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About Bellona:
The Bellona Foundation is an international environmental NGO working on the major climate and environmental problems. Founded in 1986 as a direct action protest group, Bellona has become a recognised technology and solution-oriented organization with offices in Oslo, Brussels, Berlin, and Vilnius, and representatives in USA and several EU Member States.

http://bellona.org
etc@bellona.org

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After Russia’s full-scale invasion of Ukraine in February 2022, Bellona ceased its activity in the aggressor country. On 18 April 2023, the Russian general prosecutor’s office declared Bellona to be an undesirable organization.

However, we continue to monitor events in the field of nuclear and radiation safety relating to Russia and Ukraine, which we believe are of interest to foreign readers. We analyze the situation in order to assess the degree of Russia’s international influence on other countries and the risks connected with this. We present you with a survey of these events for July 2023.

Follow the links to read the digests for June, May and April. Subscribe to our mailing list to make sure you don’t miss the next digest.

In this issue:
Nuclear risks and the war in Ukraine

Zaporizhzhya NPP. Event timeline

On 1 July, four months after damages, the ZNPP was reconnected to the Ferrosplavnaya-1 330 kV back-up line. The connection to this line was broken on 1 March 2023 after damage on the right bank of the Dnipro River controlled by Ukraine, and could not be restored because of danger for personnel. Before the start of the war in February 2022, there were six of these back-up lines. In July, Ferrosplavnaya-1 remained in back-up in case the only remaining main 750 kV line Dneprovskaya shut down (before the war there were four of these lines). This is indeed what happened on 4 July: the station lost power on the main external 750 kV line, and was switched to the back-up line which had just been restored. The reasons for the shutdown were not given. Several hours later, power from the main line was restored. On 21 July, a short-term shutdown from the main power line took place again, caused by a technical accident at one of the switch houses.

On 4 July, the advisor to the general director of Rosenergoatom Renat Karchaa reported on Russian television that Ukraine intended to attack the Zaporizhzhya NPP on the night of 5 July using high-precision long-range missiles and kamikaze drones, and bombard the plant with explosives containing radioactive waste which were transported on 3 July from the South Ukraine NPP.

On the evening of the same day, the Ukraine Armed Forces reported a possible act of provocation planned by the Russian side on the territory of the ZNPP in the near future. According to their information, on this day on the outer roof of power units 3 and 4 of the ZNPP, foreign objects were placed resembling explosives. The Ukrainian Armed Forces
noted that the explosion of these devices could not damage the power units, but could create the impression of shelling by the Ukrainian side. On the same evening, Ukrainian President Volodymyr Zelensky also mentioned this provocation in his address. In the following days under Zelensky’s leadership a number of meetings were held, which also discussed safety issues at Ukraine’s nuclear sites.

On 6 July, journalists at Radio Liberty drew attention to fresh satellite images of the Planet Labs services taken on 5 July, where new objects were visible on the roof of power unit 4. “We know that machine-gun nests were placed on the roofs of several power units. These new images may show that there could be explosives on the roofs. Of course, the quality of the image means it is impossible to say what they are exactly,” said President of Energoatom Petro Kotin.

Images of objects on the roof of the turbine hall of power unit 4 of the ZNPP, July 2023.

Source: Energoatom/Planet Labs
On the same day, 6 July, The Times published an interview with the head of Ukrainian Intelligence Kirill Budanov, where he commented on the situation at the Zaporizhzhya NPP: “I think that now the danger of an artificial manmade disaster is gradually decreasing”. He also added that public and non-public efforts in Ukraine had provided assistance with this.

On 8 July, Ukrainian intelligence published a plan of mining at the ZNPP. According to their information, around the perimeter of the plant, in service rooms and machine rooms mine and explosive barriers are installed, consisting of remotely controlled and unguided directional type anti-personnel landmines of Soviet manufacture, containing from 0.66 to 12 kg of explosives each.
Throughout July, experts from the IAEA mission at the ZNPP inspected the plant territory for land mines and explosives. They inspected several sections around the perimeter of the cooling pond, which Ukrainian defense ministry intelligence reported had been mined in June. In particular, they inspected the isolation gate separating the cooling pond from what remains of the Kakhovka reservoir (gates reinforced with counterweights and sand to prevent water leakage), and also the gate separating the discharge channel of the nearby Zaporizhzhya Thermal Power Plant (ZTPP) from the reservoir. In mid-July during the inspection, IAEA experts observed work for strengthening the walls of the smaller channel transferring water from the discharge channel to the cooling pond.

On 9-12 July, experts inspected the perimeter and surroundings of the sprinkler cooling ponds, the main control room, emergency control room, rooms where electrical cabinets of the safety systems are located and the turbine hall of reactor units 1 and 3, the unit 1 reactor hall, coolant pumps and safety system pumps. In the following days, the reactor buildings 2 and 4 were inspected, and also unit 6: the main control room, reactor halls, spent fuel pools, emergency control rooms, rooms where electrical cabinets of the safety systems are located and the turbine halls. On 28 July, the reactor vessel, spent fuel pool and the steam generator of power unit 5 were examined. Evident traces of explosive devices or mines were not detected during the inspection.

In the turbine halls of units 1, 2 and 4, experts saw vehicles. Oleh Korikov, head of the State Nuclear Regulatory Inspectorate of Ukraine, notes that "IAEA representatives cannot check what is under these covered trucks. The Russian occupants do not provide this opportunity. The occupants also restrict access to equipment and systems that are important for safety". Additionally, he noticed that a considerable interval of time elapses between IAEA request for access to certain systems and equipment, and the actual inspection. This time may be used to carry out certain manipulations in order to deceive IAEA representatives.

Also, despite numerous requests from the IAEA mission, access to the roofs of reactor buildings and turbine halls, including units 3 and 4, was not given in July. IAEA experts were only able to access the roofs of the reactor buildings of these units on 3 August, immediately after the latest rotation of the IAEA mission at the plant, and almost a month after alarms were raised concerning foreign objects on these roofs. During the inspection mines and explosives were not detected on the roofs. IAEA experts did not report the presence of firing points there.
On 23 July, the IAEA group detected anti-infantry mines in the buffer zone between the site’s internal and external perimeter barriers. They were situated in a restricted area that operating plant personnel could not access. The director of the IAEA noted that although having such explosives on the site was inconsistent with the IAEA safety standards and nuclear safety guidance and created additional psychological pressure on plant staff, the IAEA assesses that any detonation of these mines should not affect the site’s nuclear safety and security systems.

In the June digest, we wrote that in May automatic data transfer to the Ukrainian authorities from eight radiation monitoring stations located near the ZNPP had been switched off. Over the course of June, the online data transfer to the State Nuclear Regulatory Inspectorate of Ukraine (SNRIU) was still not working. Data is manually sent by the Russian side to the IAEA group, which also regularly conducts independent radiation monitoring on the site. This data and the actual measurements of the group are uploaded by the IAEA into the IAEA’s International Radiation Monitoring Information System (IRMIS). Additionally, to monitor the radiation state around the plant on the territory controlled by Ukraine, Energoatom uses a network of radiation monitoring sensors, located 5 km away from the power plant, on the right bank of the Dnipro.

From 10 July, on its website Energoatom began publishing information practically every day about the radiation background at the industrial site of the ZNPP, in the sanitary protection zone of the plant and the observation zone. Over this time, the background radiation level did not exceed the permissible norms and came to around 0.1-0.15 µSv/h.
The water supply for the plant remains relatively stable, while the water level in the ZNPP cooling pond throughout the course of June dropped by around 1 cm per day from plant operation and evaporation. In the present conditions, this means that water supplies in the cooling pond are sufficient for at least several months. In July, to pump water from the inlet channel of the Zaporizhzhya Thermal Power Plant (ZTPP) into the discharge channel, submersible pumps were periodically used. This factor, along with the torrential rain at the end of the month, caused the water level in the discharge channel to increase by approximately 25 cm at the end of the month. The discharge channel is used for feeding the spraying pools of the plant, which carry the main burden for cooling fuel in the energy units in cold shutdown.

![Change in the water level in the cooling pond](image)

Change in the water level in the cooling pond after the destruction of the Kakhovka dam on 6 June.

*Graph compiled by Bellona based on data from Energoatom and reports of the permanent representative of the RF at the IAEA.*

On **24 July**, unit 4 of the ZNPP was put into hot shutdown mode. Four days later, on **28 July**, unit 5 was switched from hot shutdown mode, which it had been in since autumn 2022, to cold shutdown mode to carry out repair works. Energoatom warns that switching unit 4 to hot shutdown entails additional risks for nuclear and radiation safety, owing to the prolonged downtime of power unit equipment, and because proper routine maintenance and repair of safety-critical equipment was not carried out. Furthermore, the plant lacks qualified personnel. Throughout July, IAEA experts called on Russia to consider the possibility of installing an external source of heat and steam for the plant’s own needs, and put all units into “cold shutdown” mode. By order of the SNRIU, the operation of all six reactors was to be limited to cold shutdown mode.
Commentary by Bellona:

A close observation and thorough analysis of the events at the ZNPP lead one to the conclusion that the prospects for the further operation of this plant in the pre-war mode seem rather unlikely, and in fact probably impossible. A scenario where Russian forces under the onslaught of the Ukrainian counterattack withdraw from Energodar and leave the ZNPP to Ukraine in working condition seems unrealistic. Given Russia’s attempts to cause the maximum destruction to Ukraine’s infrastructure, including energy infrastructure, if it is impossible to hold the ZNPP, Russia will probably attempt to make its future use by Ukraine as difficult as possible. In the best case, with the withdrawal of Russian troops, the main equipment of the plant will be worn out from unregulated use and lack of proper maintenance, in the worst case it will be intentionally damaged as much as possible or looted, and in the worst possible scenario imaginable, this may be accompanied by a nuclear radiation incident, with the aim of hindering further use of the plant, and as an act of provocation.

Late June and early July was one of the most anxious periods at the ZNPP during the time of its occupation, except for the periods of direct shelling of the station, accompanied by numerous charges by both sides of preparing a radiation diversion and provocation at the station. Full control of the situation at the plant on Russia’s part and the inability of IAEA inspectors to receive access to requested locations at the plant for control and independent assessments in an efficient and timely manner gives Russia free rein in placing military objects and equipment at the plant, and for future actions at the plant, depending on political goals and current situation on the frontline. All that Ukraine can do in this situation is to act preventatively by publishing operative intelligence data, and draw maximum international attention to the problem of the ZNPP, both in the public field and by official diplomatic channels.

To all appearances, even if Russia remains on this territory for a long time, it does not intend to operate the ZNPP in energy mode, as the site will be under constant threat of an armed attack or other dangers. The six units of the NPP will not be able to work unhindered after the drying out of the Kakhovka reservoir, and it will not be possible to create a new cooling system for the units to work in energy mode in these conditions. One should also not forget the enormous problem of a lack of personnel and the need for quality maintenance of faulty equipment.

Therefore, we may say that for the Russian side everything that is taking place around and inside the ZNPP now entails a period of “anxious waiting”, deliberation and blackmail, while for the Ukrainian side it provides the opportunity to make maximum use of the situation to attract international attention.
Ukraine holds talks with Bulgaria on purchase of two nuclear reactors

On 7 July, on the basis of a memorandum of understanding signed on the previous day concerning cooperation between Ukraine and Bulgaria on nuclear energy, the gas sector, green energy and the energy transition, talks began on selling Ukraine equipment of Russian manufacture intended for the Belene NPP project. On 12 July Ukraine’s Energy Minister Herman Halushchenko confirmed this report. This concerns two VVER-100 nuclear reactors and other power equipment. According to Energoatom, the possibility is being examined of installing them on the sites of the uncompleted power units 3 and 4 of the Khmelnitsky NPP. If the talks are successful, it is planned to install the reactors with the assistance of the Westinghouse company.

The modern appearance of unit 3 of the Khmelnitsky NPP, where it is proposed to install the new reactor. Construction of the unit began in 1985.

Photo: Khmelnitsky NPP.
A number of independent experts express concerns about these plans. In particular, they say that technical problems may arise in installing the reactors and subsequent technical maintenance. Ukraine’s former deputy minister of fuel and energy Nikolai Shteinberg told Ukrinform news agency that the reactors in question lacked a whole range of crucial equipment which is only manufactured in Russia, as it is originally of Soviet design. Another aspect is assessing the state of construction on the Khmelnitsky NPP site. The issue was also raised of observing requirements of expert control, as the equipment in question is a dual-purpose object. According to Shteinberg, “permission of the direct manufacturers is required, i.e. Russia. Accordingly, a trilateral agreement must be signed: Russia-Bulgaria-Ukraine.”

The Energoatom report states that Ukraine is not conducting any talks and does not plan to sign any documents with Russia. It also states that an inspection was made of elements, constructions and hubs of uncompleted buildings and structures of units 3 and 4 of the Khmelnitsky NPP, which deemed it possible to use existing structures in the construction process.

We should note that according to the decision passed by the Bulgarian parliament on 6 July, the sale price cannot be lower than what Bulgaria paid Russia for the equipment – around 610 million Euros.

Several years ago, Bulgaria sold a VVER-1000 reactor vessel designed for the Belene NPP. It was delivered by the Czech company ŠKODA JS in 1989, but was sold to Russia and used for completing unit 4 of the Kalininsky NPP.

**Commentary by Bellona:**

The situation surrounding Bulgaria’s proposal is not clear-cut. It is understandable that both Bulgaria and Ukraine have an economic interest in this deal, and for Ukraine this option may be cheaper than building a new unit from scratch. Especially as there have already been precedents in the past with the sale and operation of a Bulgarian reactor. However, Bellona believes that the concerns voiced by Ukrainian independent experts are fully justified. This complex procedure, which directly affects issues of reliability and safety of construction and the future operation of nuclear power units, requires a comprehensive analysis and public and expert discussion, which is impossible during wartime when there are restrictions on access to information about critically vital infrastructure.
International nuclear news and its connection with Russia

Sanctions against Rosatom

On 20 July, Australia levelled new targeted sanctions against individuals and legal entities “with economic and strategic significance for Russia.” In particular, the updated list included Russian companies connected with the nuclear sector: Atomflot, the owner of Russia’s fleet of nuclear icebreakers; the High-Technology Scientific Institute of Inorganic Materials Named for Academic A.A. Bochvar (VNIINM, part of the fuel company of Rosatom TVEL), which specializes in issues of material science and technologies of the nuclear fuel cycle for all types of reactors; the State Research Center – Research Institute of Nuclear Reactors (SSC RIAR), specializing in studies in the field of reactor technologies. These scientific institutes have also been under sanction by the UK since 19 May.

On 20 July, Canada levelled personal sanctions against several heads of the Russian nuclear sector: Evgeny Pakermanov, president of Rusatom Overseas; Ivan Kamenskikh, first deputy CEO of Rosatom, director of the directorate of the nuclear weapons complex; Yuri Olenin, deputy director general of Rosatom for science and strategy; Sergey Obozov, deputy general director of Rosatom for development of the production system.
On 20 July, the USA levelled sanctions against the affiliated companies of Rosatom AEM Propulsion (manufactures elements of propulsion complexes for vessels of different purpose and class) and the Scientific and Production Association Critical Information Systems (manufactures electronics and electronic components).

Commentary by Bellona:

The new sanctions levelled against individuals and legal entities connected with Rosatom have yet to have a serious influence on the international and domestic business of the corporation, and on its ability to promote the interests of the Russian leadership. In many ways these sanctions simply duplicate sanctions that were previously levelled in other jurisdictions, where Rosatom structures included on the sanctions list do not conduct activity.

Urenco expands enrichment capacity in the USA

On 6 July, Urenco reported that investment had been approved in expanding enrichment facilities at its American plant UUSA in New Mexico. Several new centrifuge cascades will be added to the existing ones at the plant, to increase capacity by around 15% (700,000 separative work units (SWU) per year). The basis of these investments is “new commitments from US customers for non-Russian fuel”. The first new cascades will be put into operation in 2025.

According to the company statement, this project will be the first project in a long-term program to create facilities to consolidate the delivery chain of nuclear fuel both in the USA and in the rest of the world, as “more countries and utility companies turn to nuclear energy for the first time, or seek to extend and/or diversify fuel supplies for existing nuclear operations”, which leads to an increase in demand for Urenco’s enrichment services.

In the June digest we wrote that according to the annual report of the US Energy Information Administration, Russia is currently the leader for import delivery of services for uranium enrichment for American NPPs. In 2022, the USA imported 3.4 million separative work units (SWU), and the volume of deliveries from the Urenco enrichment plant came to 3.9 million SWU.
Commentary by Bellona:

The nuclear industry of the USA and Western European countries depends to a large degree on the Russian nuclear sector for deliveries of uranium and services for its enrichment and conversion. Direct sanctions against Rosatom in these sectors may be lacking because it is impossible to make a drastic curtailment in Russia’s services, but it was inevitable that businesses would attempt to develop their own replacement facilities with the direct and indirect support of the political circles of these countries, and this is indeed what is taking place. This process may take time, but in the long-term perspective this will raise the stability of western supplies, and may lead to a decrease in Rosatom’s share on international markets.
Czech Republic makes exceptions to sanctions for companies linked with Russia’s nuclear industry

According to information from the Czech news portal Seznam Zprávy, since the beginning of the war in Ukraine, the Financial Analysis Department of the country has granted exceptions to sanctions for 33 Czech organizations, mainly in the fields of nuclear power (37% of cases) and pharmaceuticals (45%).

Although in response to journalists’ inquiries, the department does not give the names of the applicants, or other specific information about them, it is clear in the case of nuclear power that the exceptions were mainly requested by the company ČEZ, so that it could continue working with several engineering companies owned by Russians.

The energy company ČEZ which owns the Temelín and Dukovany NPPs confirmed that it had made several requests to the FAU for exceptions to sanctions. The press secretary of the ČEZ group Ladislav Kříž said that “they could not continue cooperation with several Czech supplier companies which have (or had) Russian owners, and in some cases are also individuals under sanctions”. For example, this concerns the engineering companies MSA and Škoda JS, and also the company Arako.

MSA, which manufactures valves, including for nuclear plants, is part of the Russian Pipe Metallurgical Companies, and the final owner of MSA until August 2022 was listed as being the sanctioned Russian entrepreneur Dmitry Pumpyansky.

Arako, which also manufactures valves for nuclear and thermal power stations, has since 2007 been part of the “Atomenergomash” group, the engineering division of Rosatom.

Skoda JS was previously part of the structure of the Russian machine-building group OMZ United Machine-Building Plants, but in 2022 ČEZ purchased it from the Russians.

Commentary by Bellona:

These actions were predictable, since a number of several Eastern European countries operating nuclear power units of Soviet design are dependent on deliveries of spare parts, materials and services from Russia. This also influences delays in applying broad sanctions against the Russian nuclear sector in Europe. Companies either demand serious exceptions for a number of Eastern European countries, which make these sanctions pointless in many ways, or for a certain time delay in their introduction, in order to adapt and organize new supply chains. These processes are probably already underway without the declaration of sanctions, as is the case for example in issues of delivering nuclear fuel for VVER reactors, but time and political will are required for this.
Uranium export from Niger under threat

On 31 July, reports appeared on social networks and several media outlets that Niger, where a military coup took place on 26 July, was stopping the export of uranium and gold to France. For example, this was reported by the Russian official news agency TASS, citing the BBC, and Forbes, citing the Financial Times. Subsequently, both the BBC and the Financial Times removed from their publications the mention that the Niger junta had prohibited the export of uranium and gold to France. On 2 August, Reuters reported that there were no official declarations on plans to stop the export of uranium or gold, and called the previous reports false.

In Niger there are two major uranium mines which provide around 5% of the world’s uranium production. Niger is the leading supplier of uranium to the European Union, its share in 2021 came to 24%. On 1 August the nuclear agency of the EU Euratom announced that it saw no direct danger for the production of nuclear power in Europe if Niger reduces uranium supplies, and that the EU had sufficient uranium supplies to last European NPPs for the next three years.

Orano, the French nuclear fuel company which holds shares in the uranium mining companies of Niger (COMINAK, SOMAïR и IMOURAREN SA), announced that it was monitoring the situation, but that so far the coup had not affected uranium deliveries: “the local teams are mobilized to ensure business continuity on our operational sites in Arlit and Akokan, and at headquarters in Niamey with the support of employees in France.”

Commentary by Bellona:

The possible problems with uranium deliveries from Niger show several things. Firstly, in the information sphere any topic that is problematic for the West is eagerly taken up and used by Russian propaganda, even if it is fake news. And if outside Russia the effect of these actions is insignificant, within the country with its harsh censorship this creates the effect that the Russian government needs, showing the numerous problems and rifts that supposedly exist in the West. Secondly, despite the lack of direct confirmation of Russia’s involvement in the Niger coup, in particular through its Wagner mercenary group that is present in the region, it is obvious that Russia actively tries to use its influence on third-party countries for its own political goals, including in the war in Ukraine. For more detail about Russia’s activity in the nuclear sphere in Africa, see below. Thirdly, this incident shows the vulnerability of raw material supplies for the West from countries with unstable political regimes, the importance of creating and developing reserves in the nuclear sector, increasing supplies from friendly countries, for example Canada and Australia, and for countries to develop their own production. Additionally, there is growing potential for developing production and deliveries of uranium from Kazakhstan.
India’s nuclear plans

During a two-day visit by Indian Prime Minister Narendra Modi to Paris on 14 July, the leaders of India and France held talks, both in one-on-one format and in delegations. As a result of these meetings, a joint statement on a roadmap was published outlining the course of development of bilateral relations between India and France until 2047. One of the points in the joint plans concerns increased cooperation in the nuclear sphere. Besides the development of the Jaitapur Nuclear Power Project (JNPP), this involves the proposal of Électricité de France S.A. (EDF) to train civil engineers and nuclear technicians from India. The two countries also agreed to work on creating partnership for small modular reactors (SMR) and advanced modular reactors (AMR).

Previously, in June, Modi held talks during his visit to the USA with President Joe Biden. The subsequent statement emphasized that nuclear power remains a necessary resource to satisfy the demands of both countries in the field of climate, energy transition and energy safety. The leaders noted the continuing negotiations between the Nuclear Power Corporation of India Limited (NPCIL) and Westinghouse Electric Company on building six nuclear reactors in India. This concerns the development of a technical and commercial proposal for the Kovvada nuclear project. They also mentioned the continuing discussion of developing technologies of small modular reactors of the next generation in the format of cooperation for the domestic market, and also for export.

Commentary by Bellona:

India, which last year became the most populous country in the world, has a severe need for energy sources, and has a major program for developing nuclear power. At present the country has 19 nuclear power units with a total capacity of just over 6 GW. In the next 10 years, India plans to triple its nuclear capacities. Despite having its own projects for heavy water reactors, without foreign assistance and technologies it is unlikely the country will be able to realize these plans. At present, the only foreign builder of NPPs in India is Russia. It has already built two VVER-1000 units at the Kudankulam NPP in 2013 and 2016, and construction is currently underway of another four units at the same site, with discussion of the possibility of building an NPP at another site. At the same time, construction of Russian NPPs in India takes place with constant delays (see the following section).

Active talks with the USA and France show the interest of these countries in India’s promising nuclear market, and in future may shake Rosatom’s position here as the only foreign constructor. However, these talks have already been continuing for many years, and it remains unknown when these plans will be realized.
Events in the Russian nuclear sector

Rosatom’s foreign projects

During the Russia-Africa summit held on 27-28 July, Russia signed two intergovernmental agreements on cooperation in the field of using nuclear power for peaceful goals – with Burundi and Zimbabwe. These agreements propose developing legal regulation in the field of nuclear and radiation safety, carrying out fundamental and applied studies in the field of using nuclear power for peaceful goals, producing radioisotopes and their use in industry, medicine and agricultural, cooperation in the field of using radiation technologies and nuclear medicine, training specialists for the nuclear sphere. Also on 27 July, the “roadmap” was signed for developing Russian-Ethiopian cooperation in the sphere of using nuclear power for peaceful purposes. The roadmap determines the specific steps which the sides will take in 2023-2025 for developing possible construction of a NPP of large or small capacity, and also a Centre of nuclear science and technologies in Ethiopia.

On 3 July, on the site of the Paks-2 NPP in Hungary, a branch of Atomstroiexport (the engineering division of Rosatom) started the next phase of preparing the construction of new power units: construction of the groundwater cut-off began. Following the construction of the groundwater cut-off and soil stabilization, excavation works and preparation for the construction of the foundation slab will begin.

On 28 July, the Russian Federation passed a law altering the procedure for Hungary to pay off the state loan for construction of the Paks-2 NPP, in connection with the sanctions levelled against Russia. According to this document, in accordance with an agreement of 28 March 2014, Hungary was granted a state export loan of a sum of €10 billion. As of 1 July
2023, the Hungarian side made use of the loan funds to a sum of around €348.55 million, the remaining debt of Hungary on the main debt is around €28.15 million. According to the new protocol, Hungary will now make payments on the loan using an account in Euros which will be opened in a Russian bank, and subsequently the Russian side will be directly debited with currency funds from this account in payment of the loan.

At unit 5 of the Kudankulam NPP, built in India according to a Russian project, the first element of a device for confining nuclear reactor core melt has been installed in final position. The so-called “core catcher” is installed under the reactor vessel and is designed to prevent radioactive elements from leaving the reactor building in a non-project accident with fuel melting.

We should note that this operation took place two years after the first concrete on the site was poured, which shows the rather slow rates of construction. For comparison, in China, in a parallel construction of Russian design of unit 3 of the Xudapu NPP, the interval between these operations took just half a year. In general, the time of the construction of the first two units of the Kudankulam NPP came to 12-15 years, which is quite a lot. This all shows that the adoption of Russian technologies on the Indian nuclear market is not proceeding very quickly, and with constant delays.
On 11 July, Atommash completed and dispatched a set of equipment – a nuclear reactor and four steam generators for power unit 3 of the Xudapu NPP under construction in China. On 25 July at power unit 3 of the Xudapu NPP, built with the assistance of Atomstroieexport, the engineering division of Rosatom, the dome of the reactor was lifted and installed on the reactor building in one stage. Previously, installation was carried out in two stages during construction of NPPs under Russian designs. Installation of the dome took place just two years after the first concrete was poured. On average, in construction of analogue Russian nuclear power units, this operation takes place 4.5 years after the first concrete is poured. General construction of units 3 and 4 of the Xudapu NPP under the VVER-1200 Russian project is being carried out by China independently. According to the contracts, the Russian side only works on designing the nuclear islands of the two plant units, delivering key equipment for them, providing services for special inspection, general assembly and general set-up of delivered equipment. The equipment of the turbine hall on these units will be of Chinese manufacture. The units are scheduled to be put into operation in 2027-2028, i.e. after only six years from the start of construction. All of this shows that China is mastering Russian nuclear technologies at a very fast rate, with constant increase in the level of localization. China builds Russian NPPs quicker than Russia does in Russia itself.

Installing the dome on the reactor building of the Xudapu NPP.

Source: Atom Media
On 10 July, power unit 2 of the Belarussian NPP was connected to the grid. On 12 July the reactor was switched to 100% capacity. Dynamic tests will later be carried out on unit 2 at different levels of power unit capacity, including zero level, with subsequent assessment of the characteristics of the equipment before its full testing at projected capacity.

The Bangladesh Atomic Energy Regulatory Authority (BAERA) on 17 July issued licenses for nuclear fuel handling, storage and transportation to the operator of the Ruppur NPP, the Bangladesh Atomic Energy Commission (BAEC). Class B license authorizes the purchase, ownership, handling and storage of nuclear materials, class D license allows a Russian transport company to transport nuclear materials, while class E provides for the possibility of nuclear materials import. Fuel is manufactured at the Novosibirsk Chemical Concentrates Plant (part of TVEL).

Acceptance inspection of the first batch of nuclear fuel for the Ruppur NPP at the Novosibirsk Chemical Concentrates Plant in early August 2033:

Photo: Atomstroiexport telegram channel.
At the scientific technical conference TopFuel 2023 held in 17-21 July in Xian, China, focusing on issues of development and operation of nuclear fuel for the PWR, BWR and VVER light water reactors, specialists of the Rosatom fuel company TVEL delivered papers on the characteristics of TVS-Kvadrat (TVSK) fuel, based on a test of the full operation cycle in the PWR-900 European reactor and post-reactor studies.

TVSK was initially developed by TVEL for use in the 3- and 4-loop PWR reactors designed by Westinghouse. In 2008, TVEL began working with the owner and operator of the Ringhals NPP in Sweden, Vattenfall. In 2020, an experimental batch of TVS-Kvadrat completed the operation cycle in a PWR-900 reactor in the third power unit of this NPP. The irradiated fuel was sent to the Studsvik scientific center in Sweden for post-reactor tests, the main phase of which were completed in autumn 2021. In December 2021, TVEL started production of fuel for PWRs at the Novosibirsk Chemical Concentrates Plant.

In 2016 TVEL and Vattenfall Nuclear Fuel AB signed a contract for commercial delivery of fuel for the Ringhals NPP from 2021 (this is one of the three contracts of Vattenfall for fuel delivery; contracts were also signed with Areva from France and Westinghouse from the USA), but on 24 February 2022 Vattenfall cancelled deliveries of Russian fuel after Russia invaded Ukraine.

Since the western nuclear fuel market is now closed to Russian fuel, the sale of fuel developed for NPPs of western design to China, where there are many technologically similar units in operation, seems quite promising and may become another direction in Russian-Chinese nuclear cooperation.

**Commentary by Bellona:**

Although in the construction of new NPPs, Rosatom has been “cordoned off” from European and other developed nations, the state corporation still hopes to remain on this market and even expand in developing countries. This explains the extensive efforts that we may observe in projects to build new NPP units in countries in Asia and the former Soviet Union, and also Rosatom’s activity in Africa. It is hard to say how this market will develop further, and in many ways this will depend on the outcome of the war in Ukraine and the conditions that Russia will be able to offer to countries wishing to build NPPs. Bellona has noted how construction technologies in China have advanced, on the example of the Xudapu NPP. At the same time, China has always been very swift and quite successful in adopting and further developing technologies in the most complex fields. We may look at the example of Chinese technologies in automobile construction, where models are manufactured that are practically the equal of the world’s finest. In the early 2000s, when Rosatom had just entered China, the head of Rosatom at the time Sergey Kiriyenko said quite
bluntly that Russia had to be wary with China, because the Chinese approach was such that in 10 to 15 years Russia might find itself lagging behind. This is in fact what the situation looks like today. It is possible that in future a number of Russian projects may emerge on the world market through Chinese suppliers or in partnership with China.
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