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On Equilibrium Isotop Composition of Thorium-Uranium-Plutonium Fuel Cycle

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The equilibrium isotope ratios and the equilibrium onset times during the recycling process of the thorium-uranium-plutonium oxide fuel in the VVER-type reactors using heavy water diluted with light water have been estimated. It has been shown that in the equilibrium state such reactor can also operate with self-reproduction of active isotopes.

Key Words: Kinetics of Reactors, Water-Cooled and Water-Moderated Reactors with Mixture of Heavy and Light Water, Thorium-Uranium-Plutonium Oxide Nuclear Fuel, Expanded Reproduction (Breeding), Equilibrium Isotope Ratio.

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Experimental and Calculation Parameters of Benchmark Spherical Assemblies with a Core of Metallic Plutonium (^{239}Pu (98 %)) in δ -Phase and Compound Reflector Containing Layers of Polyethylene and Steel

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Presented are results of analysis of critical experiments with metallic assemblies performed earlier in RFNC-VNIIEF at FKBN facility. These assemblies possess a core made of plutonium (^{239}Pu ($\approx 98\%$)) in δ -phase and a compound reflector containing layers of polyethylene and steel. Critical ($k_{\text{ef}} = 1 \pm 0.0016$) parameters for the core and reflector are determined. Experimental values of k_{ef} are compared to the calculated ones, obtained by Monte-Carlo method using different nuclear data libraries (BAS-78, ENDF/B-7.1, JENDL-4, JEF-3, CENDL-2). Critical assemblies can be recommended as benchmark ones to be incorporated into the International reference book on Nuclear safety.

Key Words: Neutron, Critical Assembly, Core, Plutonium, Reflector, Polyethylene, Test Parameters, Reactivity, Efficient Multiplication Factor, Monte-Carlo Method, Nuclear Data Libraries.

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Experimental and Calculation Parameters of Benchmark Spherical Assemblies with Core Made of Metallic Plutonium (^{239}Pu (88 %)) in α -Phase and Reflected by Beryllium

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Presented are results of analysis of critical experiments with metallic assemblies possessing a core of (^{239}Pu ($\approx 88\%$)) in α -phase and a Be reflector performed earlier in RFNC-VNIIEF at FKBN facility. The experiments

were carried out by M. I. Kuvshinov, A. A. Malinkin and V. P. Egorov at FKBN in 1965.

Critical ($k_{\text{ef}} = 1 \pm 0,0016$) parameters for the core and reflector are determined. Experimental values k_{ef} are compared to the calculated ones, obtained by the use of different nuclear data libraries (BAS, ENDF/B-7, JEF3, CENDL). Critical assemblies can be recommended as benchmark ones for their incorporating into the International reference book on Nuclear safety.

Key Words: Neutron, Critical Assembly, Core, Plutonium, Reflector, Beryllium, Test Parameters, Reactivity, Efficient Multiplication Factor, Monte-Carlo Method, Nuclear Data Libraries.

UDC 539.1.074.8+621.039.571

About Possibility of the Creation of a Specialized Oruk-Reactimeter with a Current Detector of Neutrons

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There are presented the file-testing results of ORUK-reactimeter based on a functional hardware-software system with a current tracer of neutrons KNK-4. The processing of power registration files of BR-1M, BR-K1 and VIR-2M reactors in FSUE «RFNC-VNIIEF» with the use of *Excel*-simulation of ORUK-formalism demonstrated the possibility of implementing reactivity monitoring during the above-specified reactors operation in a stationary mode beginning from the level of $\sim 5 \cdot 10^{-4} \beta_{\text{ef}}$.

Key Words: Reactor, Stationary Power, Reactivity, Inverse Solution of Kinetics Equations, Current Detector of Neutrons, Digital Recorder of Current.

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Wide-Range Structurally Optimized Channel of Certified Power Monitoring for Small-Core Reactors

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There are presented the results of testing on reactor BR-K1 (FSUE «RFNC-VNIIEF») a version of technical decision for a small-core reactor channel of certified power monitoring produced with the use of SNM-11 counter and commercial compensation chambers KNK-4 and KNK-3 as neutron detectors. Certified measurement modules IMSN and IMTK are applied under the control of PC with specialized software as measurement equipment. There are considered the peculiarities of the channel calibration metrological provision in the required format of reactor power monitoring.

Key Words: Reactor, Certified Power, Certified Power Monitoring, Neutron Counter, Neutron Current Chamber, Working Range of Power Monitoring.

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Measurement of Prompt Neutrons Production Time of VIR-2M Pulsed Nuclear Reactor

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The study of the prompt neutrons production time in VIR-2M research reactor core was carried out. Inves-

tigations were performed under conditions of a subcritical state of the reactor. Babala method was used. Description of the reactor arrangement and used experimental equipment are presented. Investigation method and way of experimental data treatment are shown in the work. Prompt neutrons production time was found to be equal $35 \pm 1 \mu\text{s}$ when experimental channel was empty.

Key Words: Prompt Neutrons Production Time, Pulse Reactor, Babala Method, Fuel Solution of Pulse Reactors VIR-2M.

UDC 550.06+519.688

Method of Purification of Industrial Waste from Radionuclides Using Geochemical Barriers

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The proposed method of treatment of LRW in various enterprises of Rosatom is based on the use of absorptive screens of high permeability with a foundation of a single methodological approach to setting speed limit filtering LRW through this screen and to definition of its design parameters (area and power). The method allows for purification of the desired volume of waste to the radionuclide concentration not exceeding the remote control for a predetermined period of time without any additional processing, and almost without the participation of the staff.

Key Words: Industrial Waste Purification, Absorptive Screen High Permeability, Migration Parameters.

UDC 539.12.164+519.2

A Method of Determining Local Spectra and Average Velocities of Neutrons in Fast Critical Assemblies

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There is described a method of determining local spectra and average velocities of neutrons in fast critical assemblies based on presenting the sought spectra in the form of a sum of model spectra and equalizing summands in the sum basing on the method of least squares and the measured cross-sections of energy-sensitive detectors.

Key words: neutron spectrum, model spectra of neutrons, energy-sensitive detectors, neutron cross-sections, fast critical assemblies, method of least squares.

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Parameters of Uranium-Graphite Fast Pulsed Reactor (Reactor BGR)

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The possibility of constructing cylindrical uranium-graphite fast pulsed reactor with very high fluence and neutron flux density functioning on the base of heat expansion principle is justified by calculation. It is demonstrated that dense graded mix of uranium carbide with graphite the ratio of the number of carbon and uranium-235 nuclei being within the limits from 2 to 40 is the most efficient material of such reactor core. The basic design of the reactor called BGR (fast pulsed graphite reactor) is developed.

Key Words: Pulsed Reactor, Reactor BGR, Uranium-Graphite Material, Uranium Carbide, Graphite, Neutron Fluence, Neutron Flux Density, Reactor Design.