

## EXTENSIVE UTILIZATION OF TRAINING REACTOR VR-1

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The training reactor VR-1 Vrabec („Sparrow“), operated at the Faculty of Nuclear Sciences and Physical Engineering, Czech Technical University in Prague, was started up on December 3, 1990. Particularly, it is designed and operated for training of students from Czech universities, preparing of experts for the Czech nuclear programme, as well as for certain research and development work, and for information programmes in the sphere of non-military nuclear energy use (public relation).

The VR-1 training reactor is a pool-type light-water reactor based on enriched uranium with maximum thermal power  $1\text{kW}_{\text{th}}$  and short time period up to  $5\text{kW}_{\text{th}}$ . The moderator of neutrons is light demineralized water ( $\text{H}_2\text{O}$ ) that is also used as a reflector, a biological shielding, and a coolant. Heat is removed from the core with natural convection. The reactor core contains 14 to 18 fuel assemblies IRT-3M, depending on the geometric arrangement and kind of experiments to be performed in the reactor. The core is accommodated in a cylindrical stainless steel vessel - pool, which is filled with water. UR-70 control rods serve the reactor control and safe shutdown.

Training of the VR-1 reactor provides students with experience in reactor and neutron physics, dosimetry, nuclear safety, and nuclear installation operation. Students from technical universities and from natural sciences universities come to the reactor for training. Approximately 200 university students are introduced to the reactor (lectures, experiments, experimental and diploma works, etc.) every year. About 12 different faculties from Czech universities use the reactor. International co-operation with European universities in Germany, Hungary, Austria, Slovakia, Holland and UK is frequent. Practical Course on Reactor Physics in Framework of European Nuclear Engineering Network has been newly introduced. Currently, students can try out more than 20 experimental exercises. Further training courses have been included to provide special training for selected specialists from Czech and Slovak Nuclear Power Plants.

Scientific research respects reactor parameters and requirements of the so-called clean reactor core (free from a major effect of the fission products). Research on VR-1 is mainly aimed at the preparation and testing of new educational methodologies, investigation of reactor lattice parameters, reactor dynamics study, research in the control equipment field, neutron detector calibration, etc.

Information services and promotional activities in the nuclear power field are important parts of the reactor operation. Many visitors, mainly high school students, come to the reactor. The reactor staff prepares an attractive program including reactor operation. Every year, more than 1500 high school students come to visit the reactor, as do many foreigner visitors.

The plan for the training reactor VR-1 for the next 10 years covers essential activities (less important activities describes the annual plan for each year) in five fields: education activities, research activities, public relation activities, international cooperation, and human resources, innovation and new equipment.

## Education activities:

- Keeping the current state in the field number of user schools, number of students and number of offered experimental exercises,
- Improving existing experimental exercises and establishing new according requests users from Universities and Nuclear Engineering companies, for example: study of neutron noise and it's application, study of thermal effects, study of digital control systems, study of transmutation technologies ADTT, study of neutron detectors.

## Research activities:

- Seeking research activities which can use advantages of "clean" core without temperature, pressure, burn-up feedback etc.,
- Continuing in study of the digitally controlled nuclear research reactors,
- Continuing development of control equipment the VR-1 reactor,
- Continuing wide co-operation with Czech and Slovak institutions,
- Studying of transmutation technologies ADTT.

## Public relation activities:

- Keeping current state in the field number of user schools and number visitors,
- Developing new demonstration experiments for Secondary/High School students.

## International co-operation:

- Continuing close co-operation with Universities in Germany, Austria, Hungary, Slovakia etc.,
- Participation in Reduce enrichment of research and test reactors RERTR Program with co-operation with Nuclear Research Institute in Rez,
- Participation in European Nuclear Education Network ENEN and NEPTUNO,
- Additional courses for potential users.

The experiences with the VR-1 operation are excellent for the last 12 years. There was no accident regarding nuclear safety or radiation protection during the whole period of the use. Operation of the reactor is widely included in many study branches and it significantly contributes to the education of our students and also to wide public in terms of conditions and acceptability of the use of nuclear energy.

**References**

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