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# Recent Developments in the Finnish Final Disposal Programme

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## Introduction

In Finland, four nuclear power plant units have been operated for over 20 years. The plants are located at two sites, Olkiluoto and Loviisa. The units supplied 27% of electricity demand in 2001. In May 2002, the Finnish parliament approved the government's Decision in Principle to construct a new nuclear power plant unit in Finland.

Responsibility for nuclear waste management lies with the utilities, which have established a joint company, POSIVA, to take care of spent fuel disposal and other specialized aspects of nuclear waste management. It was in 1983 that the Finnish government set the objectives and the schedule for the national waste management programme. Since then, two shallow underground repositories have been constructed for low- and medium-level operating waste in crystalline rock at the power plant sites.

Today, the main activities in nuclear waste management concern spent fuel disposal deep in the Finnish bedrock. This task has required, and will also in the future require, a lot of work. Apart from technical and scientific issues, a major challenge has been the creation of a sufficient degree of public acceptance, which is a 'must' in order to obtain favourable political decisions.

## Steps in the years 1980 – 2000

The construction of the first Finnish underground repository for low- and medium-level waste was started in 1988 at Olkiluoto. The repository, which was commissioned in 1992, is located less than one kilometre from the power plant units. It is situated at a depth of 70–100 metres in crystalline bedrock. The total capacity of the silos is about 8000 $m^3$ of waste.

The excavation work on the Loviisa repository began in 1993, and the facility was commissioned in 1998. The repository comprises a transport tunnel of about 1100 metres in length, with tunnel and hall spaces built at a depth of about 110 metres. The repository, when built to its full capacity, will accommodate about 4000$m^3$ of waste.

 

For spent fuel, facilities have been constructed for interim storage. Spent fuel bundles are stored in water pools at both power plant areas until disposal, which, it is intended, will begin from 2020. Thus, the available storage capacity gives enough time for all the preparatory measures necessary for the implementation of final disposal.

Another important element in the Finnish nuclear waste management system is the nuclear waste management fund, which was established in 1987. The utilities have to collect a fee within the price of nuclear electricity and set it aside in the state-controlled fund. The fund and the securities must cover all the future costs of waste management, including spent fuel and operating waste, as well as other necessary activities (decommissioning of power plants, etc.). By 2002, about 1200 million Euros had been accumulated in the fund.

**Development of deep disposal for spent fuel**

Until 1996, spent fuel from the Loviisa power plant was returned to Russia (originally to the Soviet Union). However, already in the early 1980s, a national programme for spent fuel disposal was considered necessary, since only a part of the spent fuel from the Finnish power plants was exported. Hence, the development of a technical concept suitable for Finnish geological conditions was started. Currently, the Nuclear Energy Act does not allow the export or import of nuclear waste. The Finnish programme aims at the construction of a national deep repository for spent fuel in the 2010s, and the facility should start operation in 2020.

The planned permanent way to take care of spent fuel is emplacement of the packaged spent fuel in the repository to be excavated in crystalline bedrock at a depth of several hundred metres. The packaging is based on use of copper canisters, which will be surrounded by compacted bentonite in the repository.

Systematic work aimed at the siting of the repository was also started some 20 years ago. The essential aim of the site characterisation programme was site selection by the end of the year 2000. The programme advanced into deep drillings and other field work in 1987. In the final phase of site selection studies since 1997, site characterisation was focused at four site candidates; the two nuclear power plant sites (Olkiluoto at Eurajoki, and Loviisa) and at two other sites (Kuhmo and Äänekoski).

The latest updated safety analysis was reported in 1999. It proves that the final disposal of spent fuel can be implemented in compliance with safety regulations issued by the government at any of the four sites studied. The results do not provide grounds for ranking any one of the sites above the others with regard to safety.

POSIVA started the assessment of environmental impacts (EIA) of spent fuel disposal in 1997. In the first phase, the procedure consisted of drafting the EIA programme. Inhabitants of the candidate municipalities were encouraged to participate in the process. The EIA process was continued by studies of the impacts on nature and on the utilisation of natural resources, on land use and on human health, as well as by an assessment of the social impacts. Alternatives for

spent fuel management were also compared. The final EIA report was completed in 1999.

In Finland, the siting and implementation of a nuclear waste management facility requires political decisions. An essential prerequisite for successful decision making is adequate public acceptance. Communications have continued since the early 1980s in order to deliver information and to create confidence in the safety of the planned final disposal facilities for different kinds of radioactive waste.

The information activities have included presentations for stakeholders, 'open houses', visits to existing nuclear waste facilities and power plants, tabloids delivered to all the households in the vicinity of the candidate areas, as well as advertisements in the local and in the national newspapers. In 1997–99, when the EIA procedure was being undertaken in four municipalities, numerous local interactive occasions were arranged. The attitudes in the municipalities in which the nuclear power plants are located, have been consistently more positive than in other parts of the country. Currently, a clear majority of the inhabitants of these municipalities is in favour of the deep disposal facility.

**Decision in Principle**

The Finnish Nuclear Energy Act requires that a policy decision, a so-called 'Decision in Principle' (DiP) has to be applied for nuclear facilities prior to implementation. This also applies to a final repository for spent fuel. The DiP is made by the government. A positive DiP does not, however, in itself enable POSIVA to construct the planned repository. In the DiP process a judgement is made on whether the planned facility is '…in line with the overall good of the society'. Later, separate licences have to be applied for to enable the construction and the operation of the facility.

According to Finnish legislation, the siting issue is closely connected with the DiP. The approval of the host municipality is a precondition for a positive decision, in addition to a supporting statement from the Safety Authority. POSIVA submitted the DiP application to the government in 1999. The site of the facility for which the decision was applied was Olkiluoto in the municipality of Eurajoki. Several factors supported the selection of Olkiluoto as the final disposal site.

Site investigations proved that the bedrock at Olkiluoto is suitable for safe disposal. According to the EIA results, environmental impacts would be minimal in a municipality where a nuclear power plant already exists. At present, the Olkiluoto nuclear plant units produce most of the spent fuel in Finland; thus the need for transportation will be minimised. Olkiluoto also offers the possibility of utilising sea transport in addition to road and railway alternatives. The power plant activities at Olkiluoto and the existing infrastructure of the area are also clear advantages for final disposal. Furthermore, there is a good local support for the repository in the municipality.

Statements concerning the application were requested from the Safety Authority, STUK, several ministries, the municipal council of Eurajoki, neighbouring municipalities and regional authorities. The public had also the possibility to

 

express its opinions on the application. The hearings and review of the application for DiP were completed in early 2000. Almost all of the statements requested, in total about 20, were in favour of the DiP.

According to the Safety Authority, STUK, the policy decision can be made on the basis of safety and Olkiluoto is suitable for the safe disposal of spent nuclear fuel. The municipality of Eurajoki took a decision supporting the selection of Olkiluoto as a repository site in January 2000. The votes in the municipal council were 20 in favour and 7 against. In December 2000, the government approved the POSIVA application.

The Nuclear Energy Act requires that the final phase in the DiP process is a decision by parliament, which may decide that the DiP remains in force, or may reverse it. The first debate took place in parliament in February 2001. After the preparatory work of two parliamentary committees, the decision was again debated in a plenary session. The final vote in May 2001 was 159 in favour and 3 against the approval (37 MPs were absent). In May 2002, the parliament also accepted the disposal of spent fuel from a new Finnish nuclear power plant unit in the same repository.

**The future**

The new stage of the final disposal programme after a positive DiP will entail the construction of an underground research facility (ONKALO) at Olkiluoto. The facility will be used to obtain detailed site data for the application for a construction licence and for fitting the deep repository into the local geological structures of the Olkiluoto island. The technical design and demonstration work and the complementary site characterisation results will provide the basis on which the safety case will be prepared to support the construction licence application around the year 2010.

The underground characterisation facility will consist of an access tunnel and an associated ventilation tunnel, as well as research levels at depths of 300, 400 and 500 metres. The total length of the access tunnel will be some five kilometres. The aim is that ONKALO will eventually be used as a part of the final disposal facility.

The construction of the access tunnel is scheduled to start in 2004, and the total length of the construction period is estimated to be 5-6 years. Research activities at the main research level, at a depth of 400 meters, will probably be started 3-4 years after the excavation work has commenced. Once ONKALO has been constructed and the underground characterisation studies completed, the project will move on to the construction of the actual final disposal facility in the 2010s.