

Posiva's disposal of spent nuclear fuel - the disposal concept and fuel studies

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Final disposal concept

- § Posiva will be the first organization to dispose spent nuclear fuel
- § The KBS-3 concept has been developed in a cooperation with Swedish Nuclear Fuel and Waste Management Company
- § Spent nuclear fuel from the nuclear power plants of Teollisuuden Voima (Olkiluoto) and Fortum (Loviisa) will be loaded in copper-steel canisters and disposed in Olkiluoto bedrock 400-450 meters deep



Figures are from
www.posiva.fi

The canister

- § Fuel assemblies will be loaded into the insert
- § The cassette inside the insert is made from steel, but the insert is casted with nodular cast iron
- § The insert will be attached into copper canister



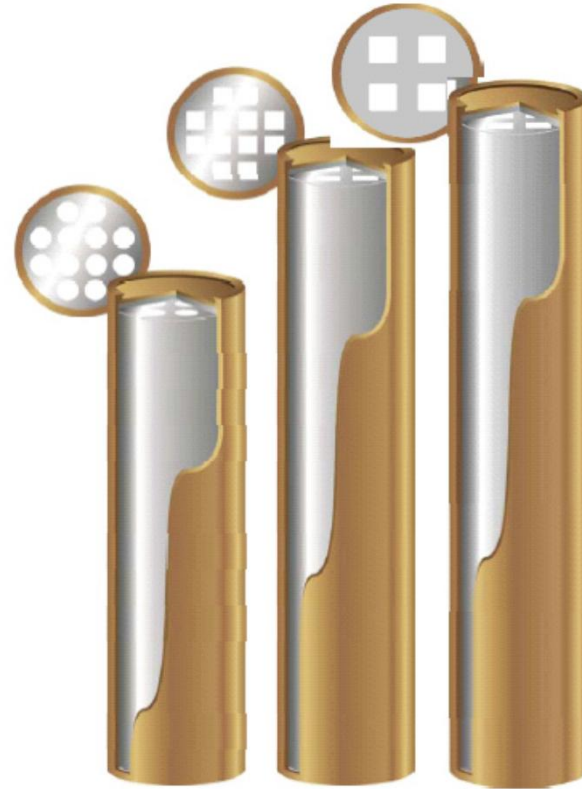
The (BWR) canister for the spent fuel disposal

The canisters' design

§ Spent fuel from Olkiluoto and Loviisa can be divided into three fuel types and they will be disposed with the different canister designs

- § BWR (Olkiluoto 1-2)
- § VVER-440 (Loviisa 1-2)
- § EPR (OL3)

§ The number of fuel assembly positions, their shape and the height of the canister are different

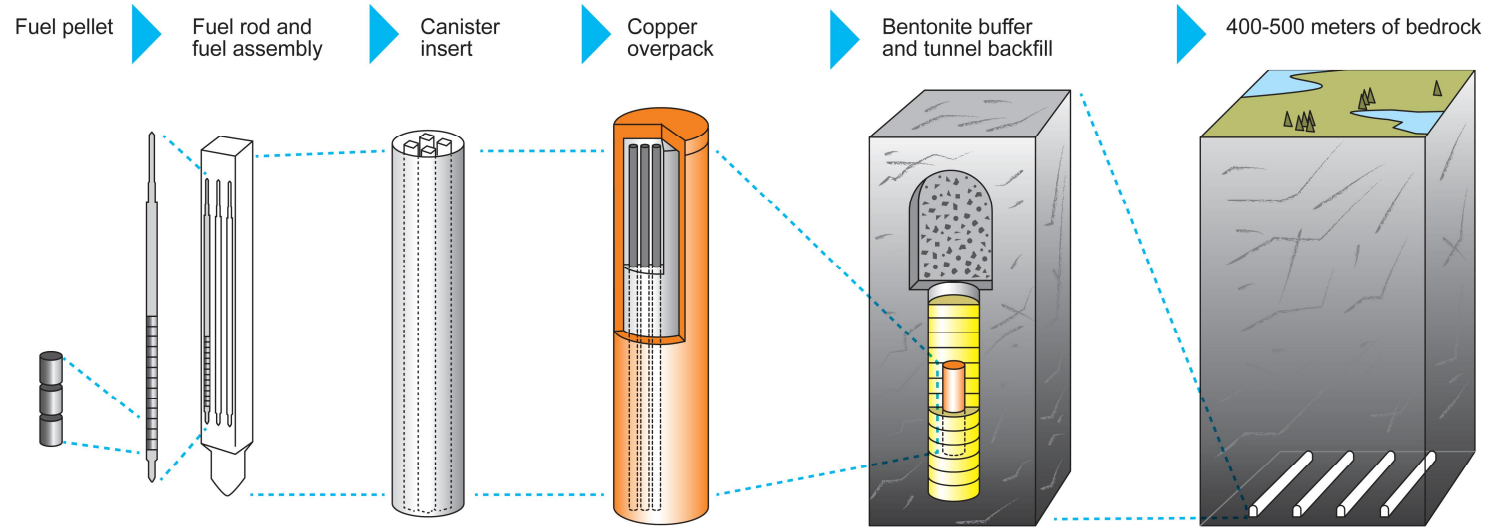


The canister types. VVER-400, BWR and EPR, from left to right, respectively.

Final disposal concept

- § The final disposal of spent nuclear fuel is based on the use of engineered barrier system (EBS), i.e. multiple release barriers and they are:
 - § fuel matrix, fuel cladding, disposal canister, bentonite buffer, backfilling of the tunnels and the surrounding rock
- § The idea is to ensure that the nuclear waste cannot be released into organic nature or become accessible to humans.

The barriers



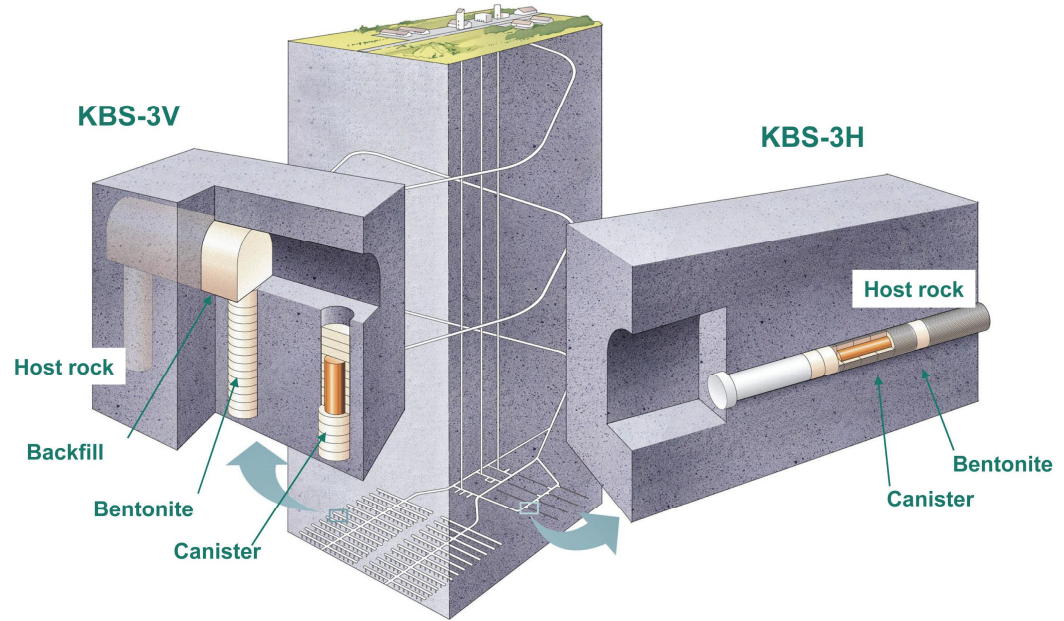
EBS contains multiple barriers, with them radioactive substances are restricted in the rock for long time, hence are not easily drifted to the biosphere.

Long-term safety

- § The disposal has designed in such a manner that the barriers last over 100 000 years
- § Even the following ice ages (their timing is rather reliably even if there were changes in the atmosphere composition) are taken into account
- § Nevertheless, some studies (e.g. the DISCO -project) consider spent fuel dissolution assuming the failed canister, thus also the most difficult scenarios have been taken into consideration

The KBS-3V

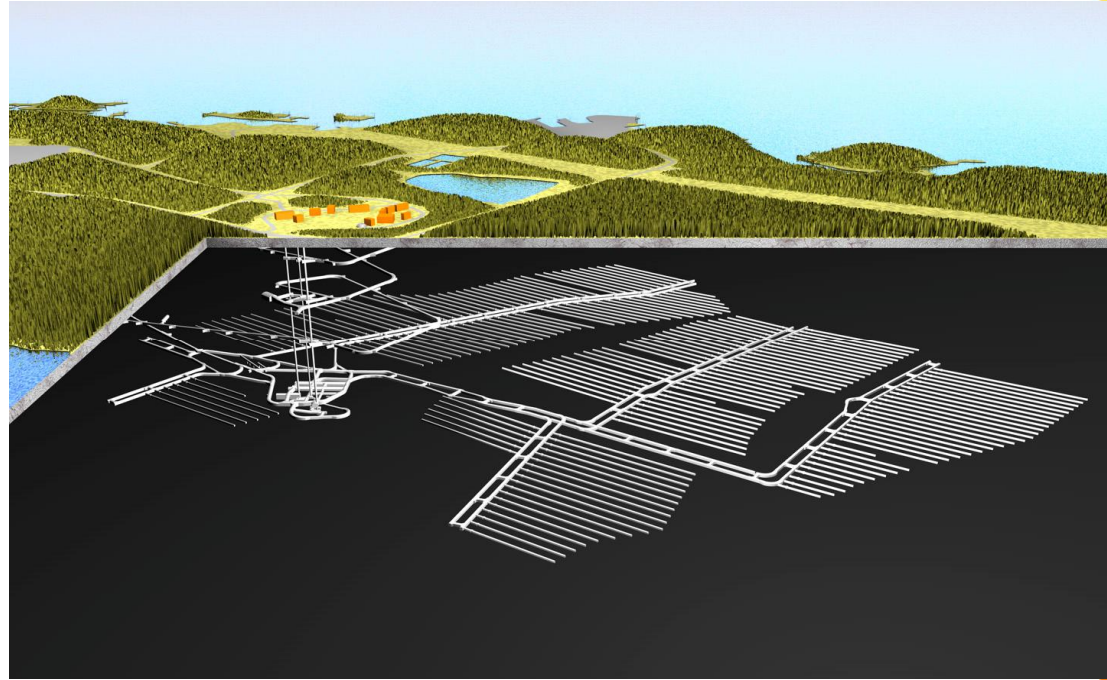
§ Canisters will be disposed vertically, but also the horizontal concept has been considered



The KBS-3 concept has the vertical and the horizontal version.

Final disposal tunnels – the facility

- § The repository's deposition tunnels are located about 400-450 m depth. The repository can be divided into three parts:
 - § deposition tunnels (each canister placed in an individual deposition hole)
 - § central tunnels (connecting the deposition tunnels)
 - § technical auxiliary facilities.



The disposal tunnels.

The encapsulation facility

- § 1. Receiving and storage area for new canisters
 - § 2. Hot cell
 - § 3. Copper lid welding chamber
 - § 4. Weld inspection
 - § 5. Canister surface cleaning area
 - § 6. Canister lift for transfer of canisters into repository.
- § Also the encapsulation plant will be described in more details in Olkiluoto on Friday



The encapsulation plant.

Spent fuel and transport

- § The total uranium amount produces roughly 2800 canisters
- § Fuel will be transported from the power plants to the encapsulation plant in transport casks



Olkiluoto (above), Loviisa (below)



The preliminary schedule

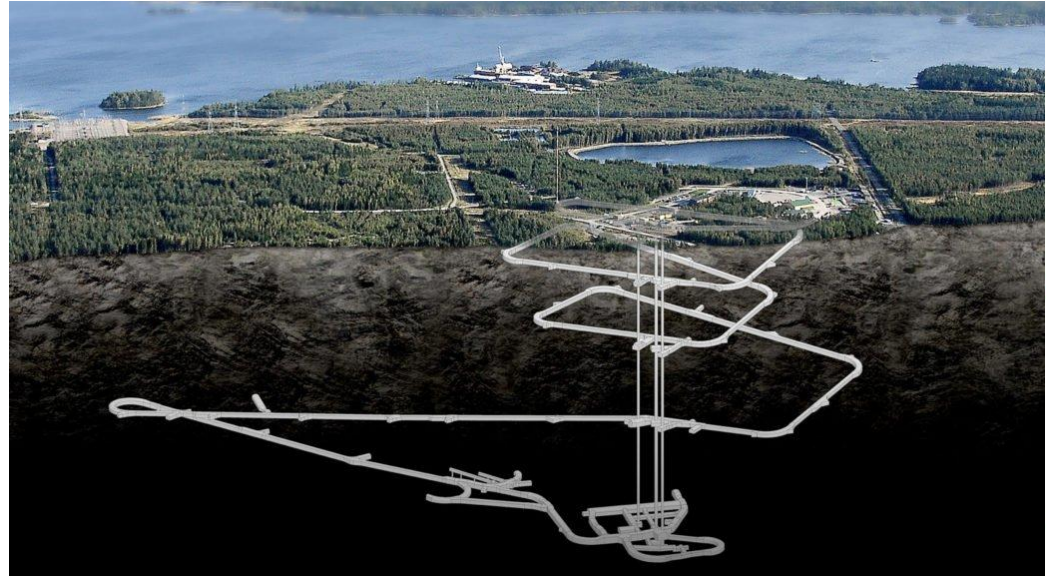
- § Posiva's preliminary plan is to start the disposal in the 2020's continuing about the hundred years
- § During the period, fuel from the mentioned reactors will be disposed (it is difficult to estimate the actual fuel amount and their type)
- § Some scenarios exist already (i.e. the amount of fuel specific canisters per year) and the idea is to dispose safely, but also optimize economic factors. Presumably, the plan is accurately few years ahead and keeps few options opens from there on

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.
- § These hot cells studies involve radio chemical measurements of samples from BWR and VVER spent fuel from the Olkiluoto and Loviisa nuclear power plants.
- § Posiva also participates in the (mentioned) EU project DISCO studying the radionuclide releases of radionuclides in disposal conditions.

Conclusions

- § Posiva will be the first organization to dispose spent nuclear fuel with the KBS-3 concept
- § The disposal starts in the 2020s and lasts approximately 100 years
- § Posiva conducts fuel experiments providing crucial information for the final disposal



Olkiluoto site with the sketched disposal facility



Kiitos
Thank you