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Effect of MOX Fuel Loading on the Antineutrino Emission of the BN-800 Fast Reactor

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For the first time, the electron-antineutrino flux and energy spectrum of the BN-800 fast reactor are studied during fuel burnup for different core loading configurations. Three core configurations containing 16%, 50%, and 100% mixed-oxide (MOX) fuel are considered.The study of antineutrino emission from fast reactors with different fuel compositions is of interest both for understanding the formation of the reactor antineutrino signal and for developing non-invasive monitoring methods. An approximately 198-effective-day fuel cycle at a nominal thermal power of 2100 MW is simulated using the KIR-C software package. The calculated fission and neutron-capture reaction rates are used to study changes in the isotopic composition of the antineutrino signal, the integral flux, and the energy spectrum during fuel burnup. Increasing the MOX fuel fraction leads to a substantial redistribution of the fission contributions of uranium and plutonium isotopes; for the full-MOX core, approximately 82% of all fissions occur in 239Pu. The antineutrino flux and the shape of the energy spectrum depend on the core composition, while the differences relative to the VVER-1000 increase with increasing MOX fuel fraction. At the same time, the time evolution of the BN-800 antineutrino spectrum remains weak for all three configurations: changes in the spectral characteristics over the considered fuel cycle do not exceed a few percent.

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