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Main building of MPEI

S.V. SEREBRYAKOV
Rector of MPEI (TU)

The Moscow Power Engineering Institute (Technical University) – MPEI (TU) – is one of the country's largest universities providing education in power engineering, electrical engineering, electronics, information science. The Institute has classrooms in modern buildings, dormitories, training and research laboratories, good experimental facilities, a pilot manufacturing facility, a thermal plant for training and research purposes, a training TV center, an extensive network for pre-university training and post-university education; the process equipment is up-to-date and the computing facilities range from large machines to personal computers. Since 1946, MPEI has been training engineers and scientists for foreign countries, its students and postgraduates come from 68 countries of the world.

MPEI was set up in 1930 through amalgamation of the Electrical Engineering and Electrical Industry Departments of the N.E. Bauman Higher Technical School and the G.V. Plekhanov Institute of National Economy. The new entity received the name of Moscow Power Engineering Institute. The Institute has been in continuous evolution throughout its history: new disciplines and departments appeared, new teaching methods were worked out, in-house reforms took place. So, in the late 1990, some MPEI departments grew into independent educational institutions.

In 2000, MPEI acquired the status of technical university and in 2010, it became a National Research University.

MPEI is a member of the International Association of Universities and belongs to international organizations, such as UNESCO, UNIDO, IAEA, International Association for Continuing Engineering Education, International Energy Club, International Computer Club, International Coordination Council of Educational Institutions Alumni (INCORVUZ), International Council on Large High-Voltage Electric Systems, International Association on Wind Power, European Association for International Education, and Association of International Departments of Technical Universities of Europe.

One of the MPEI sections is the Institute of Thermal and Nuclear Power Engineering with a Chair of Nuclear Power Plants (NPP) led by Dr. Sc. (Tech.) Professor Vladimir Blinkov.

The Chair has at its disposal a unique complex of training and research facilities, one of which is a subcritical uranium-water facility.

Subcritical facility UV

Thermal power	0.001 kW
First criticality year	1980
Status	In operation
Operation time*	32 years

**As of 2012.*

The main research areas include:

– studies on progression of severe accidents at plants with water-water reactors;

– NPP reliability and safety analysis;

– assessment of the performance and service life of structural materials and equipment of nuclear power plants;

– methods and tools for NPP equipment diagnostics;

– development of the theory to underpin analyses of natural circulation, hydraulics and distribution of impurities in steam-generating equipment of NPP;

– development of a computer-based system for modeling and calculation of process flow charts for NPP;

– strategy for decommissioning of nuclear power units;

– fuel cycles of water-water reactors;

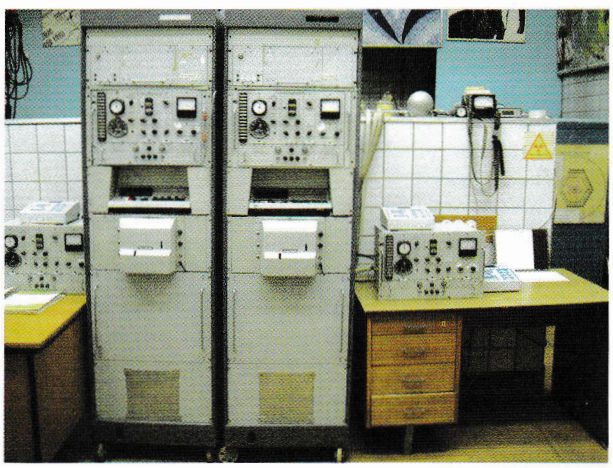
– methodological principles and specific methods of raising safety culture at NPPs and other enterprises of the nuclear power and industry.

Staff of the NPP Chair

SUBCRITICAL FACILITY UV

The uranium-water subcritical facility UV belonging to the Chair of Nuclear Power Plants of MPEI is built on the ground floor of a permanent brick five-storied building. The facility was put into operation on December 4, 1980.

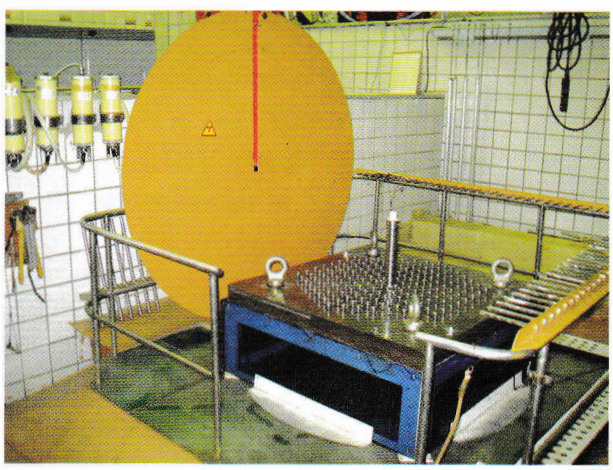
The UV SCF comprises a uranium-water subcritical assembly, two identical channels for neutron flux monitoring with helium counters SNM-12, two racks with counter-indicator facilities SPU-1-1M, recorders, and a two-channel counting device US-6.



UV SCF control board

Core composition

The core of this subcritical assembly is a system of 168 process channels loaded with uranium metal slugs of natural enrichment in a leak-tight cladding made of aluminum alloy, measuring 31×120 mm (each channel containing 9 cylindrical slugs). The core is arranged in a cylindrical aluminum tank 1200 mm in diameter and 1400 mm in height. The total uranium mass is 2479.7 kg.



General view of the UV SCF

The aluminum tank is filled with moderator (light water) and rests on a block of nuclear-grade graphite (graphite prism), which is intended for neutron field flattening at the core inlet. A special channel of the prism found under the tank bottom can accommodate a neutron source.

The facility is equipped with a pump to draw off moderator from the assembly tank and with two telfers to lift the core (3 t) and a container with a neutron source (1.5 t).

The assembly tank is filled with distilled water from the condensate line of the MPEI thermal cogeneration plant.

Experimental capabilities of UV SCF

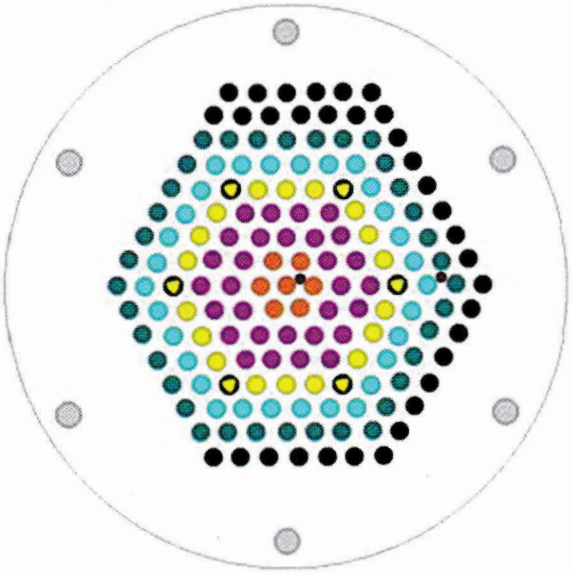
To step up the uranium fission reaction, the assembly is provided with sealed neutron sources. At present, the assembly has a californium source of fast neutrons (NK-252) with the capacity of $2.3 \cdot 10^7$ s^{-1}, which was installed under the tank bottom by means of a mechanical remotely controlled device.

The facility design allows using cores of four modifications with a fixed lattice pitch. The channels are installed in spacer baskets with a pitch of 45, 50, 55, 60 mm. The channel pitch can be changed in the range from 45 to 65 mm (at 5 mm intervals), if so required by a training experiment, for which purpose the spacer baskets will be replaced with a special plate. In such a case the water-uranium ratio will vary between 0.8224 and 3.3411.

Main areas of studies

The UV SCF is designed for:

- studies in the physics of the natural uranium – light water system;
- hands-on activities for the discipline of Nuclear Reactor Physics;



UV SCF core map:

- *neutron counter;*
- *1st charge channels (7);*
- *2nd charge channels (30);*
- *3rd charge channels (24);*
- *4th charge channels (30);*
- *5th charge channels (36);*
- *asymmetrically charged channels (33);*
- *absorber channels (6)*

Spacer basket

- measurement of physical parameters to an adequate accuracy with a fixed pitch of the channel lattice.

Main performance of the UV SCF

Fuel	Uranium metal of natural enrichment
Moderator	Light water
Number of:	
working fuel assemblies	Up to 168
channels with absorber	6
startup channels	1
Neutron source capacity	Up to $5 \cdot 10^7$ s^{-1}
Highest possible multiplication factor	0.83
Design and extended life	Unlimited

International cooperation

In the framework of international cooperation, a full cycle of laboratory work at the UV SCF was carried out by a total of 502 students from East Germany, Bulgaria, Poland, Czechia, Slovakia, Hungary, Vietnam, Cuba, North Korea, Yugoslavia, Romania, Iran, Mongolia, Syria.

Personalities

MIKHAIL ALKHUTOV
Associate Professor of the NPP Chair, Deputy Chief of Radiation Safety Service at MPEI (TU).

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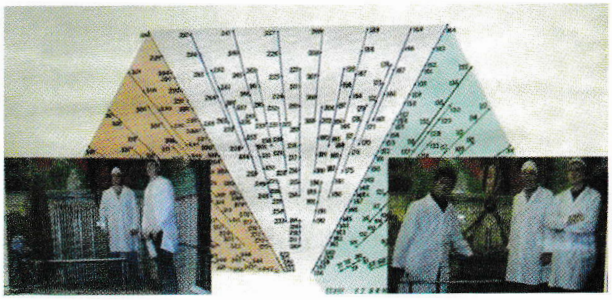
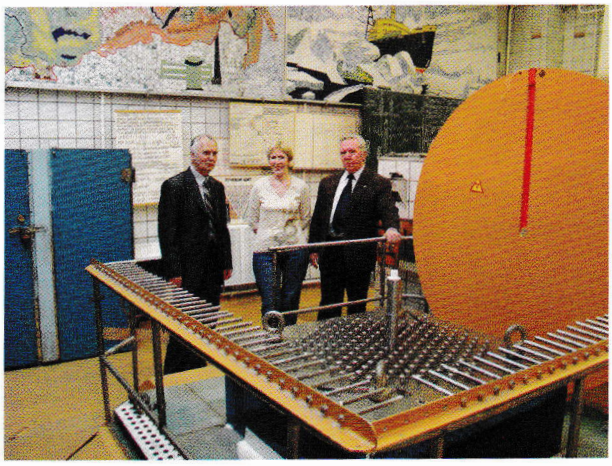


Control room of the MPEI SCF



UV SCF staff (left to right: M.S. Alkhutov, Ye.M. Karmanovskaya, M.A. Skachek)