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TRANSMUTATION OF MINOR ACTINIDES IN A LIQUID SALT REACTOR AS A SOLUTION FOR THE DISPOSAL OF SPENT NUCLEAR FUEL

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Most of the spent nuclear fuel is reprocessed for further use as fuel in nuclear power plants. However, a small part of minor actinides (the isotopes of neptunium (Np-237), americium (Am-241, Am-243), and curium (Cm-242, Cm-244, Cm-245)) are currently subject to contamination. These radioactive elements have relatively long half-lives and high radioactivity, which increases the cost of their disposal.

The solution to this problem can be transmutation in a liquid-salt reactor. Transmutation is the processing of spent nuclear fuel by a stream of fast neutrons from reactors, electro-nuclear or thermonuclear installations in order to convert minor actinides into stable nuclei or isotopes with short half-lives [1]. In a liquid salt reactor with a LiF-BeF2 salt carrier, the average annual loss of Np, Am, Cm in the medium will be ~250 kg. At the same time, the reactor will transmit ~18.2 tons of Np, ~5.2 tons of 243Am, and produce ~10.7 tons of 238Pu and ~11.7 tons of 241Am over 50 years of operation. China and the Russian Federation have already taken note of this decision. As for the latter, it is planned to start construction of the first reactor at the site of the Mining and Chemical Plant after 2030.

Thus, this solution to the problem has a great potential for development, but it will take a large capital investment in the development of this technology before it can be used for commercial purposes.

References

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