Site Selection Process for Spent Fuel in Finland

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Abstract

This presentation is a short summary of the Finnish processfor selection and characterisation of potential sites for geological deep disposal of spent nuclear fuel. The process lasted nearly two decades from 1983 to 2000, and was concluded by the Government's Decision in Principle (DiP) on the construction of a repository in Olkiluoto. This presentation gives an outline of the early site selection criteria and a description of this process.

The beginning of the entire project was a policy decision on the management of nuclear waste, which was made by Finnish government in 1983. This decision set the goals and milestones for the site selection programme for a future geological repository. According to the decision, several potential candidates, selected from the entire country, should be characterised and the repository site should be selected by the year 2000.

Presentation begins with a description of the geological and environmental site selection criteria and their use in the first and second phase of the selection process, in which five candidate sites were rooted out from a total of 101 potential areas. The program and outlines of these early studies are presented in Figures 1 and 2. The initial site selection process found five candidate sites, which were subjected to preliminary investigations. This second phase of the selection process is described.

On basis of phase two results only three sites, Olkiluoto, Kivetty and Romuvaara, were selected for detailed investigations starting in 1993. Afterwards, the Hästholmen site in Loviisa was added to these three targets. This was a result of the Finnish state-owned power company joining the programme in 1995, after an amendment of the Nuclear Act had prevented the return of spent nuclear fuel to Russia.

The overall strategy and the applied investigation techniques of the third selection phase are explained in more detail. The main purposes of these investigations were the development of lithological and structural models of the three sites. These models were used to develop understanding of the hydrogeological and hydrochemical environments plus groundwater flow at the sites. Also the geotechnical constructability of the sites is described, with focus on the location and orientation of fracture zones in bedrock.

The conclusions of the project and some special issuespresent at the winner site Olkiluoto are discussed. Some of the further investigations at Olkiluoto, especially the construction of an underground rock characterisation facility now named ONKALO, were planned beforehand during this selection process. The ultimate goal of all present and future work is to ensure that a final repository can be safely constructed and operated at Olkiluoto. The operation of the repository is scheduled to start in the year 2020, but the research will continue in parallel for many years thereafter.

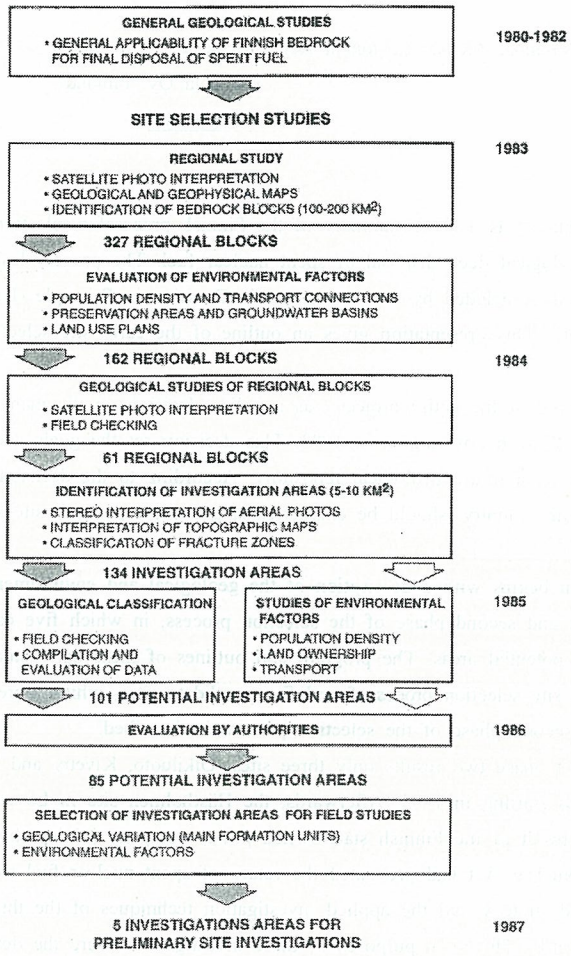

Figure 1. The program of early site selection process from year 1983 to the selection of five candidate sites in 1987.

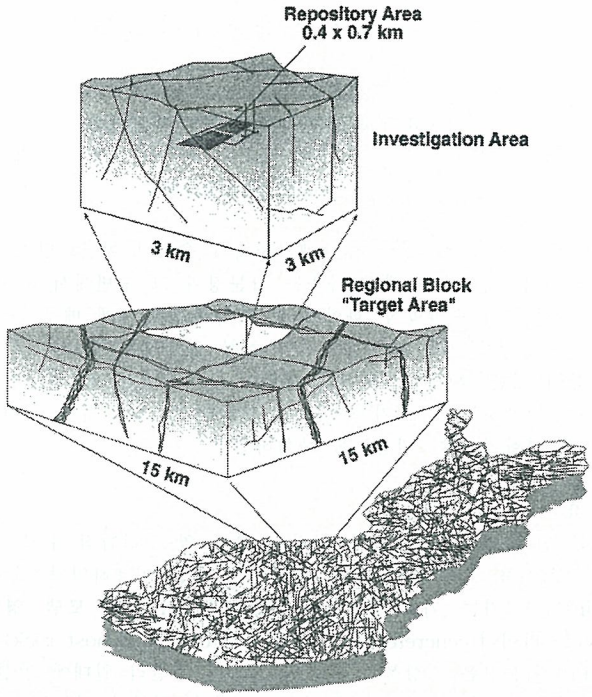

Figure 2. An outline of the Finnish site selection process between years 1983 and 1987.

The entire site selection programme and its associated investigations and research work produced a substantial amount of knowledge on Finnish bedrock and its ability to host a spent nuclear fuel repository. The investigations eventually showed that the differences between the candidate sites were minor, and from the viewpoint of safety the variation within a single site was far more significant than the differences between sites.

Due to the small differences in bedrock conditions between sites, other factors played a more significant role in selection of the preferred repository site. The facility could have been located at any one of the sites, and the sites could not be ranked in terms of their long-term safety.

The assessment of environmental impact from the development of a disposal facility was of low significance, as the more environmentally sensitive areas were already rejected during the earlier phases of selection. The socio-economic changes from the development were considered more important instead. The most suitable site was deemed to be the one where the local population would be likely to accept the disposal facility and where the social and economic advantages outweigh the disadvantages. In this regard, the communities of Loviisa and Eurajoki, where nuclear power was already an integral part of the local economy, were considered most suitable.

Of these two, Olkiluoto had an advantage over Loviisa in two senses. The amount of spent fuel in interim storages was greater in Olkiluoto, as the fuel was never exported. By developing the disposal facility in Olkiluoto, the fuel transports could be minimized. Secondly, attitude surveys performed in Eurajoki and Loviisa showed a slight polarisation of opinions among the residents of Loviisa. The positive attitude of Eurajoki offered the best prospect for the development of a disposal facility. Consequently, only Olkiluoto was nominated as the development site in the DiP application submitted to the State Council.