Minor actinide production rate in fast reactor MOX fuel is < 1/2 of that in LWRs, in spite of higher Pu concentration in fuel. Why?

The minor actinide production rate in fast reactor MOX fuel is lower than half of that in LWRs due to the higher neutron energy spectrum in fast reactors, which favors heavier isotopes like plutonium and curium to fission instead of transmuting into minor actinides. This information can be found on page 47 in the document.

Which fraction of fast reactors is required to achieve net zero production of MA in nuclear fleet?

The answer to this question is not explicitly given in the text provided.

Which fraction of fast reactors is required to achieve net zero production of minor actinides in nuclear fleet?

The fraction of fast reactors required to achieve net zero production of minor actinides in the nuclear fleet is around 40%, according to Table 5.3 in the document by J. Wallenius & S. Bortot. This approach reduces the fraction of fast reactors required to less than half when compared to the heterogeneous transmutation approach in a minor actinide bearing blanket. (Page 47)

ASSUMPTIONS: 1)LWR MOX fuel cost: USD 12000/kg 2)Gen-IV fuel cost: USD 9000/kg (why would it be cheaper?)

The assumptions regarding fuel costs in the study are that LWR-MOX fuel costs USD 12000/kg, while the estimated cost of Generation IV reactor fuel assembly, which includes minor actinides, is USD 9000/kg. It should be noted that the cost of manufacturing the fast reactor MOX fuel assembly is estimated at USD 5000/kg of fuel. These assumptions are discussed on page 6 in the document "Fast neutron Generation IV reactors" by J. Wallenius & S. Bortot.

What are the potential benefits of fully closing the fuel cycle?

Fully closing the fuel cycle in nuclear reactors can lead to a reduction in the long-term radio-toxic inventory and heat load of geological repositories. It also allows for the recycling of fissile nuclides in spent fuel, which can help reduce the production of long-lived high-level waste in power reactors. These potential benefits are discussed in detail on pages 21-22 of the document.

What is the cost driver for implementation of Gen-IV reactors?

The cost driver for implementation of Gen-IV reactors is the use of plutonium and minor actinide bearing fuels, which would likely eliminate the capital cost advantage. Remote handling must be applied for MOX fuel fabrication and adding americium to that may require industrial scale introduction of hot cells. This information can be found on page 4-5 of J. Wallenius & S. Bortot's article on Fast neutron Generation IV reactors.

How can costs be minimised?

Costs can be minimized by optimizing the reactor fleet for a given objective such as cost, repository volume, or inventory. This can be achieved by considering various factors such as the specific capital cost for building a fast reactor, conversion efficiency from thermal to electrical power, fuel burn-up, and the fuel-related cost penalty. Further details can be found on pages 5 and 6 of the document.