

# *Pioneering solutions from Finland: Realisation of the Finnish (URL) Underground Research Laboratory and deep geological disposal for SNF*

Picture Saanio & Riekkola Oy

AtomEco 22.11.2017

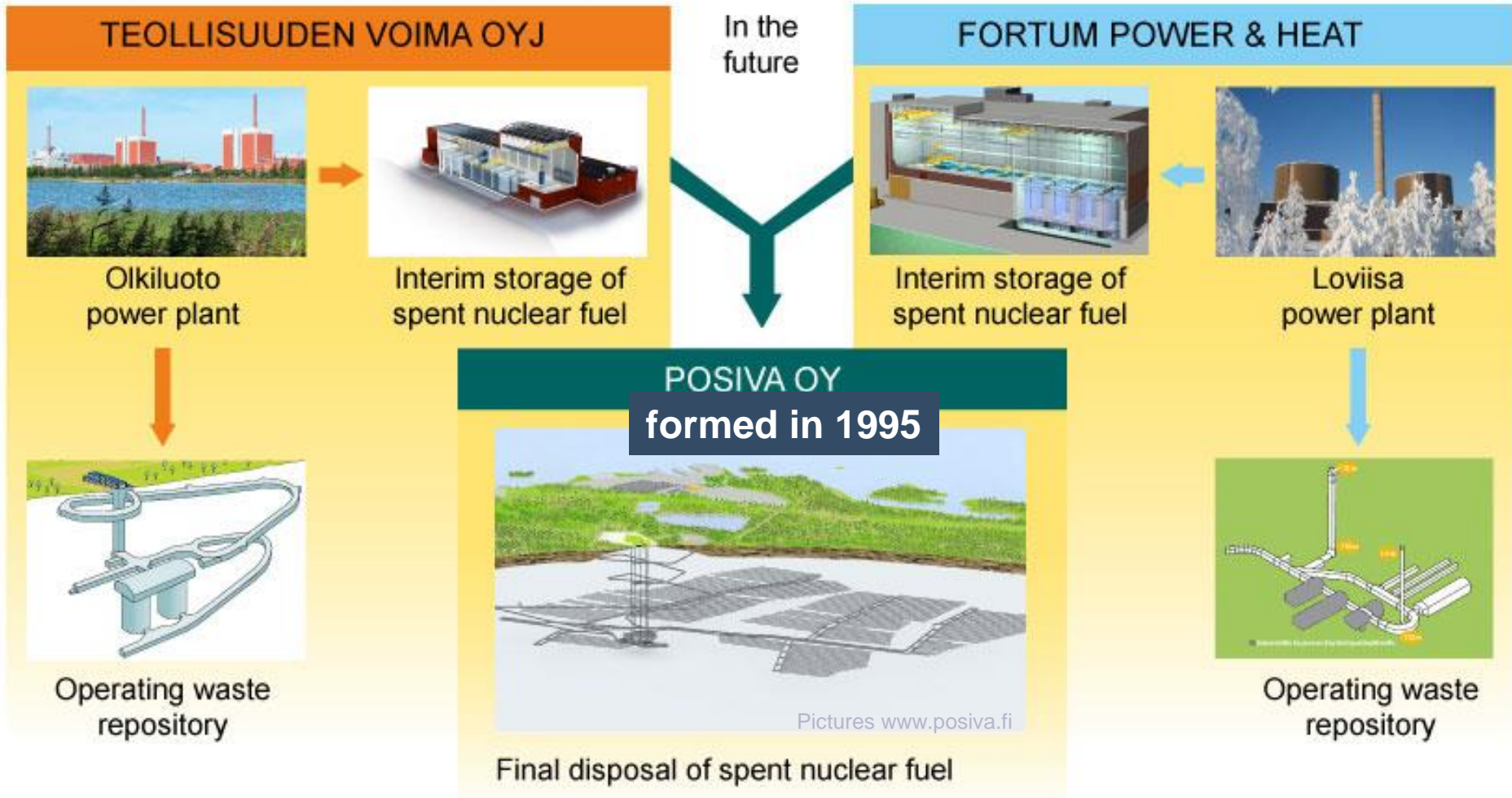
Antti Ikonen

Director, Nuclear Waste Management  
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SAANIO & RIEKKOLA OY  
CONSULTING ENGINEERS

# Nuclear waste storage & disposal

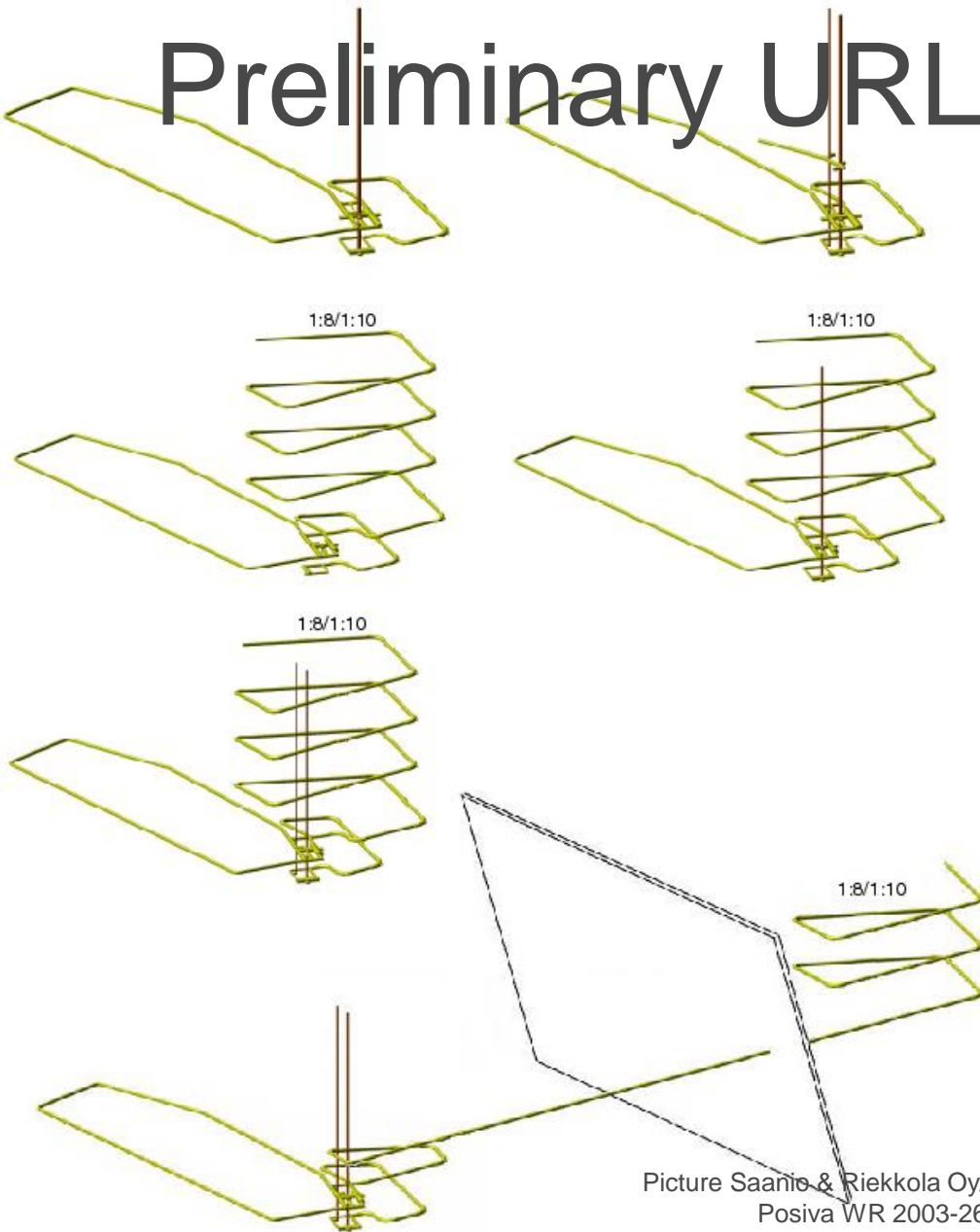


# Preliminary URL design (2001)

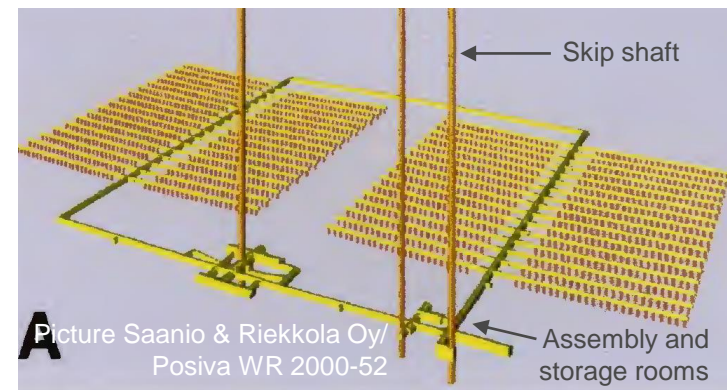
*Different alternatives were considered in Principle - no site-specific data were used for these variants.*

At least two separate access routes were considered feasible in terms of operational safety.

An access tunnel steeper than 1:10 was excluded - necessary to include the possibility for the transport of heavy waste packages.



Picture Saanio & Riekkola Oy/  
Posiva WR 2003-26



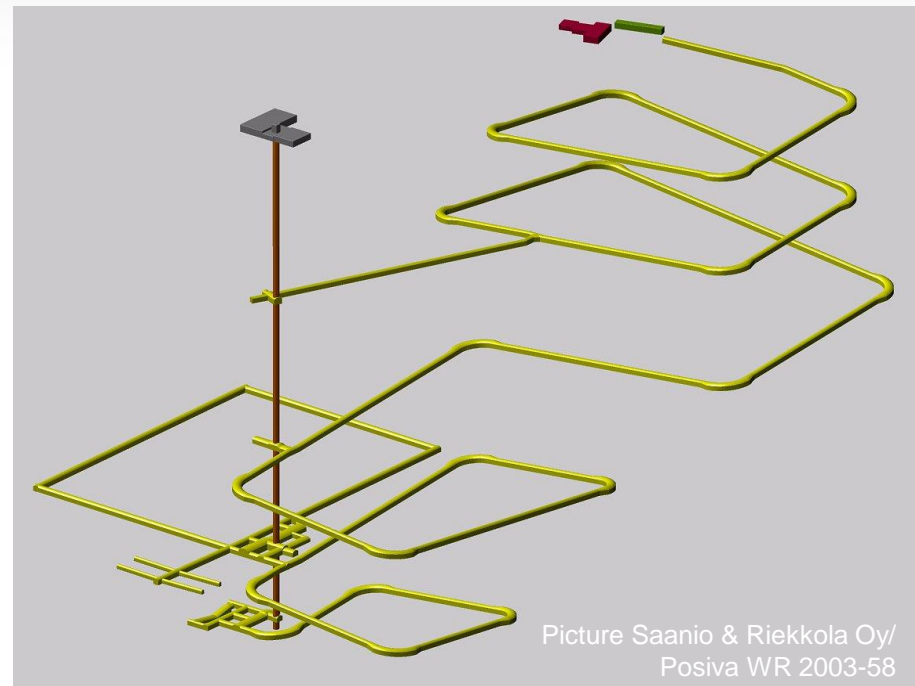
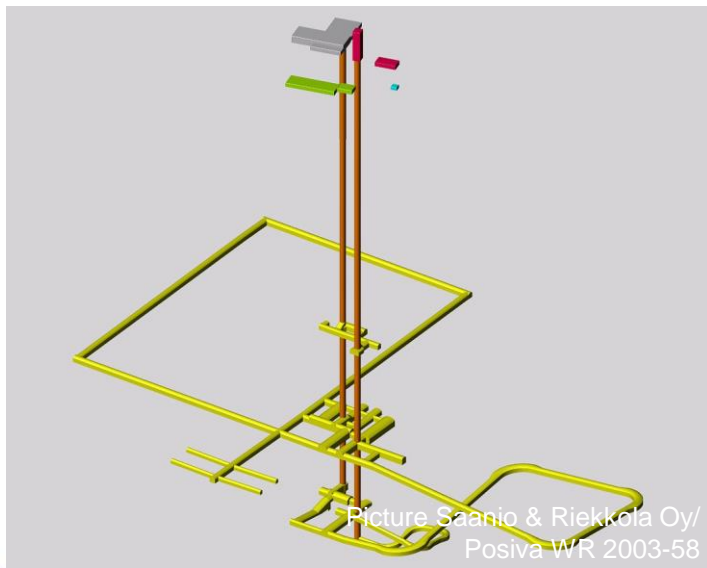
**A** Picture Saanio & Riekkola Oy/  
Posiva WR 2000-52



# URL outline planning stage (2002)

*The outline plans (not site specific): the two shafts alternative on the left and the access tunnel + shaft alternative on the right. The latter was chosen for further development.*

The access tunnel alternative was selected mainly because it provides the greater flexibility for implementation, better logistics, working environment and feasibility for characterisation of larger rock volumes during construction period.



# Access tunnel portal

Picture Saanio & Riekkola Oy

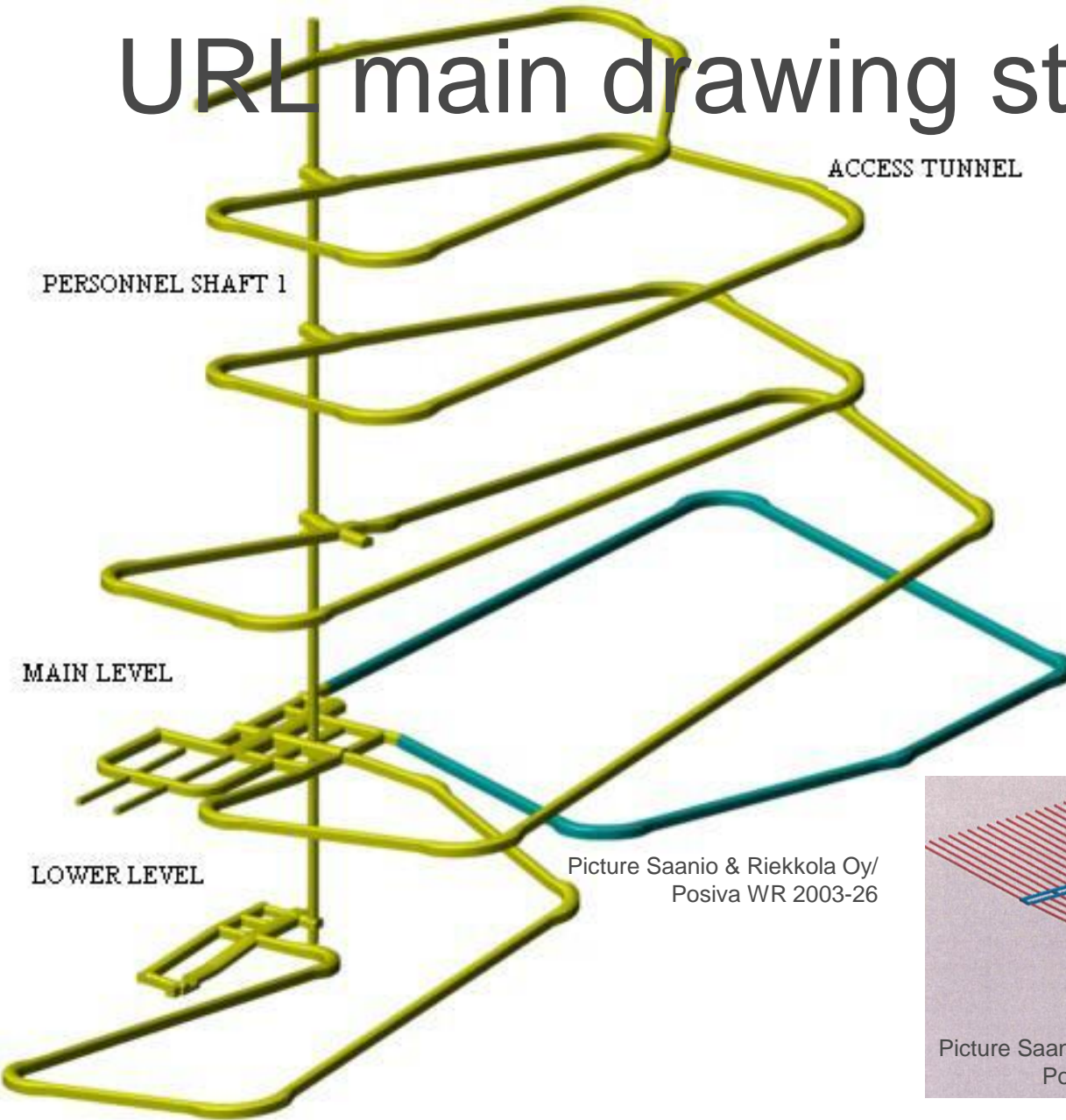


Using access tunnel and shafts compared to using only shafts has no remarkable difference in costs (depth 400-500 m). The possible total cost difference depends on the backfill concept cost, which will be totally clear no earlier than at the closure stage (Working report 2003-58).



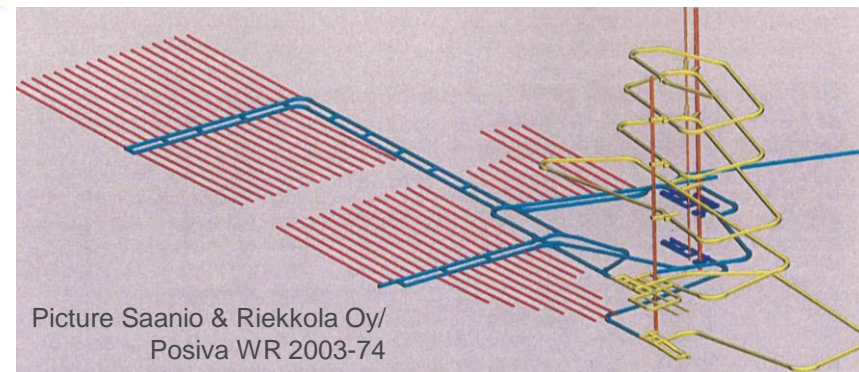
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# URL main drawing stage (2003)



Picture Saanio & Riekkola Oy/  
Posiva WR 2003-26

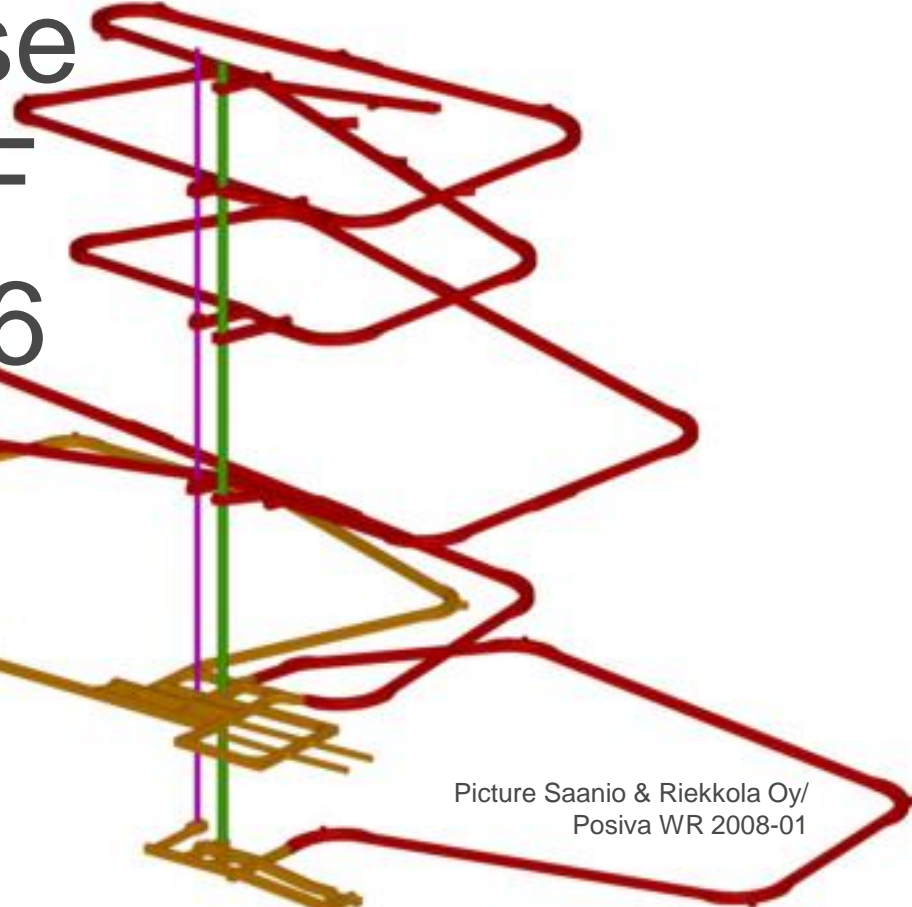
The spent fuel has been assumed to be disposed of at a minimum depth of 400 metres. Seepage water to the pumping station by gravity => The depth of the main characterisation level, 420 metres, was chosen on this basis.



Picture Saanio & Riekkola Oy/  
Posiva WR 2003-74

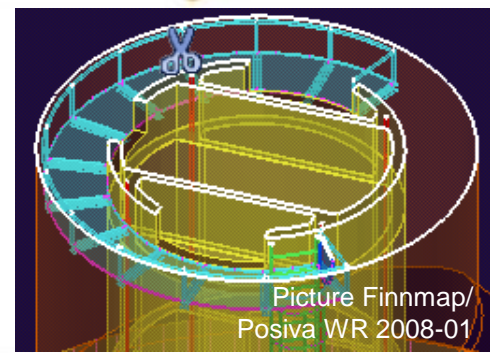
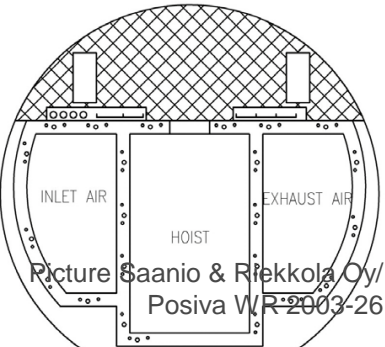


# Increase of SNF in 2006



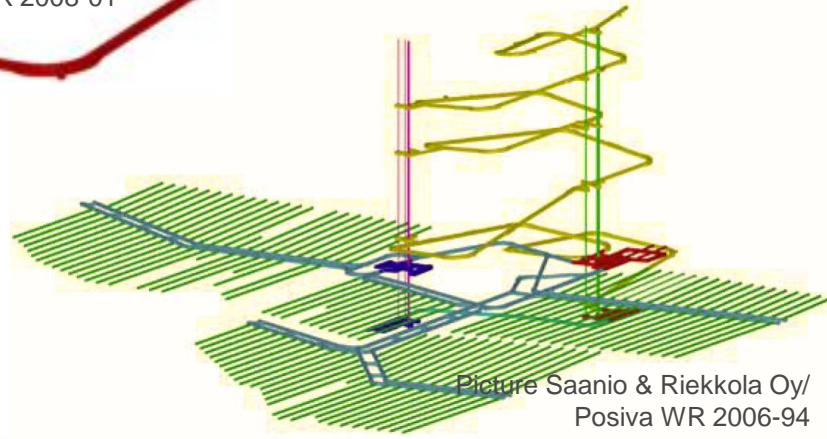
Picture Saanio & Riekkola Oy/  
Posiva WR 2008-01

Olkiluoto 3 reactor was decided to be built. This increased the volume and the planned life span of the facility - the personnel shaft from about 30 years to more than 100 years. Space need for shaft wall maintenance became inevitable: the minimum working allowance 1 m. Air need was doubled.



Picture Finnmap/  
Posiva WR 2008-01

Diameter ~ 6 m

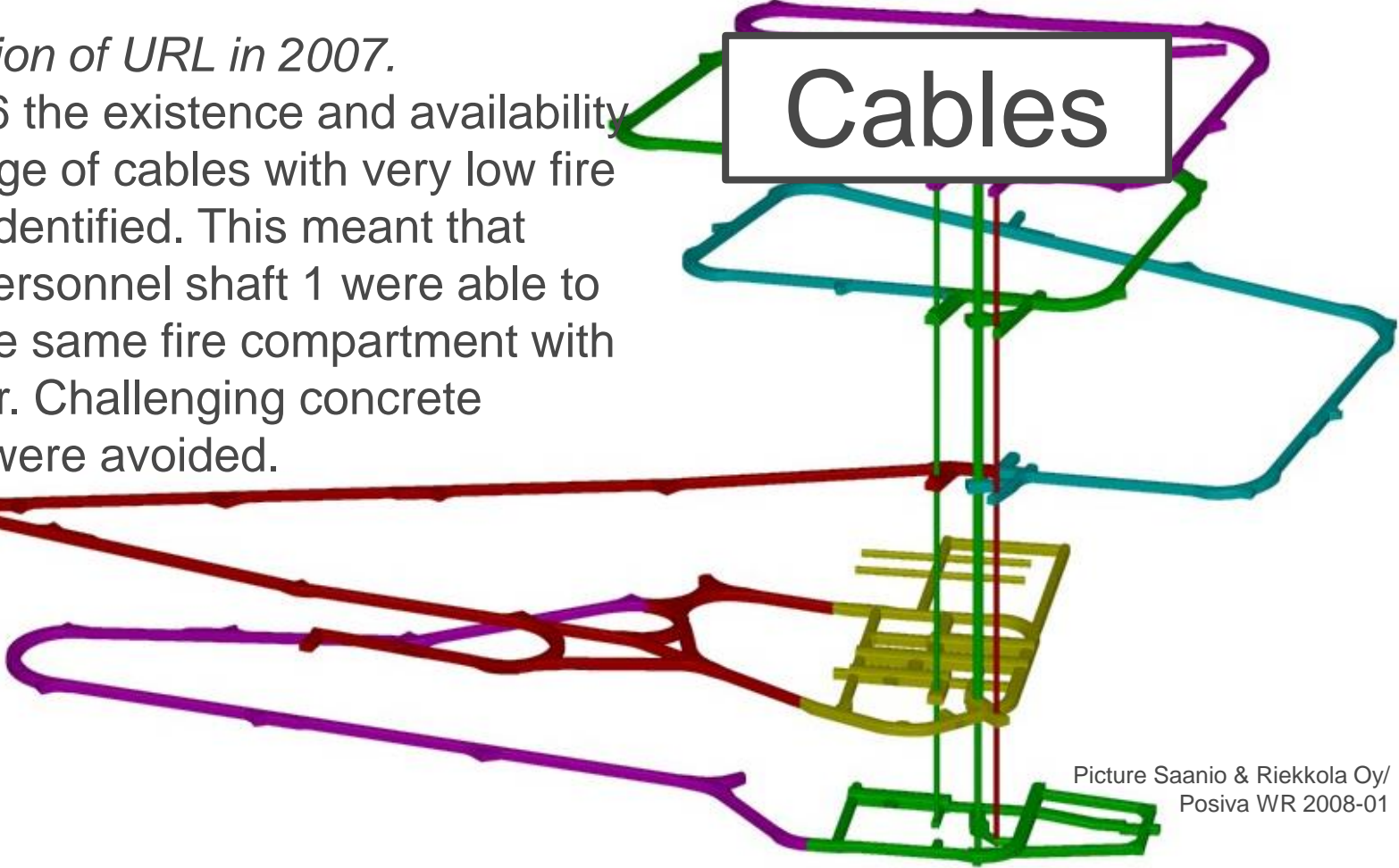


Picture Saanio & Riekkola Oy/  
Posiva WR 2006-94

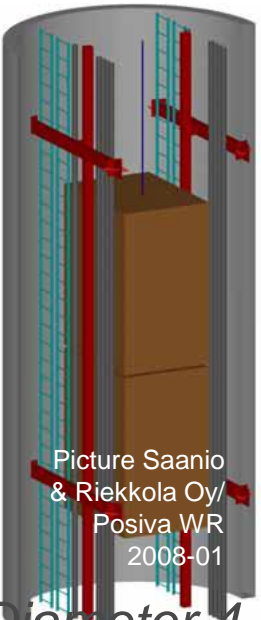
### 3D-illustration of URL in 2007.

In late 2006 the existence and availability of wide range of cables with very low fire load were identified. This meant that cables in personnel shaft 1 were able to locate in the same fire compartment with the elevator. Challenging concrete structures were avoided.

Cables



Picture Saanio & Riekkola Oy/  
Posiva WR 2008-01



Picture Saanio & Riekkola Oy/  
Posiva WR 2008-01

Diameter 4.5 m

Also auxiliary rooms were combined. The controlled area's rescue chamber, parking vaults, canister receiving station etc. were brought next to the uncontrolled area's auxiliary rooms.



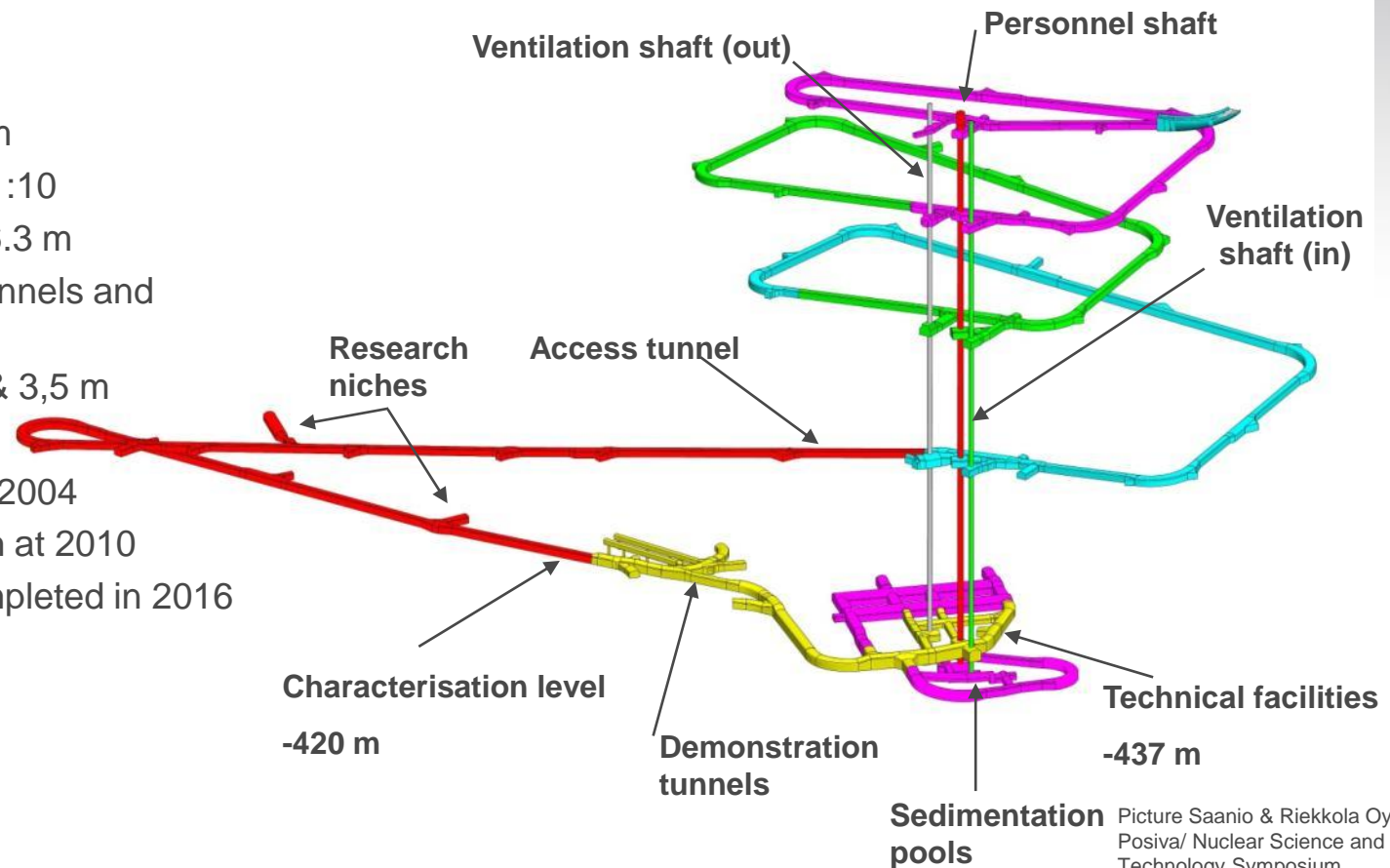
# URL technical data

## TECHNICAL INFORMATION

- Excavation volume  
365,000 m<sup>3</sup>
- Access tunnel
  - Length 5 km
  - Inclination 1:10
  - Size 5.5 x 6.3 m
- Total length of tunnels and shafts 9,5 km
- Shafts 3.5, 4.5 & 3,5 m

## TIME-TABLE

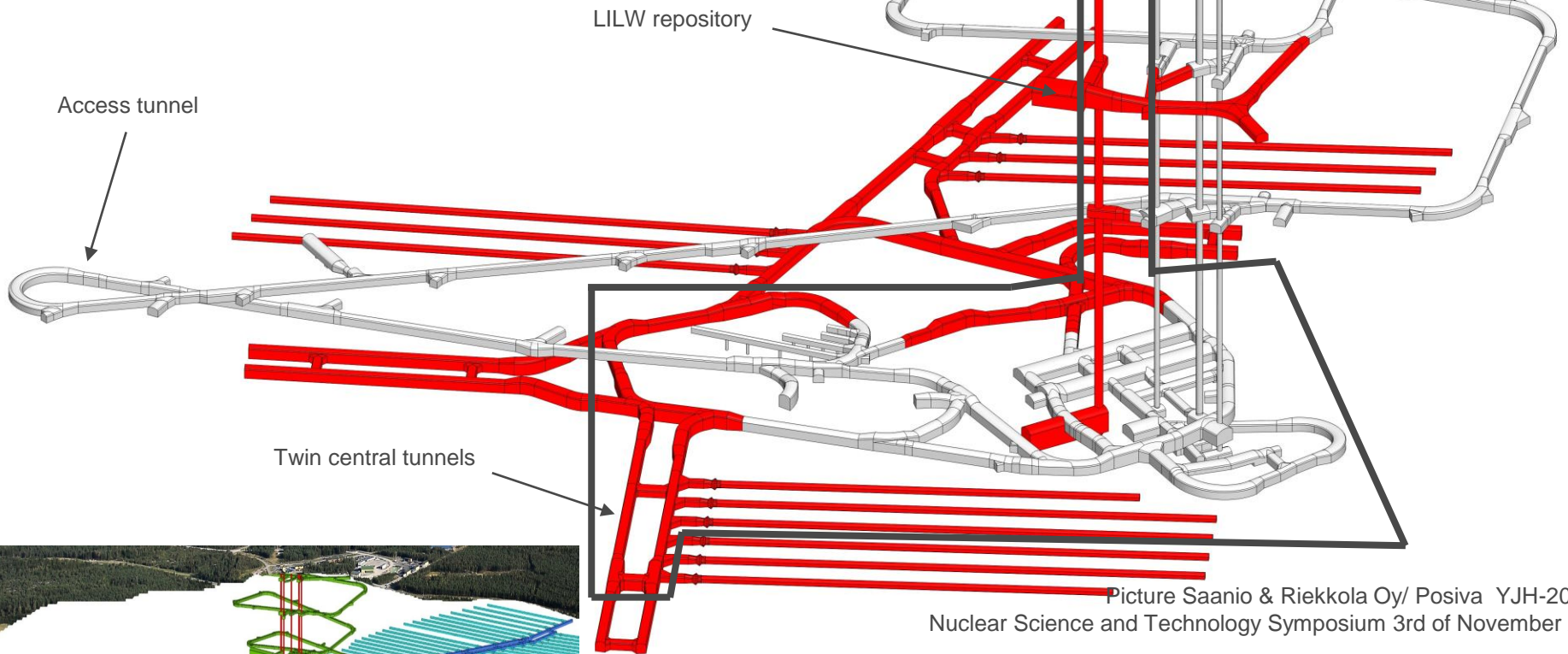
- Start summer in 2004
- Repository depth at 2010
- Excavations completed in 2016



Picture Saanio & Riekkola Oy /  
Posiva/ Nuclear Science and  
Technology Symposium  
3rd of November 2016



# URL and the forthcoming disposal facility design, 1st stage



- The scope of the 1st construction stage of the disposal facility
- The scope of the 1st detailed design stage of the disposal facility
- URL

Picture Posiva / Saanio & Riekkola Oy



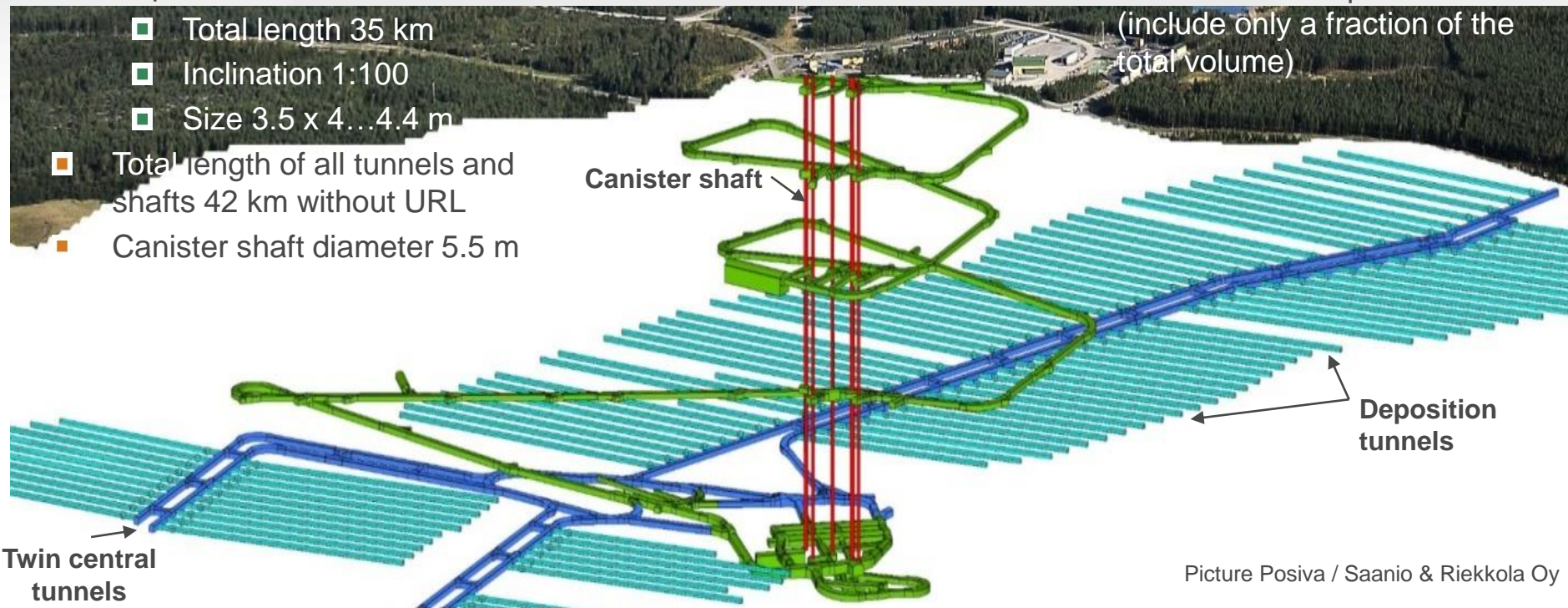
# Disposal Facility technical data

## TECHNICAL INFORMATION

- Excavation volume 956.000 m<sup>3</sup>, 200.000 m<sup>2</sup> without URL
- Deposition tunnels
  - Total length 35 km
  - Inclination 1:100
  - Size 3.5 x 4...4.4 m
- Total length of all tunnels and shafts 42 km without URL
- Canister shaft diameter 5.5 m

## TIME-TABLE

- Start december 2016
- 1st stage excavations and installations completed in 2022 (include only a fraction of the total volume)



Picture Posiva / Saanio & Riekkola Oy



# Olkiluoto island



Picture Posiva / docplayer.fi



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# Construction work started in 2004



Pictures Posiva / docplayer.fi



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# Site in summer 2016



Picture: Posiva / docplayer.fi



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# Access tunnel portal



Picture Suomen Kuvalehti



# Access tunnel



Picture Posiva / docplayer.fi



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# Pregrouting when needed



Picture SKB-report R-08-116



# Shotcrete in technical facilities

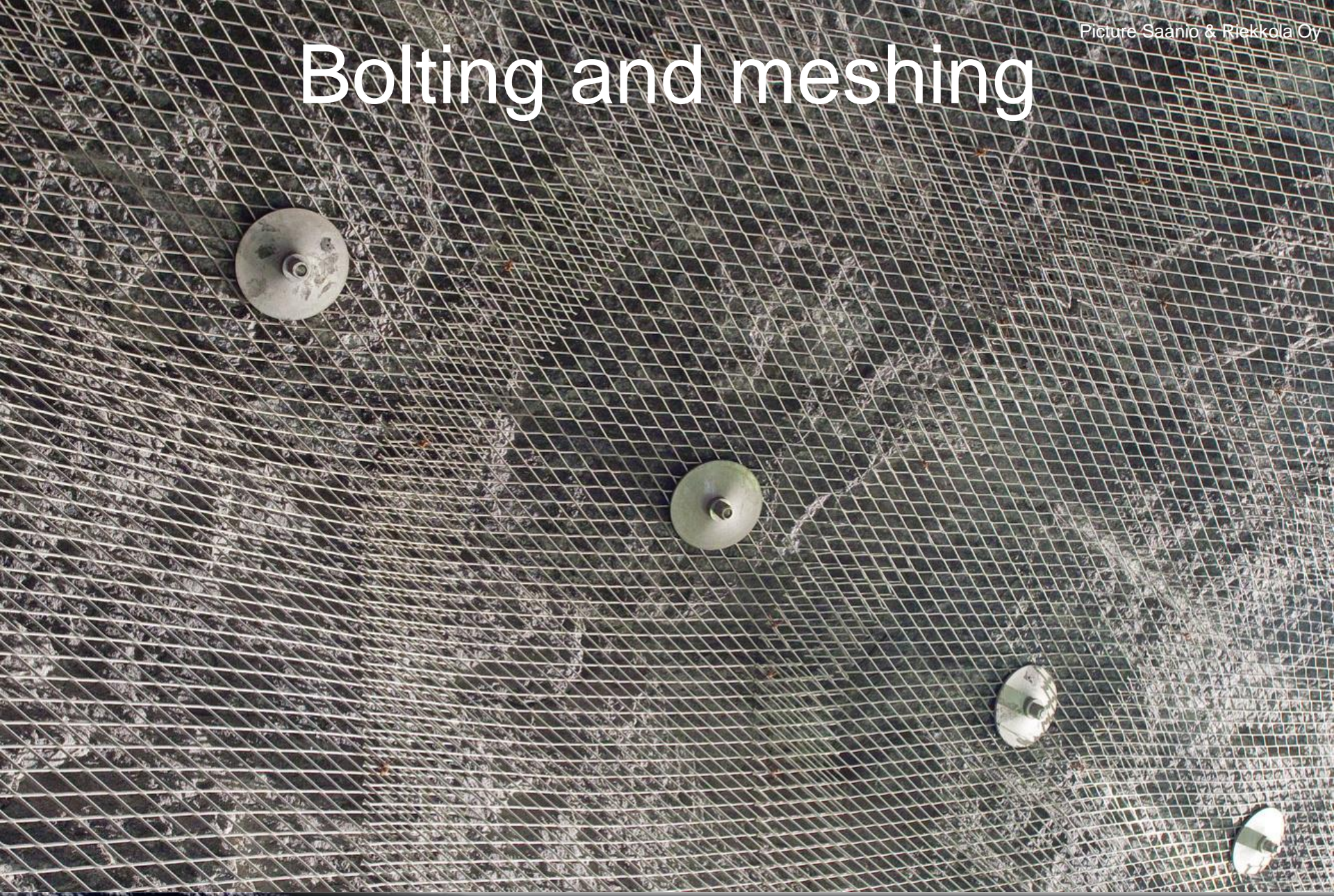


Picture Posiva / docplayer.fi

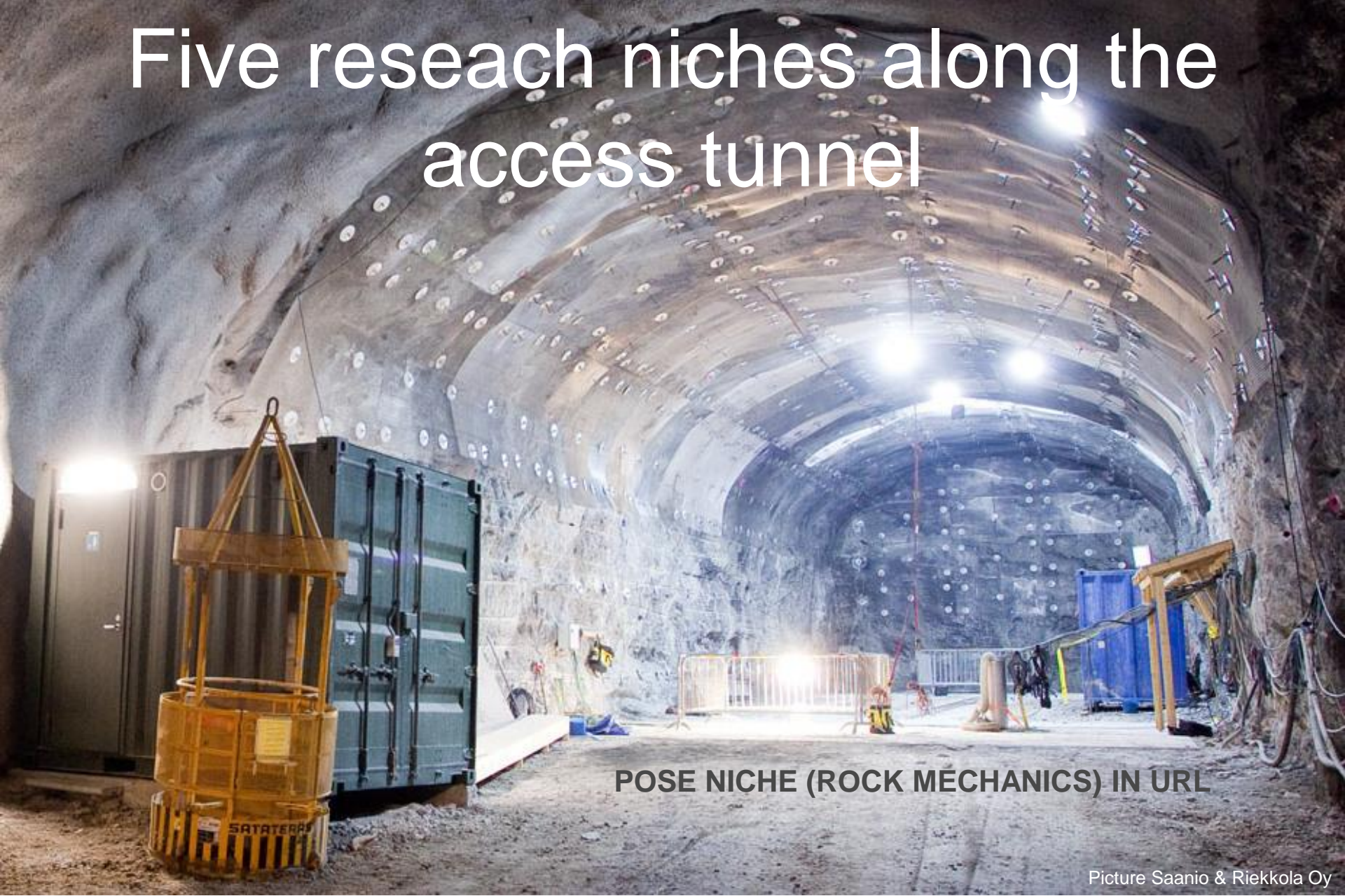


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# Bolting and meshing



# Five research niches along the access tunnel



**POSE NICHE (ROCK MECHANICS) IN URL**

Picture Saanio & Riekkola Oy



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# Four demonstration tunnels



Picture Saanio & Riekkola Oy



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# SAFETY & RESPONSIBILITY

IN NUCLEAR WASTE MANAGEMENT



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