologies aimed at closing the nuclear fuel cycle and ensuring a safer operation of nuclear reactors.

Correct answers

1. Generation IV reactor systems are designed with a focus on enhancing safety, closing the nuclear fuel cycle, reducing the volume of radioactive waste, and maximizing the use of energy contained in natural uranium. These goals are achieved through a combination of new reactor technologies, a closed nuclear fuel cycle, and the use of inherent safety mechanisms.

2. The BREST-OD-300 is a lead-cooled fast neutron reactor using mixed uranium-plutonium nitride fuel, and is one of Rosatom's flagship projects.

3. The main goal of the Proryv (Breakthrough) project is to develop reference Generation IV nuclear energy systems for large-capacity nuclear generation facilities.

4. A "fast reactor" is a reactor in which fast (high-energy) neutrons participate in the chain reaction. In such reactors, neutrons are not moderated (unlike in thermal reactors), which allows for more efficient use of uranium's energy potential.

5. Lead is a high-boiling, radiation-resistant, low-activation coolant that is inert in contact with water and air and does not require high pressure in the circuit.

6. A closed nuclear fuel cycle eliminates the need for natural uranium mining and drastically reduces the potential biological hazard of nuclear waste.

7. Inherent safety is ensured through the maximum use of the fundamental chemical properties of materials and the physical laws governing processes, combined with passive safety systems. For example, as reactor power increases, reactivity automatically decreases due to negative feedback; lead does not enter into hazardous chemical reactions with water or air; and its high boiling point provides an additional safety margin.

8. Both reactors are advancing Generation IV systems, and both belong to the fast neutron type.

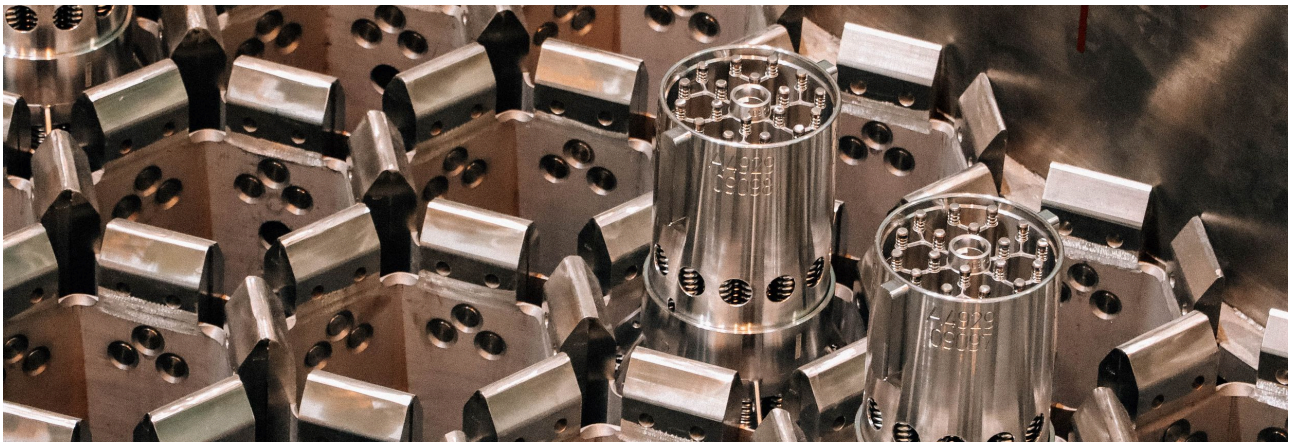
9. Rosatom is building spent nuclear fuel reprocessing facilities to recycle valuable energy products, reduce the spent nuclear fuel accumulation, and decrease the volume of radioactive waste sent for final disposal.

10. Rosatom develops and implements new reactor and fuel technologies aimed at closing the nuclear fuel cycle and ensuring a safer operation of nuclear reactors. Rosatom is the originator of the concept and a global leader in the development of Generation IV systems: the Russian corporation is working on fast reactor designs with various coolants, building facilities for spent nuclear fuel reprocessing and new fuel types, training new personnel, and establishing a new regulatory framework.

Photo by: JSC Siberian Chemical Combine, State Atomic Energy Corporation Rosatom

Rosatom: 2025 in Review

In July, Rosatom presented its performance results for the past year to experts and journalists. The Russian nuclear corporation met all targeted objectives, ensuring growth in revenue, new orders, and key production metrics. The year was also marked by the launch of several new manufacturing facilities and high-tech projects.



"Solving the Unsolvable" was the motto that guided Rosatom through the year 2025. Over the year, the Russian nuclear corporation maintained its leadership in the export market for nuclear power plants. Despite external pressure, it continues to operate successfully in the global arena. As of the end of 2025, Rosatom was constructing 22 large-capacity power units in seven countries, accounting for 88% of the global market for new build exports. Active construction is underway in Turkey, Egypt, China, Bangladesh, and Hungary. The total international portfolio includes 35 large-capacity power units and six small modular reactors across 11 countries. In Uzbekistan, following consultations with local partners, agreements were reached to modify the project configuration into an integrated nuclear power plant featuring both large-capacity power units and small modular reactors; excavation for the SMR units has already commenced. In Kazakhstan, engineering surveys were launched to select the optimal site for a large-capacity nuclear power plant planned to be built in the country. In Belarus, options for constructing a third power unit were explored in 2025. These developments underscore Russia's position as a global leader in nuclear energy. Overall, the portfolio of overseas projects across the entire nuclear life cycle increased to USD 206.2 billion, showing a 2.9% year-on-year growth. Rosatom's project geography now spans 65 countries.

65 countries: Rosatom's international project footprint

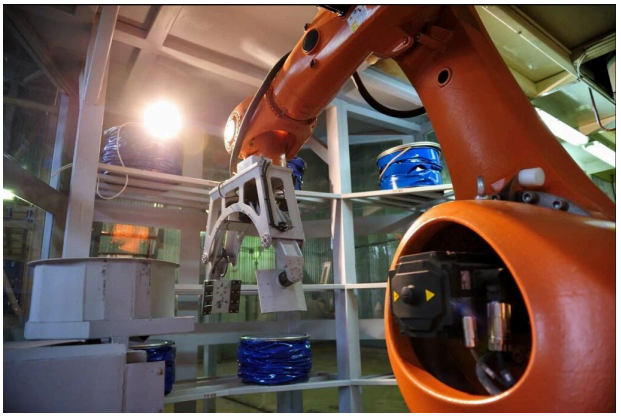
By the end of 2025, Rosatom also led the uranium enrichment market with a 36% global share. The Russian corporation ranks second in uranium reserves and is among the top three in uranium mining (12% market share) and nuclear fuel supply (18% market share).

36%: Rosatom's share of the global uranium enrichment market

Rosatom's total revenue reached a record RUB 3.3 trillion (approx. USD 43.2 billion), a 7.9% increase over 2024. This growth was primarily driven by increased sales of electricity and capacity, heat energy, uranium-containing products, enrichment services, and nuclear fuel.

Core business

Russian nuclear power plants achieved record-high efficiency levels in the history of the Russian nuclear industry, with the capacity factor exceeding 87%. The share of nuclear power in Russia's total electricity mix reached 18.7% in 2025. Throughout the year, no nuclear or radiological events above Level 1 on the International Nuclear and Radiological Event Scale (INES) occurred at any of Rosatom's facilities, reaffirming the reliability and safety of Russian nuclear technologies. The total electricity generation from Rosatom's nuclear and wind assets reached 220.7 billion kWh.



New lines of business

Revenue from new products exceeded RUB 1.5 trillion (USD 19.6 billion), surpassing targets by 25%, a nearly fivefold increase over the past five years. Flagship high-tech projects are moving into the industrial phase. For instance, pilot production of lithium-ion batteries for electric vehicles was launched in the Neman District of the Kaliningrad Region. The factory will annually produce energy storage systems with a total capacity of 4 GWh, equivalent to 50,000 traction batteries.

Rosatom remains a key player in Arctic development. The Russian corporation operates the world's only nuclear icebreaker fleet, providing escort services for cargo ships across the Arctic seas. In November, the keel was laid for the new Project 22220 nuclear icebreaker, Stalingrad. The transit potential of the sea lanes on the Northern Sea Route (NSR) continues to expand: cargo traffic along the NSR reached 37.02 million tonnes, with container transit from China doubling. A total of 1,521 voyages were completed via the NSR, 14% more than in 2024, which confirms the efficiency of NSR lanes. Rosatom is also involved in establishing the Trans-Arctic Transport Corridor.

In the healthcare sector, the Russian nuclear corporation is introducing new medical products to the market. In February 2025, a patent was granted for a production technology for the pharmaceuticals containing actinium-225. In December, a radium-223-based drug, Rakurs (223Ra), was registered in Russia for treatment of prostate cancer.

RUB 3.3 trillion: Rosatom's revenue in 2025

Development of digital products also accelerated. Rosatom's Smart City technologies are now integrated into the infrastructure of 20 nuclear host cities and 131 non-nuclear cities. These systems manage municipal utilities (water and heating networks) and transport, and enable rapid response by city authorities and law enforcement agencies to incidents and resident requests. They are also used for long-term urban planning. Overall, the Smart City toolkit helps create a safe and comfortable urban environment while saving resources and reducing municipal utility costs.

Environmental stewardship and human capital

Rosatom's environmental protection expenditures in 2025 totaled RUB 43.43 billion (approx. USD 568.5 million). For comparison, this figure stood at RUB 36.44 billion (approx. USD 477 million) in 2024. Occupational health and safety spending in the reporting year reached RUB 24.4 billion (approx. USD 319.4 million), up from RUB 20.4 billion (approx. USD 267 million) the previous year.

Rosatom is remediating legacy industrial sites in Russia and abroad, rendering them safe and minimizing damage to the environment. For example, work was completed under the CIS Uranium Mining Site Rehabilitation Program, successfully rendering safe a number of legacy sites in Kyrgyzstan and Tajikistan.

Foundation for the future

Rosatom is laying the groundwork for Russia's future leadership in nuclear technologies. Its Proryv (Breakthrough) project aims to develop Generation IV nuclear energy systems for large-capacity nuclear generation facilities, focusing on demonstrating the technological feasibility of closing the nuclear fuel cycle through the use of fast neutron reactors.

Rosatom also remains a global leader in controlled thermonuclear fusion, developing advanced technology and solutions, manufacturing and supplying systems and components for the International Thermonuclear Experimental Reactor (ITER) project, and conducting R&D for domestic fusion facilities.

In the field of quantum computing, Rosatom developed and tested new generations of five quantum computer prototypes based on ion, atomic, superconducting, and photonic platforms. By the end of 2025, two of them had reached a capacity of 72 qubits.

Anniversary

In 2025, marking the 80th anniversary of the Russian nuclear industry, Rosatom hosted the World Atomic Week, a world-class event that brought together over 20,000 participants from 119 countries, including heads of state and government, ministers, globally recognized experts, leaders of major international nuclear organizations, students, and representatives of public organizations. More than 50 documents were signed during the World Atomic Week. Participants reaffirmed that nuclear energy is indispensable for the sustainable development of the planet and called for equitable cooperation. Offering “partnerships of equals” remains Rosatom’s core competitive advantage for both emerging and established nuclear nations.

Photo by: Akkuyu Nuclear JSC, Novovoronezh Nuclear Power Plant, JSC Production Association Electrochemical Plant, FSUE RADON