Review of the justification for extension of theme 1105 "Development of the IBR-2 facility with a complex of cryogenic moderators" for the period of 2020-2022

On the section «Construction of a complex of cryogenic moderators at IBR-2»:

The project on the construction of a complex of cryogenic moderators (CM) was proposed for its implementation on the modernized IBR-2 reactor. The complex was intended to include three CM for 8 out of 14 spectrometers of the Laboratory. The fulfillment of this task was expected to enhance the efficiency of experiments for the study of long-period and low-dimensional structures as well as complex advanced materials due to an increase in the slow neutron flux up to a factor of 20 and to place the IBR-2 among the world's leading neutron sources (ISIS, SNS, JSNS). A moderator CM-202 was the first to be put into operation in 2013 for beamlines 7, 8, 10, 11. It is, in fact, a bispectral source, i.e. it comprises both cold and thermal neutron moderators. The CM-202 operation has proven the reliability and efficiency of the technology proposed in FLNP. In 2020-2022, it is planned to install and commission a moderator CM-201 for beamlines 4, 5, 6 and 9. Two cryogenic refrigerators KGU 1200 W/10 K (from Linde Kryotechnik AG) will provide cooling for CM-202 and CM-201. In parallel, it is planned to develop requirements specification and project documentation for a cryogenic moderator CM-203 for beamlines 2 and 3. The technical feasibility of the program for the development of a complex of cryogenic moderators in 2020-2022 is beyond any doubt, since its successful implementation is ensured by the availability of highly-skilled experienced personnel and state-of-the-art technologies and equipment.

On the section «Construction of a backup movable reflector MR-3R»:

At present (as of 01.06.2019), the existing movable reflector MR-3 is at 50% of its estimated mechanical service life, which coincides with the expected service life of the IBR-2. The MR-3 operation is reliable; continuous monitoring and diagnostics of its state are provided. However, a movable reflector is potentially the most hazardous reactor unit. Therefore, even a slight deviation of MR-3 parameters from the norm will result in the reactor shutdown and termination of the research program, possibly for a long period of time. To ensure the trouble-free operation of the reactor, a backup movable reflector MR-3R has been manufactured. In 2019-2021, during the period of duration of theme 1105, a large complex of activities will be performed on check assembling, adjustment and testing of MR-3R at the FLNP test bench. This work is undeniably of particular relevance and importance, and the key to its success is that the large amount of technical work lying ahead is mostly the repetition of the work already done with MR-3.

On the section «Research activities under contracts to ensure safe operation of the reactor. Monitoring, diagnostics and prognostics of the reactor state»

The nuclear-physical and operational characteristics of IBR-2 vary significantly in the process of its operation. To maintain a high level of nuclear, radiation and technical safety of the facility, and ensure control over the state of the reactor, regular monitoring of the operating parameters of the movable reflector, basic technological equipment, vessel and other reactor

equipment is conducted. The information-measuring system for research and diagnostics of the IBR-2 reactor state requires constant improvement and development using the most advanced hardware, computational and analytical methods of diagnostics and prognostics. In the period of 2020-2022, as was in the previous periods, similar activities are planned, the relevance of which is particularly clear in view of the negative trends in the recent changes in the reactor characteristics. They include computational and experimental substantiation of the safe and reliable operation of the IBR-2 under conditions of increasing radiation load and intensification of degradation processes in the core. On the basis of the performed analysis, appropriate measures are planned to compensate for undesirable changes in the reactor parameters.

Upgrading of safety-related equipment

In the process of operation of the reactor, appropriate activities are regularly planned and conducted to maintain the design performance efficiency of the equipment of the IBR-2 safety systems. An effective way to improve or ensure high-level performance of the equipment is its phased upgrading. This work is performed at the reactor by specialized organizations and encompasses several stages including design, manufacturing, installation, commissioning operations and testing.

Licensing of operation and extension of service life

The Rostekhnadzor license for operation of the IBR-2 nuclear research facility will expire on September 30, 2022. In this regard, it is necessary to ensure the timely preparation of a package of documents for obtaining a new license and accomplishment of routine maintenance for the extension of the service life of equipment and components of the IBR-2 safety systems. The extension of the IBR-2 service life beyond 2022 would be highly desirable in respect of reducing the waiting time for the commissioning of a pulsed source, which will apparently be a successor to the IBR-2.

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