THE PAST OF WWR-M REACTOR
(25 years from 35)

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The formation of Petersburg Nuclear Physics Institute as independent institute in considerable extent was defined to the existence and successful work of two main experimental facilities - WWR-M reactor and synchrocyclotron. 25-th year of the institute existence coinsides with the forties anniversary of the beginning of PhTI branch building. Just in 1956 it was began to excavate the foundation pit for the reactor and for the author of this article it was the beginning of his work in Orlova Roscha.

From the history of WWR-M reactor point of view it's not possible to divide its existence on PhTI branch and institute independence periodes. The approach to scientific problems and personnel remained the same but during a period of the first 10 years of the reactor work Gatchina held a stable position among the nuclear centers - luminaries of the Soviet Union both in nuclear physics and reactor utilization fields. From the moment when a decision about the reactor building in PhTI was took and further the reactor continually modernizes, as far as, the reactor is the greatest part of the physical facility and no one but at once several and the technics of the physical experiment makes all new and new demands. Analyzing the works carried out in the past years one can see distinctly the two directions of work: experimental possibilities development and safety of the reactor improvement. Thus was from the very beginning but undoubtedly the safety improving direction increased particularly in the last years for the reason of two important events coincidence; that's the post Chernobyl thought and depletion of the essential part of the reactor equipment resources.

During the first 10 years of reactor work in the PhTI period it was formed the extent of work and a concrete notions about requirements to reactor from the choosed scientific directions. Besides the obvious desire neutron fluxes increasing it was obviously the storage of the possibilities for new experiments organization. For the solution of this tasks thermal column was reconstructed with creation of new horizontal channels, the chamber over the reactor was created that gave a possibility to carried out new experiments of vide class in the vertical channels, servo of new construction that allowed to make for the experiments all volume of active core including its centre. Detail experiments on critical mock-up allowed to our theoretical department to develop the reliable calculation models. Reactor power was increased by steps to 14 MW and then to 18 MW. In spite of great work volume at operating reactor conditions the icreasing of work efficiency was brought to gradually decreasing of radiation burden on the staff and to decreasing of radioactive release in the athmosphere and of water disposals to chemical water treatment. In spite of that disposals at that distant time were less in below of today accepted rigid norms, they were reduced more then 10 times [1]. It was achieved as the result of detail and tedious investigations of gase and water regims of the reactor and of introduction of new developed technlogies of nondeaerator regim and the system of first circuit water treatment by electrophoresis filter. It was researched and test-operated regims of disposals decreasing still more then $2 \div 3$ times but it was offered unjustifiable since radiation burden on environment is negligible [2].

During last 25 years on the reactor like at past we didn't afraid to carry out cumbrous and volumetric works, for example, to undertake the building of cryogenic plant or second storage for spent fuel elements but perhaps more appreciable for the growth of physical

experiments on the reactor and more important for the growth of reactor technics was the development of thin-walled fuel elements. Our Institute initiated this works in the Soviet Union what as the final result allowed the industry to begin the output of new fuel elements for research reactors. Before this work it was to preceded the deep studying of fuel element operation. It was defined the conditions of normal exploitation and limited parameters of temperature corrosion rate, of thermal load, of leak of the outlet of fission products and of quite of number of other important parameters. The conclusion was clear that it's possible to make the fuel element more thinly, to develop its heat surface and to increase volumetric power of fuel element two times. And what's more after the factory assimilated the new technology it was clear that it was possible to increase and volumetric content of uranium to 100 g of uranium-235 per 1 liter of the core volume and so more.

For our reactor which was changed for WWR-M5 fuel elements it means the possibility of using more then half of the active core for the placing of experimental facilities. For foreign reactors it was allowes to use the limitated uranium enrichment what is recommended by International organizations issue from the principle of nuclear weapon nonproliferation. It's appropriate to mention here that built by Soviet design the reactors in GDR, in Hungary, in Poland were modernized as our WWR-M reactor with our help, and how it's strange to hear without any compensation, however, we also used this collaboration without any compensation essentially with the German Institute in Dresden.

Roughly from the moment of our Institute formation to present time on the reactor it's proceed active and successfull assimilation of the technique of the generation of cold and ultracold neutrons. Each new source was important step as the increasing of neutron flux density but it was brought to greater connection with physics of the reactor as itself and to depending on its safety. Definite experience of work with big channels which were placed immediately in active core, it yet was accumulated during the known work of nonconservation of parity in (n, γ) reactions. The placement of the chamber that content liquid hydrogen in active core centre was required cruel measures of safety but this result was deserved this efforts - the reactor of average power successfully competed with the best of existent reactors which is Grenoble High Flux Reactor by the flux of ultracold neutrons [3].

WWR-M reactor is operating for 36 years and its systems is sufficiently reliable for further exploitation. To considerable extent it's consiquence of careful and competent regard of personnel to their reactor. As in any economy, including house-keeping, as on the reactor - as you careful house keep so your things will be serve you during a long time. We are given much time for repairs, for the investigation of the state of all units, for the investigation of the depending of the radiation and the corrosion on reactor systems state and considerable efforts were direct to the development of the method of an estimation of operational reliability and analogic investigations. It isn't affirm that considerable growth of the attention to safety problems, the growth of safety efficiency of the personnel brought to decreasing of power output of the reactor last years. It's not. It's the result of economics difficulties and stoppages which are characteristic of all our country. The lag of wages of trained specialists of research reactors from wages of analogous specialists of atomic power plants, of steam power plants and water power plants were stood striking, besides wages of commercial workers. Experienced personnel on the reactor is appreciably diminished, but the training of new person to independent operation is roughly took up a year. That isn't reduced it's a necessity of neutrons for research work. It even is noticeably increased after the closing

some of research reactors and after the departure of some of research reactors abroad.

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THE REACTOR WWR-M AT PRESENT AND PROJECT

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The Present (February 1995)

The reactor WWR-M that was stopped on scheduled preventive maintenance (SPM) in July 1994 was started again only at December 20 past year. From the beginning of 1995 it stable operates on the physical experiment in conformity new conditions which are formed to this time. A stability and regularity of the operation aren't yet signify that all problems of the reactor and its operating personnel were settled at the rather long (five and half monthes) period of the shutdown.

The term of the passport of GOSATOMENERGONADZOR (the permit for operation) expires at November 1, 1995. It was known long ago. So at the Scientific Counsil of NRD (Nuclear Research Department) at May 1994 the question of the reactor WWR-M future was discussed. At this time it was take a decision about the expediency to prolong the reactor operation term to next year and it was made the first financial support for the development of the activity for the extending of the reactor operation term. It was alloted 200 million roubles for the summer SPM and 200 million roubles for the overhaul. This direction of activity was named by "Bringing systems and the reactor eguipment into accordance with the safety reguirements of Regulatory Instruction Manuals (RIM)" with replacement of the old and amortization assemblies in the end by the new equipment that will meet to the physical experiment requirements. This activity will be provided till 2000. State Design Organizations such as VNIPIET (the Chief Designer), NIKIET (the Chief Construction Architect) and CNII KM "Prometey" (the Chief Material Science Organization) are involved in this activity too. It's provided to realize this activity stage by stage during the reactor operation and SPM shutdowns. The first shutdown of this year plans at March 20 for two weeks term. It will be realized general preventive inspections testings, installation works, and also a careful inspection and a testing of non-standard welds which have the bounded term of operation. It was occured the one request for the installation of the new experimental equipment in the tangential experimental channel No. 10-10'. It must shed light on the possibility for the creation of a new generation of high-effective cold and ultracold neutron sources with the using of the frozen deuterium as the neutron thermalyzator.

But how it can be realize the plans of the operation term of the reactor which was on power operated for 35 years? (This anniversary slipped away at December 29 last year only one and half monthes ago). It will need only speedy completion of inspections that projected in current year, by the implementation of design works and its realization and also as primary request by the receiving of "The Temporary Permit" for the reactor operation. It is the new