

Overview of NEA Activities on Actinide and Fission Product Partitioning and Transmutation

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Overview of NEA Activities on P & T

◆ Scientific Issues

- Handbook on lead-bismuth eutectic
- Fuel cycle flow-sheet studies
- Future activities

◆ Strategic Issues

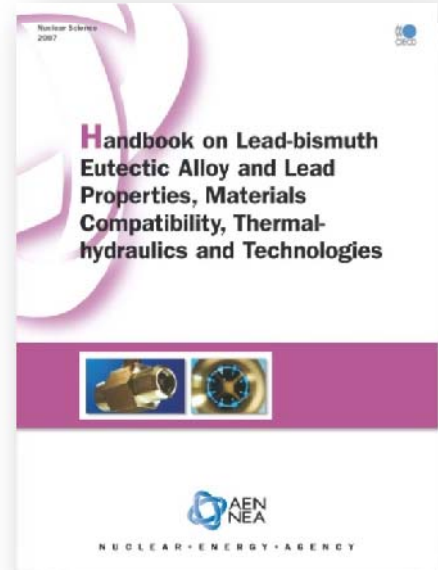
- Management of recyclable materials
- National programmes in partitioning
- Transition scenarios

◆ Conferences and Workshops

NSC (Nuclear Science Committee) WPFC & WPRS
NDC (Nuclear Development Committee)

Handbook on Lead-bismuth Eutectic

- ◆ First version issued in 2007
 - ◆ ~ 700 pages
 - ◆ Main contents
 - Thermo-physical and electrical properties
 - Transport and chemical thermodynamics data
 - Chemistry control and monitoring, material science
 - Compatibilities and mechanical properties, structure materials
 - Thermal-hydraulics, instrumentation and safety guidelines
 - ◆ Updated version planned for 2010
- Invited speech by C. Fazio (Session IV – Thursday)*



Fuel cycle flow-sheet studies

- ◆ Detailed mass balance flow sheet
- ◆ Characterising generated high-level waste
- ◆ Assessment of technical needs
- ◆ Study aqueous and pyrochemical processes
 - oxide fuel
 - coated-particle fuel
 - metallic fuel
 - nitride fuel
- ◆ 13 processes
- ◆ Report planned for 2010

Flow-sheet studies - List of Processes

- ◆ Standard PUREX
- ◆ UREX+3 (Pu/Np recovery, minor actinide separation)
- ◆ Grind/Leach
- ◆ Pyrochemical (Non-fertile nitride)
- ◆ 2 Pyrochemical (reduction to metal, followed by electrochemical steps)
- ◆ Pyrochemical (direct electrochemical processing of oxide)
- ◆ Extended PUREX (Pu/Np recovery, minor actinide separation)
- ◆ Fluoride Volatility
- ◆ Pyrochemical (direct electrochemical processing of metallic fuel)
- ◆ Pyrochemical (FR nitride)
- ◆ Advanced PUREX (innovative features)
- ◆ UREX+1a (group transuranic recovery)

New Activities in Preparation

- ◆ **Innovative fuels**
 - **Study on minor actinide containing fuels**
- ◆ **Curium separation and management**
- ◆ **Comparative study on homogeneous vs. heterogeneous recycle of TRU in fast reactors**
- ◆ **Potential benefits of advanced fuel cycles with P&T and impact studies**

Management of Recyclable Fissile and Fertile Materials (2007)

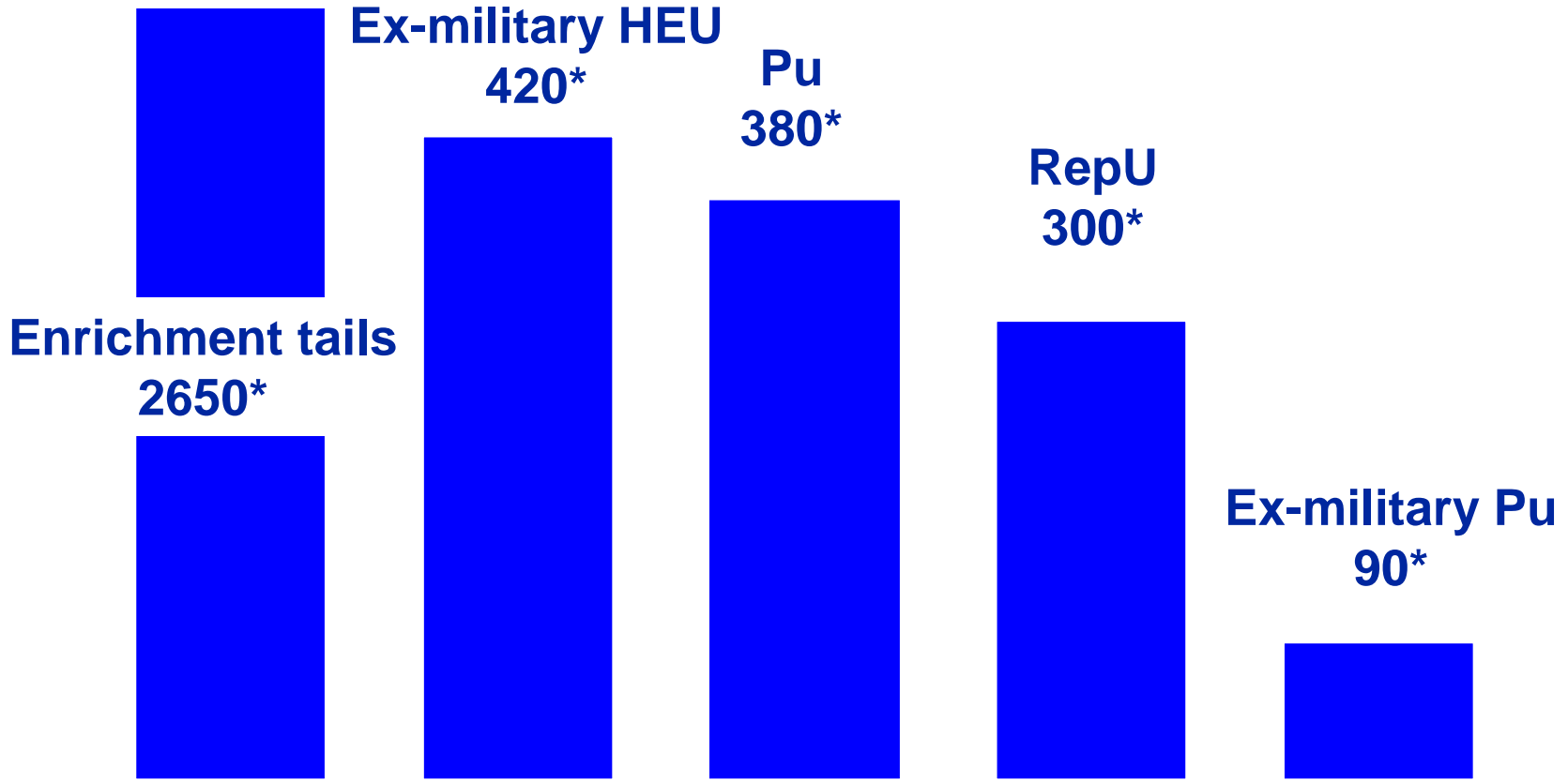
◆ Objective and scope

- Overview of recyclable fissile and fertile materials inventories which can be reused as nuclear fuel
- Reviews the options available for managing those materials

◆ Main conclusions

- Choices between options should be based on comprehensive assessments of short and long-term aspects
- No optimal option for all countries/circumstances
- **All options require eventually disposal of ultimate waste**
- International R&D projects strengthen the effectiveness of national efforts
- International cooperation helps addressing key issues such as safety and proliferation resistance
- Implementation of multinational, regional and/or international facilities could provide opportunities for global optimisation

Potential supply from recyclable materials



* Reactor-years of supply for 1000 MWe LWRs operating at 80% load factor

National Programmes in Partitioning

◆ Background and scope

- State-of-the-art on national programmes in partitioning
- Covering both aqueous and pyrochemical processes
 - ❖ For pyrochemical processes – update from the 2004 NEA report

◆ List of contributors

- Czech Rep., France, Italy, Japan, Korea, Russian Federation, Spain, UK, USA and EC
- Results from FP6/EURATOM will be inserted

◆ Publication planned for the first half of 2009

Fuel Cycle Transition Scenarios Studies

- ◆ **NSC/WPFC Expert Group on fuel cycle transition scenarios studies**
 - **Assemble and organise issues involving fuel transition from current thermal to future sustainable fuel cycle**
 - **Provide a framework for assessing national needs for fuel cycle transition**
 - **List of activities**
 - ❖ **State-of-the-art report of scenarios and national programmes**
 - ❖ **Benchmark on scenario code performances**
 - ❖ **Regional study related to the potential implementation in Europe of advanced fuel cycle (*M Salvatores speech this afternoon*)**
 - ❖ **Global transition scenarios study**

“Transitioning from thermal to fast nuclear energy systems – Strategic and policy issues”

*A new NDC report to be published early 2009
Emphasis on topics of interest to policy makers*

◆ Scope

- Transition from thermal to fast neutron systems at national, regional, global levels
- Review of data from previous studies
- Focus on strategic aspects

◆ Context

- Renaissance of nuclear programmes
- High interest in fast neutron systems but also in lifetime extension
- Transition scenarios were already investigated in many scientific/technical studies
- Transition raises specific policy issues which had not been analysed in depth

“Transitioning from thermal to fast nuclear energy systems – Strategic and policy issues” (2)

Main findings

- **Fast neutron systems are relevant for**
 - ❖ enhancing security of energy supply
 - ❖ facilitating waste management and disposal
- **The attractiveness of fast neutron systems depends on context**
 - ❖ Size and age of the nuclear fleet
 - ❖ Waste management policy
- **The transition period is long and challenging**
 - ❖ Nuclear unit lifetimes may be up to 60 years
 - ❖ Managing (burning or breeding) fissile materials and reaching equilibrium is a lengthy process
 - ❖ Building and operating several nuclear systems in symbiosis
 - ❖ Adapting industrial infrastructure and human resources continuously
- **Multi-national/global approaches may facilitate transitions**
 - ❖ Joint RD&D
 - ❖ Economy of scale and reduced need for national infrastructure
- **International initiatives are relevant**
 - ❖ Agreements on guarantee of fuel supply, Multinational fuel cycle centres

“Transitioning from thermal to fast nuclear energy systems – Strategic and policy issues” (3)

Preliminary Conclusions & Recommendations

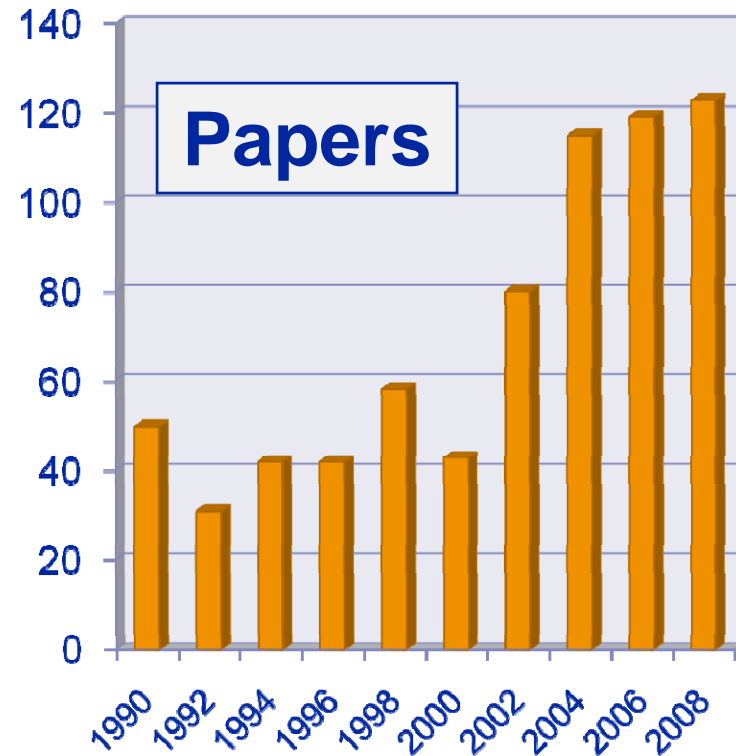
- **Government's role**
 - ❖ RD&D support, incl. education and equipment
 - ❖ Legal/regulatory framework adaptation
 - ❖ Global policy making
- **Industry's role**
 - ❖ Capacity building
 - ❖ Human resource management, incl. training
- **International organisations' role**
 - ❖ Fostering information exchange
 - ❖ Facilitating multinational endeavours

- A multicriteria approach is recommended for assessing transition scenarios
- Social and environmental aspects should be evaluated together with economics
- Transition scenarios should be considered in long-term perspective and require long-term commitments *[many decades to one century]*
- Seeking synergies through international cooperation is advisable

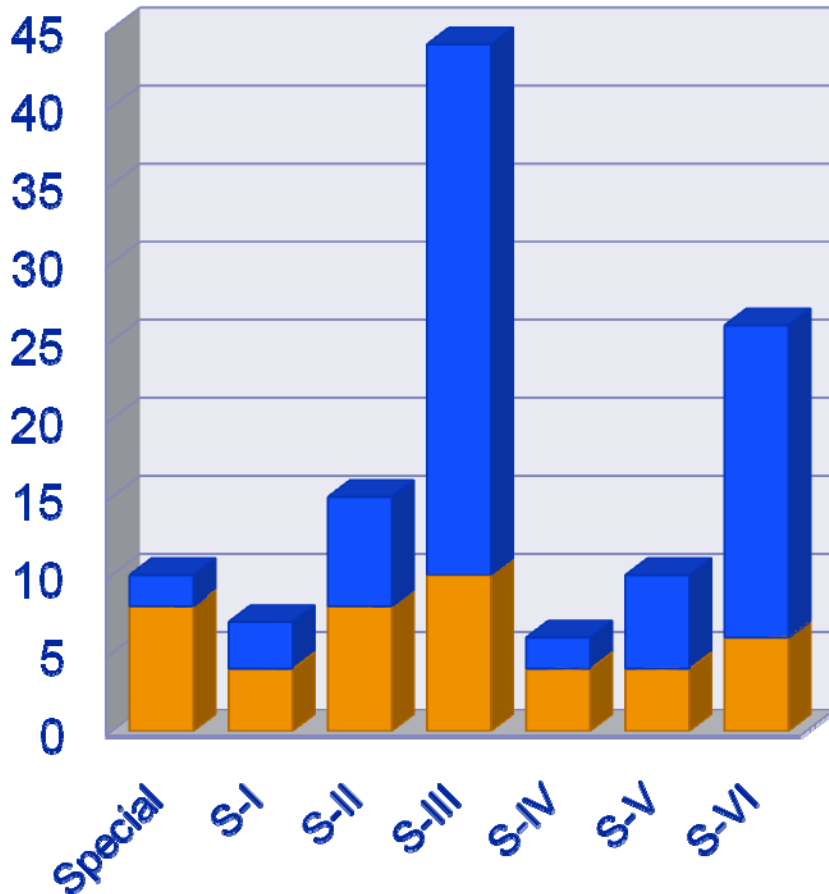
Information Exchange Meeting on Actinide & Fission Product Partitioning and Transmutation

- ◆ Forum for the discussion of scientific and strategic developments in the field of P&T (since 1990)

- Mito (Japan) 1990
- ANL (USA) 1992
- Cadarache (France) 1994
- Mito (Japan) 1996
- Mol (Belgium) 1998
- Madrid (Spain) 2000
- Jeju (Korea) 2002
- Las Vegas (USA) 2004
- Nimes (France) 2006
- **Mito (Japan) 2008**
- USA 2010



Papers by Session of 10th IEM P&T



 Oral presentation

 Poster

Special session on fuel cycle strategies and transition scenarios

S-I: Impact of P&T on waste management and geological disposal

S-II: Progress in transmutation fuels and targets

S-III: Progress in partitioning, waste forms and management

S-IV: Progress in materials, including spallation targets and coolants

S-V: Progress in transmutation physics experiments and nuclear data

S-VI: Transmutation systems: design, performance and safety

- ◆ **Workshop on technology and component of ADS (TCADS)**
 - Replace workshop on High Power Proton Accelerator (HPPA) to cover sub-critical system development
 - HPPA5, 6-9 May 2007, SCKCEN, 42 papers were presented
 - ❖ MEGAPIE, SNS, MYRRHA, ...
 - TCADS-1 will be held in 1st half 2010, hosted by FZK, Germany

- ◆ **Workshop on the structural materials for innovative nuclear systems (SMINS)**
 - Materials of Gen-IV, transmutation and fusion systems
 - ❖ 4-5 June 2007, FZK, 81 papers were presented
 - SMINS n°2 - organisation will start in the near future

Concluding Remarks

- ◆ **Numerous and various NEA activities in the field of P&T**
 - **Horizontal / crosscutting within the NEA**
 - **Balance between science and strategy**
- ◆ **Increasing activity: Transition scenarios**
- ◆ **Decreasing activity: ADS**

Altogether a good measure of the major concern regarding the management of HLW