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Conversion of WWR-K Research Reactor to LEU Fuel

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ABSTRACT

The WWR-K research reactor is a heterogeneous light water research reactor operated by the Institute of Nuclear Physics under the Kazakhstan Ministry of Energy. The permitted maximum thermal power is 6 MW. Operation was started in 1967.

In 2003, feasibility study of reactor conversion to low-enriched fuel was started, including neutronic and hydraulic calculations for various versions of fuel elements and fuel assemblies. On a base of the performed studies, designs of the eight-tube and five-tube fuel assemblies (FA) with thin-walled (1.6 mm) fuel elements were chosen. Fuel composition is uranium dioxide dispersed in aluminum matrix, with uranium density 2.8 g/cm³, enriched to 19.7% in uranium-235. The new FA design was named as «VVR-KN».

In a period from 2011 to 2013, life test of three lead test assemblies (LTAs) was performed in order to prove its design characteristics. Average burnup of ~50% uranium 235 was reached in all three LTAs.

In July 2015, the reactor was shut down for upgrading the control and protection system, control rod drives, some core elements, emergency power supply and emergency cooling systems.

In March-June 2016, physical and power startup of the WWR-K reactor with low-enriched fuel was carried out. In the course of both physical and power start up, the integration tests of the new control and protection system were completed. Permission for regular operation of WWR-K reactor with LEU fuel was issued by regulator in August, 2016.

According to concept of WWR-K reactor conversion, the side light water reflector will be gradually replaced by beryllium one which will maintain the reactivity margin without increase in core dimensions. Unloading of spent fuel and loading of fresh fuel will start after complete formation of beryllium reflector.