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NUCLEAR PROPULSION  
REACTOR PLANTS.  
LIFE CYCLE MANAGEMENT  
TECHNOLOGIES

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UDC 621.039:658.264

## Outlook of district heating nuclear power plants in Russia

*A.Ya. Blagoveshchensky, L.B. Gusev*

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### Abstract

The paper addresses the problem of utilizing nuclear power for district heating applications. The authors describe the history of nuclear district heating development in Russia beginning from the «pre-Perestroika years», when the AST-500 nuclear heating plant was built and ready for startup, and up to the present day, when this plant is almost fallen to the ground and all work on nuclear-fueled district heating schemes is stopped. The paper presents data in support of the concept for using district heating nuclear power plants. In 2018, the Rosatom State Atomic Energy Corporation approved a long-term strategy for nuclear power development in Russia to year 2050 and up to year 2100, where the necessity of renewing activities on non-electric applications for nuclear power is mentioned.

**Key words:** reactor, nuclear-fueled district heating, integral layout, natural circulation of coolant, riser pipes, coolant flow self-profiling.

UDC 621.039.56

## Operating experience of the systems affecting the reactivity of KV-1 facility

*O.B. Samoylov, V.S. Kuul, D.G. Preobrazhensky, O.A. Morozov, P.A. Bocharov*

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### Abstract

The Article presents the analysis of the operating experience of the systems affecting the reactivity of the KV-1 prototype facility. The basic structural and functional solutions of CG and EP systems are shown. The calendar service was more than forty years, the reached service life characteristics of the equipment present the unique substantial database for justification of the systems affecting the reactivity of the transport reactors.

**Key words:** KV-1 facility, compensating group, the emergency protection, absorbing elements, the interchannel space, guiding tube, CG rod, EP rod, EP thimble.

UDC 621.039.51:006.91

## **Preparation and verification of a model for calculating the neutron characteristics of fast neutron spectrum gas cooled reactor cores**

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### **Abstract**

The paper describes a neutron model for calculation of small size fast neutron spectrum reactors. The model is prepared using the SAPFIR\_RF&RC program package. Results of the model verification are presented. The model is verified by simulating the neutron characteristics of a fast critical assembly: multiplication factors, control rod worth, and core power distribution. The obtained results of calculations performed with SAPFIR\_RF&RC are compared to benchmarks and experimental data.

**Key words:** fast reactor, critical assembly facility, neutron calculation, SAPFIR\_95&RC program package

UDC УДК 532.542: 004.942

## **KORSAR/CFD calculations of condensate plug mixing processes after start of circulation pump in VVER-1000 model at OKB “GIDROPRESS” test facility**

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### **Abstract**

The paper compares KORSAR/CFD calculation results and data obtained from the first series of experiments carried out in the VVER-1000 reactor model at the OKB “GIDROPRESS” four-loop test facility. The experiments simulated mixing processes that occurred when one circulation pump was started and a condensate plug with low boron concentration flowed from the cold leg loop seal to the reactor core and entered it through the lower plenum. The effect of the coolant flow pattern in the plenum annular space on the boron concentration distribution at the core inlet is shown.

**Key words:** reactor, lower plenum, coolant, concentration, experiment, computer code, computational grid, computational fluid dynamics.

UDC 621.039.586

## Study of fission products release from corium melt

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### Abstract

The article presents the experimental results of influence of temperature and corium melt oxidation index on the rate of low-volatile fission products release. Thermodynamic modeling of the composition of the gas phase and comparison of obtained estimations with experimental data was carried out. The results of the work can be used in assessing the distribution of fission products in the In-Vessel stage of NPP severe accidents.

**Key words:** severe accidents, corium melt, fission products, phase equilibria.