4.2.32. PLUTONIUM ROCK-LIKE OXIDE FUEL (ROXF). SYSTEM, THEIR ONCE-THROUGH BURNING AND USAGE

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The ROXf is a kind of inert matrix fuel U238-free matrices, it has a high plutonium transmutation capability. The ROXf consists of chemically stable phases of fluorite stabilized ZrO_2 or ThO_2 and spinel $MgAl_2O_4$. In this fuel, PuO_2 is solidified in a fluorite phase. With U238-Free matrices, a large part of the plutonium can be burned after irradiation in conventional LWRs. The spent ROXf consists of natural analogous geologically stable phases , and is disposed directly as high level wastes 'HLWs' after about 50 years cooling. From the high plutonium burn up rate and the high stability of the fuel, the ROXf-LWRs system has proliferation resistance and environmental safety.

Characteristics of two types of ROXf, Zr-ROX and Th-ROX with weapons-Pu, in an LWR core arrangement are evaluated by cell burn up calculations and 2-D core calculations using the SRAC code system and JENDL-3 nuclear library. In an LWR of moderator to fuel volume ratio = 1.9, which corresponds to current PWRs, Pu transmutation rates with the two types of ROXf are large enough and more than 80% and 99% of Pu and Pu239, respectively, can be burned. The calculated kinetic parameters indicate less moderate characteristics of ROX cores, especially with Zr-ROX .The fertile Th 232 in Th-ROX works like U238 in the UO_2 fuel, making kinetic parameters more moderate and reactivity drop due to burn up smaller than that Zr-ROX. The neutron capture of Th 232 to generate U233, causes the safeguards problem. Thus, the characteristics of Zr-ROX as a typical example, were investigated in this study.