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Managing the Residues

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A question of survival for the mankind:

How to produce energy in a large scale

- meeting the essential global needs, and
- doing this in a sustainable manner for an unlimited time?

Is it well advised and ethically acceptable to believe in potential future innovations in energy technology (solar energy, nuclear fusion, ...) ?

or

do we want to have an insurance against the risk that no new large scale energy source would emerge in the future ?

To day we have only one energy source that has a proven potential to meet the needs for base load energy in a sustainable manner − nuclear fission.

Its large scale use requires determined development and building of components for a **nuclear fuel cycle** that could provide efficient use of world's uranium and thorium resources:

- **breeder reactors**
- **facilities for recycling their fuel**
- **nuclear waste management approach to deal with radioactive residues of recycling**

In developing new nuclear fuel cycles, equal emphasis must be given to safety and security of nuclear facilities, and security and safeguards of nuclear materials.

Optimum safety, security and safeguards would probably be achieved with multinational approaches. This means that

- only a few countries should host key fuel cycle facilities such as nuclear fuel reprocessing plants,
- experts from other countries should have an opportunity to join their development, construction and operation, and
- all countries should have secured supply of services offered by one or more multinational facilities.

Joint development of waste management technology in connection with the nuclear fuel reprocessing plants should have following main objectives:

- reduce release of all radioactive effluents as close to zero as achievable,
- immobilize all radioactive waste,
- minimize the waste volume in all categories of radioactivity: low, intermediate and high level, and
- develop standardized packages for ultimate disposal of each type of waste; each package needs to provide a reliable release barrier as long as the contents must be isolated from the biosphere due to its elevated radioactivity.

As a trust building measure, the IAEA should verify safety of radioactive waste management by peer reviews of each multinational reprocessing plant and related disposal facilities

- this would be necessary for gaining public acceptance of the waste management in host and customer countries.
- verification should start already during the development and planning stage

Ultimate responsibility for managing the residues is with the waste producing countries - 1

- No country should build its long term waste management strategy on an expectation that political acceptance for large scale ultimate disposal of foreign radioactive waste will some day be achieved in a country offering reprocessing, or in any other country.

- Therefore, every country sending nuclear fuel for reprocessing must be prepared to receive in return high level waste (HLW) arising from reprocessing and to take care of its final disposal.

Ultimate responsibility for managing the residues is with the waste producing countries - 2

Proper means for safe final disposal of all types of radioactive waste can probably be found in every country having a nuclear programme.

- The most important safety factor in preventing radioactive releases from a disposal facility is provision of reliable engineered release barriers − container and other barriers installed inside or around it.
- Geological disposal protects the barriers from the mechanical and chemical environmental impacts and from human intrusion − a variety of geological environment are available for providing such protection.

Ultimate responsibility for managing the residues is with the waste producing countries - 3

- Countries planning to buy services from a certain reprocessing plant should assign its experts to support the development of a model disposal facility in the country hosting the reprocessing plant.
- The same nuclear waste disposal technology could then be transferred to all co-operating countries.

How about the Low and Intermediate Level Waste

Long distance transport of L&ILW is not meaningful due to high costs and unnecessary increase of safety and security risks.

- final disposal of L&ILW should preferably take place on the site where the waste is being generated
- for instance, all waste arising from nuclear power plant operation in Finland is regularly transferred to underground final disposal facilities that are at about 100 m depth and are in use **on each NPP site** since 1990's.

Also I&ILW arising from reprocessing should be disposed of on site; as compensation an equivalent amount of waste could be returned to the country of origin in the form of HLW.

- the technology for low and intermediate level waste disposal could be developed jointly in connection with a reprocessing plant project, thus ensuring technology transfer to all participating countries

Case study: Russian initiative - 1

A workshop on Multinational Approaches for the Back-End of Nuclear Fuel Cycle was held in Helsinki on May 16-17, 2007.

- attended by 30 experts from eight countries and three international organizations
- background: DG ElBaradei's initiative on multilateral approaches to the nuclear fuel cycle and President Putin's initiative to establish nuclear fuel cycle centres in Russia
- elaborated a proposal to develop a centre for nuclear fuel cycle back-end services in Russia

Case study: Russian initiative - 2

Helsinki workshop concluded that

- multinational facilities for back-end of nuclear fuel cycle could bring many benefits to the hosts of the facilities and their customers: safety, security, non-proliferation, fuel supply assurance, economy
- the long term goal would be a full scale reprocessing plant owned by Russian Federation and operating on commercial basis; the plant would reprocess fuel from different reactors and produce raw material for nuclear fuel fabrication and nuclear waste conditioned and packed in accordance with high standards.
- concrete steps towards that goal are still in a distant future; they must be preceded by joint R&D and changes in the legislation both in Russia and in potential customer countries
- work could start in the form of separate projects, some connected with the INPRO or GNEP and some being bilateral or multilateral between countries but the projects should be coordinated and driven towards a common goal: an industrial scale facility

Case study: Russian initiative - 3

Joint R&D projects should focus in three areas:

- development and design of a pilot reprocessing plant
  - Russia would welcome collaboration with experts from other countries
- volume reduction of reprocessing waste in all categories − LLW, ILW, and HLW − and standardized packing of waste in each category into capsules that are ready for final disposal
  - this work would benefit from co-operation with Sellafield and LaHague facilities where major progress has been achieved
- development of waste disposal concepts that are not sensitive to the geological circumstances of the disposal site
  - co-operation with underground and other laboratories providing relevant new knowledge would be welcome

Why is Finland taking a different course today ?

In Finland the approach to HLW disposal is based on a Decision in Principle (ratified in Parliament) that aims for **direct disposal of spent fuel.** This approach is well founded for several reasons

- our current nuclear law does not permit import or export of nuclear waste
- all steps in nuclear waste management can be implemented by using only national resources and existing technology
- we have been able to demonstrate one possible solution for nuclear waste management, both L&ILW as well as HLW (this is important for public acceptance of new nuclear power plants !)
- we can accurately calculate the costs of all nuclear waste management based on the decided approach − this gives also reference cost for considering reprocessing services in future
- the facilities at 400-500 m depth that are now being constructed can be used either for direct disposal of spent fuel or for disposal of HLW