International Atomic Energy Agency (IAEA) Activities on Spent fuel Management; Keeping the Recycle Option Open

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WM'09 Panel on SF Recycle

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International Atomic Energy Agency

Current world scene in nuclear energy application; country groups

1. Countries that have developed or are developing nuclear technologies (Canada, USA, Russia, France, UK, Japan, India, Korea, Germany, Belgium),
2. Countries receivers of nuclear technology with some experience in nuclear operations (other countries from total of 30 that have power reactors),
3. Potential newcomers.

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Current world scene in SF management

- Spent fuel disposal projects delayed significantly (no SF repository in operation),
- “Wait and see” approach adopted by many countries in particular by countries that do not plan to have reprocessing technology,
- **Increased interest for reprocessing and recycling of SF (with the grain of salt),**
- Long - term SF storage of 100 years (and even more) very likely.

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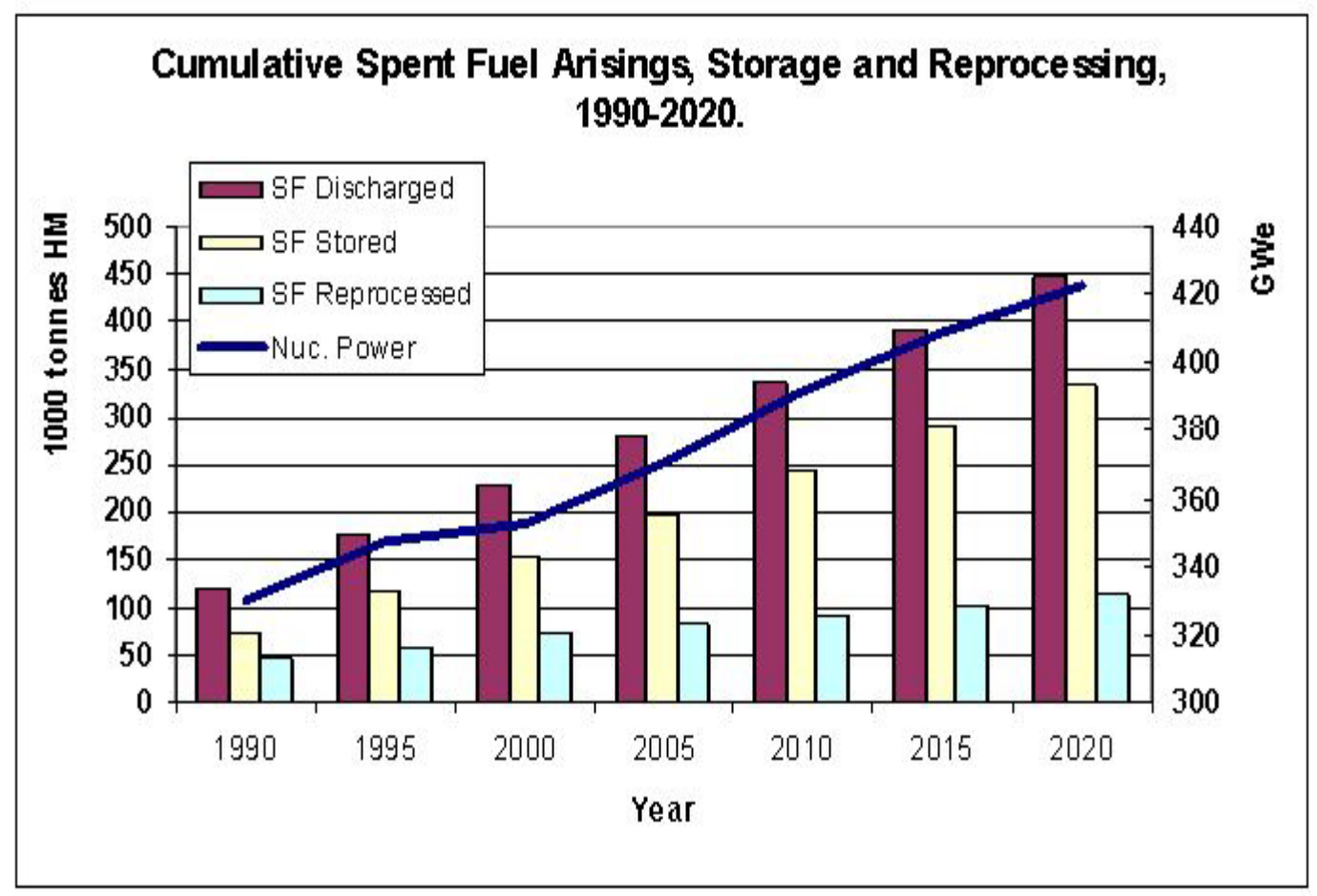
Global Statistics on Spent Fuel



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Spent fuel (SF) arising from power reactors

- Yearly approximately 10500 tonnes of SF arising from power reactors,
- Reprocessing capacity 6500 tonnes/year,
- Cumulatively reprocessed SF by 2007 94011 tonnes.

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REPROCESSING OPTIONS (current and in development); IAEA TECDOC-1587

- **Processes implemented today in commercial plants on industrial scale –** PUREX (France, Japan, UK, Russia, India).

- **Evolutionary technologies (Gen 3) based on aqueous separation methods derived from PUREX:** COEX, NUEX, Simplified PUREX, THOREX, NEXT,REPA (France, UK, Russia, India, Japan, Russia).

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REPROCESSING OPTIONS (current and in development); IAEA TECDOC-1587

- **Innovative aqueous processes using new extractant molecules,**
- **Non-aqueous technologies (dry route)-Pyrochemical processes,**
- **Hybrid methods combining Hydro and Pyro processes,**
- **Other innovative processes**: Fluid extraction, Ion exchange processes, Sedimentation processes.

- **NOTE**: Some processes may have limited applicability to specific fuels only.

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Some IAEA findings on reprocessing

- Civil reprocessing of spent fuel utilizing the PUREX process has been successfully practiced on a commercial scale for over 40 years without occurrences of diversion of special nuclear materials.

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Some IAEA findings on reprocessing

- The deployment of multi-national fuel cycle centres, operating under an international framework and implemented in those countries with a sufficiently large civil nuclear energy infrastructure, can ensure a sustained supply of nuclear fuel and related services under conditions in which the risk of proliferation of technologies related to the production of nuclear weapons is minimized.

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Some IAEA findings on reprocessing

- A number of options exist or will exist for the recycling of spent fuel.
- Some, including those that avoid separation of a pure plutonium stream, are at an advanced level of technological maturity and could be deployed soon,
- Others (such as dry methods) are at a pilot scale, laboratory scale or conceptual stage of development.

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Some IAEA findings on reprocessing

- Next-generation spent fuel reprocessing plants are likely to be based on aqueous extraction processes.
- Designed to a country specific set of spent fuel partitioning criteria for recycling of fissile materials to advanced light water reactors and/or fast spectrum reactors.
- Physical design of these plants must incorporate effective means for materials accountancy, safeguards and physical protection.

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Some IAEA findings on reprocessing

- Innovative reprocessing methods to be developed for the reprocessing of fuel types that may be utilized in the future; these fuels may differ substantially from the UO2 or MOX ceramics used in current light water reactors.

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Some IAEA findings on reprocessing

- International collaboration on the development of advanced reprocessing methods is essential to facilitate the future deployment of these technologies.

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Some IAEA findings on reprocessing

- Waste production, safeguards, and the impact of partitioning on operations such as the fabrication of fuel for the recycle of recovered actinides have all to be taken into account.

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Connecting SF Management with reliable fuel services; some new initiatives

- Take-back fuel and fuel lease are appealing concepts especially for new countries interested in nuclear energy,

Advantages:

- Proliferation resistance of the concepts,
- Eliminate/minimize problems with the SF Management for new countries interested in nuclear energy.

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Some general conclusions

- Non proliferation concerns will continue to be high on the agenda and will warrant the effort in arranging for multilateral approaches in nuclear fuel cycle,

- Long term storage over 100 years or more likely for many countries.

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IAEA involved in other nuclear initiatives

- IAEA proposal for internationalization of nuclear fuel cycle
- GNEP support; reliable fuel services and infrastructure
- Collaboration with OECD-NEA
- Russian Initiative
- NPT – Nuclear Proliferation Threat

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Other Agency programs with inputs to SF Management

- INPRO (International Project on Innovative Nuclear Reactors and Fuel Cycles),
- PRIS (Power Reactor Information System),
- Joint Convention on the Safety of Spent Fuel Management and Radioactive Waste Management,
- Safety standards (i.e. TS-R-1 for transport),
- Safety Review Services.

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The End

Thank you for your attention!

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SFM activities in the IAEA

- Work in Spent Fuel Management in Nuclear Fuel Cycle and Materials Section,
- Work includes SF predisposal management (storage and transport) and SF reprocessing,
- In addition, there are activities on Partitioning and Transmutation of Actinides and on Innovative Reactors and Fuel Cycles.

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