FROM THE ABBN-93 PROJECT LIBRARY TO THE UNIFIED SYSTEM OF REACTOR CONSTANTS ABBN-RF22 FOR THE CALCULATION FOR FAST REACTOR CALCULATIONS

D. V. Panova, S. V. Zabrodskaya, G. N. Manturov, A. A. Peregudov, M. Y. Semenov, M. N. Slyunyayev

Joint Stock Company "State Scientific Center of the Russian Federation – A.I. Leipunsky Institute of Physics and Power Engineering", Obninsk, Russia

The transition of the BN-800 reactor at Beloyarsk NPP to full loading with mixed oxide uranium-plutonium fuel was an important stage in the implementation of the national strategy of the closed nuclear fuel cycle. At the same time, the interest in solving such problems as burning of minor actinides in fast reactors, development of technologies of fast reactors with lead and lead-bismuth coolant, evaluation of characteristics and possibilities of utilization of spent nuclear fuel has increased.

The solution of these problems requires increasing the accuracy of calculation codes, minimization of methodological, statistical and constant errors. Thus, when estimating the neutron-physical characteristics of the BN-800 reactor during the transition to mixed oxide uranium-plutonium fuel, a large discrepancy (about 1%) was revealed in the estimation of the effective multiplication factor when calculated using different libraries of estimated nuclear data.

In order to minimize the constant component of the error, a new system of reactor constants ABBN-RF22 [1] was created, which describes with equal accuracy both uranium loading and loading with mixed oxide uranium-plutonium fuel.

The process of forming a new system of group constants included the selection of initial neutron data files, updating the tables of basic neutron cross sections, self-shielding factors and Doppler coefficients, and data on fission spectra for the main fuel nuclides. Using the ABBN-RF22 system of group constants, it was possible to estimate the correction in the group calculation. Previously, when using the ABBN-93 library [2], such a possibility was not available due to the lack of continuity between the files of evaluated neutron data and the group constants used.

Thus, the creation of a unified system of group constants made it possible to minimize the constant component of the error and provided an increase in accuracy and reliability in describing and characterizing fuel configurations of fast reactor cores.

This paper describes in detail the modifications of algorithms for preparation of the group library of reactor constants, features of data presentation formats, provides a comparison of the capabilities of ABBN-RF22 and ABBN-93 library, describes the experience of implementation of the new system of constants in the practice of calculations for maintenance of the BN-800 reactor at Beloyarsk NPP.

References

1. **Panova, D. V.** Generating a System of Group Constants for Neutron-Physical Calculations of Fast Reactors Based on ROSFOND-2020.2 Library Files [Text] / D. V. Panova, Y. V. Dyachenko, S. V. Zabrodskaya et al. // Izvestia vuzov. Yadernaya energetika. – 2024. – No. 2. – P. 155–169. doi: https://doi.org/10.26583/npe.2024.2.13.

2. **Manturov, G. N.** System of group constants ABBN-93. [Text] Part 1. Nuclear constants for calculation of neutron and photon radiation fields / G. N. Manturov, M. N. Nikolaev, A. M. Tsibulya // Voprosy atomnoy nauki i tekhniki. Ser. "Nuclear Constants". – 1996. – No. 1. – P. 59–98. (in Russian).