

R & D Programme for the Transmutation of Minor Actinides (MA) and Long-lived Fission-products (FP) at KfK

1. General Aim of the Investigation

The present paper presents an outline of a R & D Programme at KfK, by which the knowledge of various possibilities to reduce the nuclear waste should be deepened and critically discussed. This programme deals with aspects of neutronics, reprocessing and refabrication under realistic technical constraints; the costs of the partitioning and transmutation efforts are to be assessed and compared with the costs of direct waste disposal and disposal of waste after reprocessing. Multiple recycling in thermal and fast reactors and also burning of waste with accelerator-driven spallation sources will be considered. As a central point the risks connected with the various modes of waste treatment will be evaluated for short, medium and long-time hazards ($\sim 10^6$ years) after irradiation of the waste in the burning system.

2. R & D Programme for Burning Nuclear Waste

Following nuclear installations for transmutation of highly radioactive nuclear materials will be investigated according to the general aim in section 1.

2.1 Reactors

- Pressurized water reactors (PWRs) of 1300 MWe power
- Advanced PWRS with 1300 MWe power

Fast reactors with the power of

a) **300 MWe**

b) **1300 MWe**

2.2 Spallation Sources

- Incineration of waste in the target (eg. Pb or W) via high-energy protons
- Incineration of waste in a thermal neutron field of high intensity (eg. as in the proposed LANL ATW)

2.3 Special Waste Burners

The flexibility and licencibility of special burner reactors with moderate power is to be investigated including the connected reprocessing and refabrication aspects.

3. Chemistry

3.1 Reprocessing with low losses

One of the outstanding efforts to be assessed is a detailed investigation of a reprocessing scheme with low losses for oxide fuel with higher amounts of minor actinides (Np, Am, Cm...), which could be used in incineration facilities, e.g. via homogeneous admixture to the fuel (either U- oder MOX-type).

3.2 Separation of hazardous nuclides from nuclear waste

The question of the separation efficiency of e.g. MA-isotopes (e.g. Am) from the rare earth isotopes is of utmost importance. The fundamental question of the needed separation factor **for Np, U, Pu, Am, Cm, Tc and I** from the waste solution is to be solved. This investigation is required **for an industrial-scale plant.**

4. Safety and Economic Aspects

All investigations should be combined with an assessment of relevant safety problems of an incineration plant and an estimation of licensing difficulties. An estimation of the associated costs is essential. Furtheron the time should be estimated which is necessary to reach the goal of burning nuclear waste effectively.