

International Conference on Management of Spent Fuel from Nuclear Power Reactors: An Integrated Approach to the Back End of the Fuel Cycle



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COMPARATIVE ANALYSIS OF ISOTOPE COMPOSITION OF VVER 1000 WESTINGHOUSE AND TVEL SPENT FUEL

Determination of isotope composition of spent fuel is necessary to solve the tasks related to:

- Account and control of quantity of nuclear hazardous material;
- Determination of source terms during analysis of radiation safety;
- Using burnup as the nuclear safety parameter while substantiating safety of spent fuel management systems ("burnup credit" principle).

Isotope composition of spent fuel is determined by not only of its burnup level, but also those conditions, or, more exactly to say, by that neutron spectrum under which this burnup occurred. Spent nuclear fuel with the same burnup value can have different isotope composition depending on neutron spectrum in which this burnup took place. The more hard was neutron spectrum, the more U238 is involved into the burnup process (mainly, due to generation of Pu239), and the more U235 is remained in spent fuel under the same burnup level. Therefore, this work considers those operational parameters, which changes are capable of influencing upon in-core neutron spectrum hardening.

This work has analyzed the impact on VVER 1000 spent fuel isotope composition caused by the different operational conditions, such as the presence or absence of absorber-rods, oscillating the concentration of boric acid, dissolved in the moderator (water) during the campaign, fuel and/or moderator temperature, as well as changes in water amount at the periphery of an assembly due to its location in the central or periphery part of the core and/or due to changes in inter-assembly gaps. Also, impact caused by technological allowances applied while manufacturing fuel assembly was analyzed by weight of fuel and by its enrichment.

Calculations were made for reactor cells of fuel assemblies for VVER-1000. They were composed of the new fuel assemblies of USA Westinghouse and the typical fuel assembly of Russian TVEL suppliers.

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