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Current Status of Storage and Disposal of Radioactive Waste and Spent Nuclear Fuel

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Storage is a temporary measure applied at any stage of the waste management scheme (e.g. before treatment or before disposal) that requires continuing surveillance and provides an interim containment of spent fuel or of radioactive waste. Storage prior to treatment, conditioning or disposal may have a functional or strategic role and thus be part of the overall waste management strategy.

Spent fuel from nuclear power reactors can be safely stored in water-filled pools for a long time. Substantial experience with storage in pools has been obtained over several decades. Despite the wet storage technology, dry storage of spent fuel has also been developed and widely adopted. Consideration of the various factors determines the choice of the length of storage of high level waste and spent fuel. Member States have indicated storage times ranging between 10 and 100 years. Although storage has been proven to be feasible and safe, it remains a temporary solution and does not replace the need for the development and application of disposal.

Disposal of solid or solidified radioactive wastes is the final step of the nuclear fuel cycle and other applications of nuclear energy and radioisotopes, and is defined as “emplacement of waste in an appropriate facility without the intention of retrieval”. It includes a number of practices adopted and/or foreseen in most countries. Different strategies can be used in planning and implementing a waste disposal system. The selection of the most appropriate strategy will depend upon the waste quantity, its type and the availability of a suitable site for repository construction.

Near surface disposal facilities, i.e. facilities located at or within a few tens of metres from the earth's surface; have been constructed and operated since the forties of the last century and, presently, there are many near surface facilities of different design around the world for the disposal of low level waste. A geological disposal system can be defined as a multiple barrier system consisting of a combination of conditioned and packaged solid wastes and other engineered barriers within an excavated or drilled repository. The rock types considered for deep geological disposal of high level waste or spent nuclear fuel range widely from crystalline rocks such as granites, over sedimentary rocks (clays), rock salt, to pyroclastic rocks such as volcanic tuff.

An important issue with the geological disposal concept is the length of time during which acceptable releases of radionuclides from the disposed waste can be guaranteed. The question of how long high level wastes and spent fuel need to be isolated from the biosphere is a complex one, and one which has received a great deal of attention. Presently, there is a general agreement that the necessary period of radionuclide isolation can reach a time span of well beyond 100,000 years.

Although no proposed geological repository for disposal of spent fuel or high level waste has yet been licensed for construction, several countries have identified candidate sites and are engaged in pre-licensing activities, notably Sweden (Östhammar near Forsmark) and Finland (at Olkiluoto). Multinational, regional and bilateral approaches are important aspects in developing R&D and implementing disposal solutions, including shared ones.