

## Posiva's disposal of spent nuclear fuel - the concept and the encapsulation facility

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Posiva will be the first organization to dispose spent nuclear fuel in its facility in Eurajoki, Finland. The planned schedule will be rather soon, starting in 2020's lasting roughly 100 years. The spent fuel is from Loviisa and Eurajoki, where the former has two VVER-type reactors and the latter two BWR-type reactors and soon also an EPR (PWR)-type reactor. Thus, the current goal is to dispose the spent fuel from five reactors, major part being located already in Eurajoki, whereas the fuel from Loviisa has to be transported to the encapsulation facility.

Here we shortly introduce the concept of the nuclear waste management including the encapsulation process and final disposal. Moreover, we highlight how fuel experiments are related with the concept's phases.

### **Posiva**

Posiva Oy has been established in 1995 and employs roughly 80. Posiva is owned by the Finnish power companies Teollisuuden Voima Oyj (60%) and Fortum Power & Heat Oy (40%). Teollisuuden Voima Oyj has its reactors in Eurajoki (Olkiluoto) and Fortum Power & Heat Oy in Loviisa (Hästhölmén). The disposal facility is located in Olkiluoto, Eurajoki, where all the spent nuclear fuel will be disposed. (Please see more from [www.Posiva.fi/en](http://www.Posiva.fi/en). Moreover, all the figures are from the pages.)

### **The concept - multiple barriers**

The concept is based on the KBS-3 method developed in cooperation with Swedish Nuclear Fuel and Waste Management Company, which carries on nuclear waste management in Sweden. More precisely, the design is KBS-3V, meaning that the canisters are placed vertically in individual deposition holes. The disposal concept relies on multiple barriers. The barriers are:

1. Fuel pellet,
2. Fuel rod and fuel assembly,
3. Canister steel insert,
4. Copper canister,
5. Bentonite buffer and tunnel backfill
6. More than 400 meters of bedrock

The idea of the barriers is to create a series of obstacles for radioactive substances penetrating from disposal.

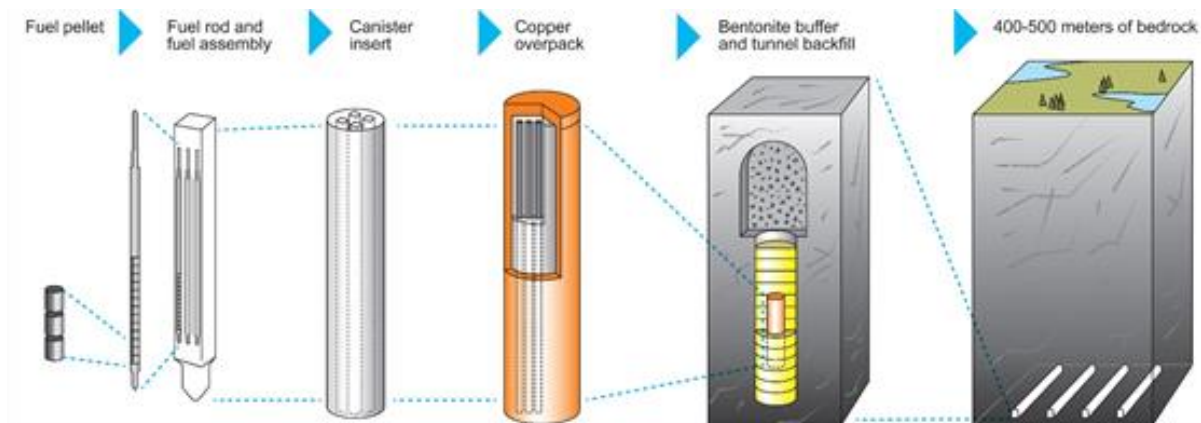


Figure 76: The barriers of the KBS-3 concept implemented by Posiva. With multiple barriers radioactive substances are not easily drifted from the disposal and being harmful in the biosphere.

### Long-term storage

The disposal has designed in such a manner that the barriers last over 100 000 years including even ice ages. Posiva has done and is doing a great effort to ensure that the long-term safety is secured for this very long time period.

### The encapsulation facility for the encapsulation and the repository

The encapsulation of spent fuel into canisters will be established in the encapsulation plant. Then the canisters will transferred by a lift to the underground repository. The repository's deposition tunnels are located about 400-450 m depth and the final disposal canisters will be placed in those tunnels. The repository can be divided into three parts: 1) deposition tunnels (each canister placed in an individual deposition hole), 2) central tunnels (connecting the deposition tunnels), 3) technical auxiliary facilities.

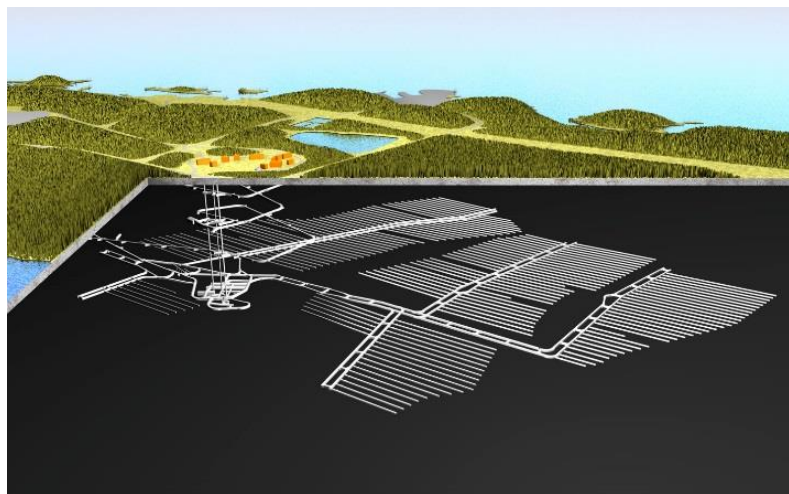


Figure 77: The facility contains deposition tunnels, central tunnels and technical auxiliary facilities.

### The spent fuel and the canister

The total amount of the spent fuel is estimated to be 5500 tU which means approximately 2800 final disposal canisters. Moreover, the spent fuel can be classified into three different groups: 1) the fuel from the power plants 1 and 2 in Olkiluoto, 2) the fuel from the power plants 1 and 2 in Loviisa, 3) the fuel from the power plant 3 from Olkiluoto, which will soon be in electric generation. All these types require an individual canister containing its own canister design.



Figure 78: The spent nuclear fuel is packed into the copper-steel canister, where the steel insert has positions for the fuel assemblies and the copper shell protects the fuel from the corrosion.

### **The spent fuel transport**

The spent nuclear fuel is stored currently in the nuclear power plant sites, Eurajoki and Loviisa. The fuel will be transported from the power plants to the encapsulation plant in transport casks.

### **Schedule**

Posiva's plan is to start the disposal sometimes in 2020's and continue for roughly one hundred years. The plan is to dispose all the spent nuclear fuel from Olkiluoto1-3 and Loviisa 1-2 reactors.

### **Spent fuel studies**

Posiva is conducting spent fuel studies to qualify the codes used for nuclear and operational safety, decay heat calculations and to reduce the uncertainties in radionuclide release and transport modelling part of the safety case. Hot cells studies involve radioisotopical measurements of samples from BWR and VVER spent fuel from the Olkiluoto and Loviisa nuclear power plants. Posiva also participates to the EU project DISCO studying the radionuclide releases of radionuclides in disposal conditions