STATUS AND PROSPECTS OF SMALL REACTORS IN RUSSIA

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The significant part of the territory of Russia (about 60 %) is in the North area. In most cases, power supply of the consumers is ensured here from small decentralized energy sources. The local needs in electrical and thermal energy do not exceed 100 - 150 MW. That is the extensive market for low power energy sources exists in Russia.

The systematic work in the field of use of nuclear reactors for energy supply in remotely isolated regions of the country was started in the middle of 50's. Till 1965 several demonstration Small Nuclear Power Plants (SNPP) were constructed and put in operation: TES-3 in Obninsk, ARBUS and VK-50 in Dimitrovgrad. In 1974-76 four power units with EGP-6 reactors of the first industrial SNPP - Bilibino Nuclear Power and Heat Co-generation Plan - were one by one connected to the isolated Chaun-Bilibino electric grid in one of the most remote region in Chukotka (NE Siberia). The construction and successful operation of the Bilibino NPP is a key stage on a way of development of small nuclear engineering in Russia. The feasibility of effective utilization of SNPP in extreme conditions of the North area has been shown.

During 60's, 70's and first half of 80's numerous design and feasibility studies on determination of a role and scope of use of SNPPs in the North were carried out. By 1986, on the basis of these works the program of development and deployment of SNPPs, providing a detailed substantiation of construction of SNPPs on 33 specific sites in the North region of the country, was prepared. The Chernobyl accident has crossed out nuclear program in the USSR, including the program of SNPPs construction.

In the subsequent years the projects of nuclear reactors and small nuclear stations were deeply analyzed and upgraded with the purpose of meeting the modern domestic safety regulations, as well as the IAEA design and safety standards. The following projects were developed during this period:

- Detailed design of the floating NPP "VOLNOLOM-3" with integral water-cooled reactor ABV
- Basic design of the second stage of Bilibino NPP with water-graphite reactors ATU-2
- Conceptual designs and proposals for reactors AST-200, AST-30Б, ATES-80 (150, 200), NIKA-150, "ANGSTREM", SVBP-75, RUTA-10 (20, 30, 55) and some other, totaling at about 20 projects.

Manifold preliminary engineering developments and the conceptual studies of nuclear reactors for nuclear stations of very low power (about 1-2 MWe), including SAKHA-92, UNITERM, KROT and other are available also.

It is necessary to emphasize that active R&D activities for the project of a floating NPP with PWR KLT-40C have been performing since 1996. Reactors of this type are used on all nuclear ice breakers and container-carrier "SEVMORPUT". The basic design of the plant is currently in a final stage, and it is planned to obtaine the construction license in 2001.

Current SNPP projects are to meet a number of the challenging technical requirements:

- Use of simple, reliable and proven designs and technologies

- Enhancement of safety relying mainly on reactor inherent safety features and passive safety systems
- Utilization of proliferation resistant technologies and technological support of non-proliferation
- Prevention of radioactive contamination of the environment in any operational situations, ecological friendliness
- Simplicity of control with minimization of amount of the operation personnel
- Maximum degree of in-shop fabrication
- Ensuring transportability to a place of operation and evacuation of a plant from the site with complete decontamination and restoration of the site
- Reliable work in a load following operation mode
- Economic competitiveness.

The projects of SNPPs cover a very wide range of capacities. The lowest and highest capacities of SNPPs may differ by two orders of magnitude. It is natural, that the many specific design and safety requirements, the approaches to maintenance and service of SNPPs are grouped in narrower ranges: less than 10 MW, 10 - 50 MW, 50 - 300 MW and more than 300 MW. Specific requirements are presented in the report with reference to these ranges.

The radical reorganization of political system in the country and, as a consequence, radical changes in economic conditions result now in essential change of needs in electric power and heat in the North regions. These force to reconsider the plans and prospective forecasts of SNPPs construction. At the same time, it is obvious, that in the XXI century unique natural resources of the northern region of the country will be in the permanently growing demand. Therefore the basic purpose and the precondition of development of small nuclear engineering in the country remain unchangeable.

The policy in the field of small nuclear engineering has been formulated in **"The Program of development of nuclear engineering in Russian Federation for 1998-2005 years and for the period till 2010 "** and **" The strategy of development of nuclear engineering of Russia in the first half of the XXI century"**. It was emphasized in these documents that design and construction of SNPPs, including that based on ship propulsion reactor technology, is an important line of development of nuclear engineering. As a particular task for 2006-2010, the construction of the floating NPP with KLT-40C in Pevek is planned. Till 2010, it is supposed to carry out the R&D for SNPPs with enhanced safety and the development of their construction and service infrastructure. Till 2030, projects of new land-based and floating nuclear stations for power and heat supply and nuclear desalination are to be implemented.