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Rosatom develops new MOX fuel for fast reactors

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Russia's Rosatom has manufactured the first three fuel assemblies of Uranium-Plutonium MOX fuel at its Mining and Chemical Combine plant in Zheleznogorsk, of Krasnoyarsk region. This innovative fuel contains actinides like Americium-241 and Neptunium-237. The fuel bundles have been successfully tested and will be loaded into the BN-800 fast neutrons reactor at the Beloyarsk NPP. The new fuel will undergo a pilot operation for approximately one and a half years.

MOX fuel or Mixed Oxide Fuel is a nuclear fuel that contains more than one oxide of fissile materials, usually consisting of Plutonium blended with natural Uranium, reprocessed Uranium, or depleted Uranium. Whereas, minor actinides are transuranic elements other than plutonium that are formed in irradiated nuclear fuel as the result of nuclear reactions at the nuclear reactor. Like plutonium, these elements do not occur in nature. Neptunium, americium, and curium isotopes are particularly important in spent nuclear fuel reprocessing and radioactive waste management. They are highly radioactive and toxic, generate much heat, have long half-lives, and are the most hazardous components of nuclear waste.

The Russian solution for the minor actinides problem is a breakthrough for fast neutron reactors. Research shows that minor actinides in the newly developed MOX fuel will fission into a fairly wide range of radioactive and stable isotopes with less potential hazard

than that of the original minor actinides. The transmutation process of minor actinides is also called “afterburning” in a reactor.

“Afterburning of minor actinides is the next step in closing the nuclear fuel cycle, which should not only reduce the amount of nuclear waste for final isolation but also significantly reduce its radioactivity. In the long term, it would enable us to avoid the complicated and expensive deep burial of waste,” said Alexander Ugryumov, Senior Vice President for Research and Development at TVEL Fuel Company of Rosatom.

Fabrication of fuel assemblies with minor actinides and their pilot operation in the BN-800 reactor is the key stage of the comprehensive research program of Rosatom’s TVEL Fuel Company for minor actinides after burning. It started in 2021 and is scheduled to run until 2035. The program includes projects of minor actinides separation into different fractions, their intermediate storage, use in fast reactor fuel, post-irradiation studies, etc. Another important issue is the optimization of reactor facilities for burning the maximum volume of minor actinides.