



PHYSOR 08

14-19 September 2008, Interlaken, Switzerland

Workshop II : Reactor for actinide management

Friday, 19 September 2008

Concluding Remarks

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Actinides



Actinide is a large family ranging from Thorium to Curium.
Management of actinides addresses 2 issues :

Resources :

- Uranium is the unique natural resource with fissile isotope
- Plutonium, resource or waste ? In the long term Plutonium will be a resource and breeding a necessity.
- Thorium, only fertile material, comparable to depleted Uranium

Wastes : 3 elements : Neptunium, Americium, Curium with very different physical properties

- Np : very long half-life and very low activity
- Am : major contributor to decay heat after some decades
- Cm : Strong radioactivity but short half live (Cm 244)

→ Manage them together or separately ?

Reactors



Many reactor types are studied to address these issues :

- Light water reactors with hardened spectrum (PWR or BWR) to allow for improved conversion factor and take advantage of technology of existing reactors.

- Fast reactors, especially sodium cooled ones, which are presented by several countries (USA, India, Japan, France) with different options for Plutonium management (burning or breeding) and for waste management (heterogeneous or homogeneous transmutation). These reactors are very flexible and allow for high breeding factors, transmutation capabilities and high burn up.

- ADS which are devoted to waste management and may be deployed in double strata strategy.

→ **Studies of reactor physics are very active and deserve to be pursued (with decreased uncertainties).**

→ **technological feasibility also has to be assessed**

Other issues for actinide management



Reactor physics is a first level of assessment, but we have to assess technological feasibility and to take into account constraints to achieve the goals of complete sustainability of nuclear energy.

Among these, 3 appear to be very important :

- **Reprocessing** : large capabilities are needed, high burn up fuel may contribute to reduce requirements. Industrial hydro does exist but pyro (metal fuel) has to be demonstrated.

- **Fuel manufacturing** : remote handling fuel manufacturing, to cope with radioactivity of minor actinides, is certainly one of the biggest difficulty of actinide management.

- **Proliferation resistance** : Safeguards are very important and have to be improved but some complementary intrinsic features would probably be needed.