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The approaches to the radiation characteristics of structural elements of the core determination during operation and decommissioning for BN-type reactors

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In the analysis of nuclear and radiation safety of existing and designed BN reactors considerable attention is paid to the problems associated with the formation of radioactive waste (RW) during their operation and decommissioning.

This paper describes the approaches to determine radiation characteristics of non-fuel compositions and structural elements of fuel assemblies (FA) and non-fuel assemblies of the core. The latter include the control and protection system (CPS) assemblies and in-vessel storage shielding assemblies. During the operation of BN reactor CPS assemblies are replaced, with subsequent transfer to RW, and in-vessel storage shielding assemblies are transferred to RW on reactor decommissioning.

Development of the approaches to determine radiation characteristics of the structural elements of the BN reactor core assemblies is an actual problem and some developments in this direction are presented within the framework of this work.

The radiation characteristics of irradiated structural elements depend on:

- the value and the spectrum of neutron flux at the location of irradiated structural elements;
- the irradiation history (the irradiation time, the number of irradiation intervals (cycles between refueling));
- the type of assemblies (weight fractions of elements and isotopes in construction materials such as steel, boron carbide; impurities in the assembly).

The calculation of the radiation characteristics for any user-defined assemblies on the core load map is provided with modern nuclear data libraries and computer codes. For this purpose, the procedure was developed for automatic selection of all the necessary data on decay energy, quantities of isotopes, activity and gamma radiation spectrum in the axial layers and entire assembly. It is also possible to define RW categories in the assembly axial layers for the selected cooling times range.

The analysis of the present study results indicates the important aspects of the radiation characteristics of the considered assembly types that need to be taken into account at all stages of BN reactors lifecycle.

Country/Int. Organization

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