Fuel Loading Ahead of Schedule at Tianwan 3

Important news has come from the Tianwan NPP construction site. Unit 3 of the Chinese nuclear plant entered the reactor startup phase as the first TVS-2M fuel assembly was loaded into the reactor. For more details read our report from the site.

The first fuel assembly was loaded into the reactor on 18 August. This was announced by the press service of Rosatom's subsidiary OKB Gidropress, the company that designed the reactor unit. According to Andrei Lebedev, Vice President for South Asia at ASE (a subsidiary of Rosatom), fuel loading was started ahead of the schedule. He said that Unit 3 was expected to be connected to the grid by the end of 2017.

"We passed another milestone in the construction of the second phase of the Tianwan NPP project," said ASE's President Valery Limarenko. "Fuel loading has begun at Unit 3. It is telling that the first two units built by us in cooperation with China are recognized among the best in the country. Tianwan is where we use our most innovative solutions in the fields of nuclear power and construction management. We hope that Tianwan II will serve the people of China and strengthen ties between our countries."

A total of 163 fuel assemblies will be loaded into the reactor. TVS-2M fuel has better operating performance and is more cost efficient as it enables longer refueling cycles. As soon as the loading process and

subsequent tests are completed, Unit 3 will go critical. The next step after the criticality is reached is connection to the Chinese power grid." Commercial operation of Tianwan Unit 3 is planned to begin in 2018.

The Tianwan nuclear project (currently in its second phase, which includes construction of Units 3 and 4) is carried out in China's Jiangsu province with the input from ASE Group. The Tianwan nuclear power plant is the largest project delivered jointly by Russia and China. Tianwan Units 1 and 2 were commissioned in 2007 and have an annual capacity of over 15 billion kWh.

100 million families

According to China National Nuclear Power Co. Ltd. (CNNP), Tianwan generated more than 160 billion kWh over ten years of its commercial operation. This amount is equivalent to the annual power consumption of 100 million Chinese families. Tianwan Units 1 and 2 have operated seamlessly since their connection to the grid. Tianwan was the first nuclear power supplier to receive the China Quality Award.

The power plant facilitates the development of infrastructure in Lianyungang, contributes to regional economic development and supports authorities in their fight against poverty. According to statistics, Tianwan paid around 15 billion yuan (1 US dollar equals 6.67 yuan) in taxes and created over 17,000 jobs over ten years after it was connected to the grid.

CNNP estimates that the two power units of Tianwan I save 5.2 million tons of coal equivalent every year and cut emissions of carbon dioxide, sulfur dioxide and nitrogen oxide by 12.76 million, 120,000 and 40,000 tons respectively.

TECHNOLOGY

Rosatom Offers Super Steel

A new stainless steel alloy developed by Russian nuclear engineers as a means of passive heat removal for nuclear plants proved successful in the harsh tropical environment.

Tropical environments are known for heavy dews, chloride contaminated air, high temperature and humidity, which are all contributors to corrosion. However, the latest developments in the global nuclear power industry show that new nuclear power plants will mostly be located in tropical areas. Corrosion affects nuclear safety, which is well known to be a top priority for Russian nuclear engineers. Material scientists of the Central Research Institute for Machine Building Technology (a subsidiary of AEM Group) have developed a new steel alloy for tropical environments with excellent heat and humidity resistance properties.

The new steel alloy known as 08H14MF is designed to manufacture heat exchange tubes of passive heat removal systems (PHRS) that will be used in tropical conditions. The PHRS is one of the most important components of a nuclear power

plant as it ensures safety of nuclear operations in emergencies. Passive heat removal systems have been installed at Kudankulam (India) and Novovoronezh-2 (Russia), and are provided for in the Akkuyu project (Turkey).
Due to the lack of experimental data on corrosion behavior in a tropical environment, the steel alloy needed test-supported proofs that it can be used in passive heat removal systems of nuclear reactors.
Climate resistance tests were carried out by the Central Research Institute for Machine Building Technology and OKB Gidropress (both belong to Rosatom's engineering division AEM) and lasted half a year to cover all seasonal changes.
Visual observation was used as a method to control the condition of the surface. No corrosion was detected on the steel surfaces of the heat exchanger, and tubes remained clear and shiny. The annual corrosion rate of the new steel alloy does not exceed 5.4 μm even in the harshest conditions (at the average salt spray accumulation rate of 600±75 mg/sq m per day). This means that corrosion will not exceed 0.3 mm in 60 years, or the entire service life of a PHRS. There is no doubt, therefore, that the steel alloy in question is highly resistant to environments with a low chloride content. Electrochemical tests have also shown that it demonstrates excellent resistance behavior in humid marine climates.

"The steel alloy 08H14MF was developed by material scientist Veniamin Borisov from the Central Research Institute for Machine Building Technology. The goal was ambitious as he wanted to develop a stainless steel alloy that was easily machined and perfect for making steam generator tubes. Ideally, it should contain no nickel, which is the most expensive of all alloy components," said Ivan Safonov, PhD in Chemistry and Head of the Corrosion Test Laboratory, Central Research Institute for Machine Building Technology, in an interview to Rosatom Newsletter. "The material was tested many times for different uses ranging from rail car roofs to sinks." According to Ivan Safonov, it was the wide range of applications in the past that helped this steel alloy enter the list of candidate materials for climate-specific heat removal systems.

"Of course, it is not perfect for extremely aggressive media, but well suited to humid climates. When we worked on the Kudankulam project, we developed a steel aluminizing technology – the PHRS made of the resulting material is still fully operational. Gidropress suggested using 08H14MF at the Akkuyu plant. A special software application was developed to model the PHRS service life with various corrosion testing methods. There was much work to be done, and we were lucky to have competent interns from the National University of Science and Technology. Each intern tested one system in three modes with a salt spray chamber and electrochemically. We summarized results in the final report, and the PHRS was approved," Ivan Safronov said.

IN FOCUS

Most Belarusians Support Nuclear

Around 60% of Belarusians support the nuclear construction project delivered with Russia's input.

The Belarus NPP construction project carried out by Russia enjoys broad support from the Belarusian people, says Mikhail Mikhadyuk, Belarusian Deputy Minister of Energy. At present, the project is supported by nearly 60% of all Belarusians, he said at a meeting with the press in the town of Ostrovets. "Here [in areas adjacent to the construction site] the popular support of the nuclear plant reaches 83%," the Deputy Minister said. He stressed that a 50% support for the nuclear construction project was seen as high across the globe.

The meeting of Russian journalists with the Belarusian Deputy Minister of Energy was held as part of the press tour dedicated to nuclear energy cooperation between Belarus and Russia. The tour was organized by the Permanent Committee of the Union State of Russia and Belarus, National Press Center of Belarus, and international news agency Russia Today. "The main objective of inviting Russian media to the nuclear power plant constructed in Belarus is to give Russia and the global community an open and honest report on the nuclear power facility, which is built on the latest technology," said Margarita Levchenko, Head of Social Policy and Information Support Department of the Union State's Permanent Committee.

WANO peer review

In 2018, the nuclear power plant will be visited by experts of the World Association of Nuclear Operators

(WANO), said Mr. Mikhadyuk. A number of IAEA missions and training seminars are also on the plan before the plant is started. The Deputy Minister emphasized Belarus' willingness to openly share information about the progress in construction with international nuclear organizations, neighboring countries and other stakeholders. "In accordance with our obligations, we have stress-tested the plant as part of the target safety reassessment because safety is our priority both in construction and operation of the facility. We are preparing a national report on the stress tests, and Belarus has agreed to submit it to the European Commission for revision. The EC is now forming a team to review our national report," Mikhadyuk said.

Alexei Likhachev, CEO of ROSATOM

"We have discussed the current situation on the site of Belarus NPP. We stay committed to the goal of bringing the entire plant online in the summer of 2020. I would like to thank the Belarusian party for paying close attention to the construction project. We appreciate this attitude, and so do our constructors working in Belarus. The Belarus nuclear power plant is a next generation facility in terms of safety. It is without peer on the global scale."

For reference

The Belarus NPP is constructed near Ostrovets (Astravets), a small town in the Grodno Region of Belarus. The plant will have two VVER-1200 reactor units with a total capacity of 2,400 MWe. Unit 1 is scheduled for commissioning in 2019, to be followed by Unit 2 in 2020. According to the Belarusian Ministry of Energy, 281.9 million US dollars was spent in the first half of 2017 to finance construction operations on the site of Belarus NPP. The scope of work included further steps in the construction of the first and second power units and auxiliary facilities.

The nuclear power plant is based on the standard AES-2006 Generation 3+ design that offers more efficient performance and advanced safety systems in accordance with post-Fukushima requirements, as well as full compliance with applicable environmental and sanitary regulations. The Russian AES-2006 design features an array of unparalleled safety systems. One of them is a core catcher, a unique safety device designed by Russian nuclear engineers to mitigate effects of a nuclear meltdown. In case of an accident, the core catcher medium mixes with the molten core materials and distributes them evenly inside the catcher body. The catcher can hold the molten core for an unlimited period of time, preventing nuclear materials from getting outside. The first ever core catcher was installed at the Russian-designed Tianwan Nuclear Power Plant in China. Passive heat removal is another unparalleled safety feature of the AES-2006 design. This technology allows for cooling of the reactor core in case of power outage without human involvement

IN BRIEF

ROSATOM America Latina and UMATEX Group became members of ALMACO

ROSATOM America Latina and UMATEX Group became members of Latin American Association of Composite Materials (ALMACO — from its acronyms in Portuguese), taking part as an inauguration act in the “Creativity Day”, organized by the association, in São Paulo, Brazil.

ROSATOM America Latina and UMATEX Group participated in ALMACO’s activities with presentations to other local affiliates. After being officially presented in a meeting of the Executive Committee, UMATEX made its first presentation to Brazilian market. The UMATEX Group is a subsidiary of Russia’s state-owned Rosatom. “We are seeking to cooperate with ALMACO because the entity brings together not only the main local players, but also has presence in other countries in the region and in the near future intends to expand its range of action to Latin America markets that are in interest of UMATEX,” says Ekaterina Tebenkova, head of export sales at UMATEX.

Ekaterina Tebenkova pointed out to the representatives of local leading companies the UMATEX Group’s manufacturing structure and the technical specifications of its composite materials. She also described the potential business model intend to be adopted for the local market. “The construction, wind, naval and sport segments, among others, are included in our list of potential clients,” she explained. “We are glad to be an official member of ALMACO. We consider ALMACO as strategically important partner who has proven experience on the organization of the events and technical seminars to promote composites across the whole continent», said the President of ROSATOM America Latina Ivan Dybov. For Erika Bernardino, manager of ALMACO, the arrival of the

UMATEX Group is excellent news for the composites sector. “It is very positive to have another great company willing to invest in our market, what can be considered a great boost to overcoming the difficulties brought by the crisis that Brazil is going through,” she says.

MCC Welding at Belarus NPP Completed Ahead of Schedule

The Belarus Nuclear Power Plant built by ASE Group as a general contractor passed a new milestone as welding operations were completed on the main circulating circuit (MCC) of Unit 1 reactor island. The welding of 28 joints and step-by-step quality control of all operations took as little as 78 days. “The fact that we have finished welding of the MCC pearlitic section ahead of the planned 84-day period proves that all the processes of this complex reactor construction phase have been improved so as to become almost automatic,” stressed Dmitry Romanets, ASE Construction Manager at the Belarus nuclear power plant. “Our reference time was 72 days, a period spent to complete similar welding operations at the second unit of Novovoronezh II, which is now under construction, too. Rosatom’s engineering division has thus established a new industry standard: MCC welding now needs less than 80 days.” The main circulating circuit measures 850 mm in diameter and has 70 mm thick walls and a total length of 130 meters. It connects core components of the primary loop, including the reactor, steam generators and main circulation pumps. The MCC is designed to ensure the circulation of coolant at 350°C under the pressure of 17.6 MPa.

TVEL to 3D Print End Fittings of Fuel Assemblies

Bochvar Russian Research Institute of Inorganic Materials (a subsidiary of Rosatom’s TVEL Fuel Company) has established a working group to develop a pilot technology to 3D print end fittings of fuel assemblies.

“We plan to use additive manufacturing solutions in the nuclear industry to produce components of fuel assemblies. They will be primarily end fittings, such as heads, shanks, spacer grids, and debris filters, which are very difficult to produce with conventional methods. By contrast, 3D printing will create components of unique design,” said Leonid Karpyuk, Director of the Institute. The project will tap to the Institute’s existing competencies in this field, particularly expertise in creating additive manufacturing powders by means of centrifugal atomization. Powders produced at the Institute meet all necessary requirements, namely a spherical shape, size (10–80 μm), and chemical uniformity of powder grains with no oxidation films, other surface contamination or porosity, and outperform many of similar foreign products.