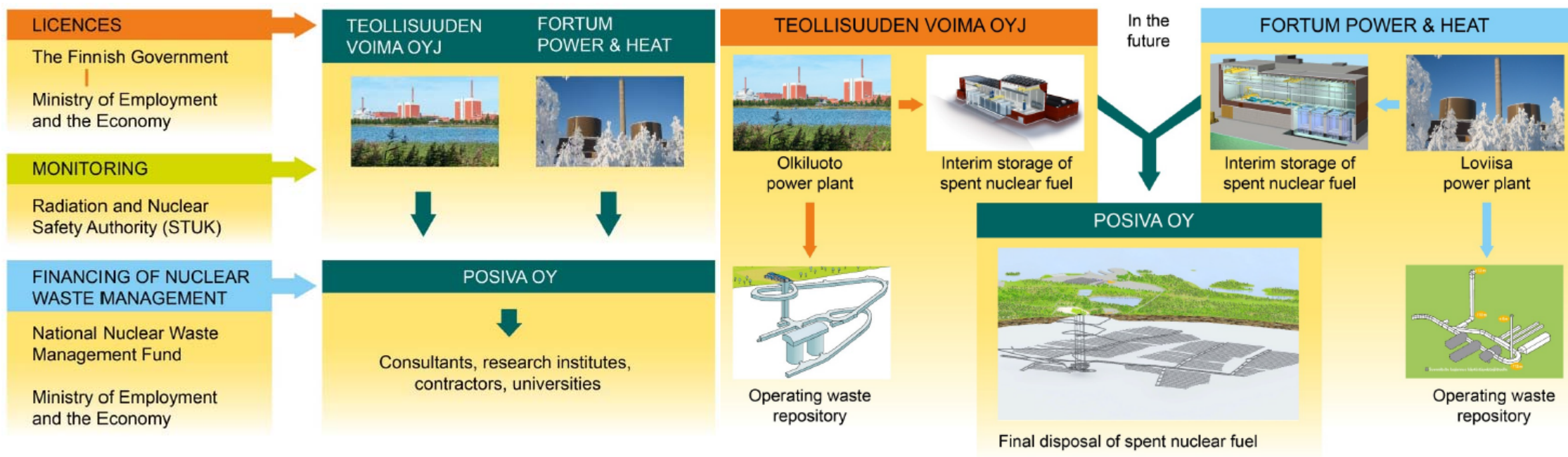




Nuclear power company case on nuclear waste management, developing methods tools and skills

Dr. Sami Hautakangas, 12 April, 2018

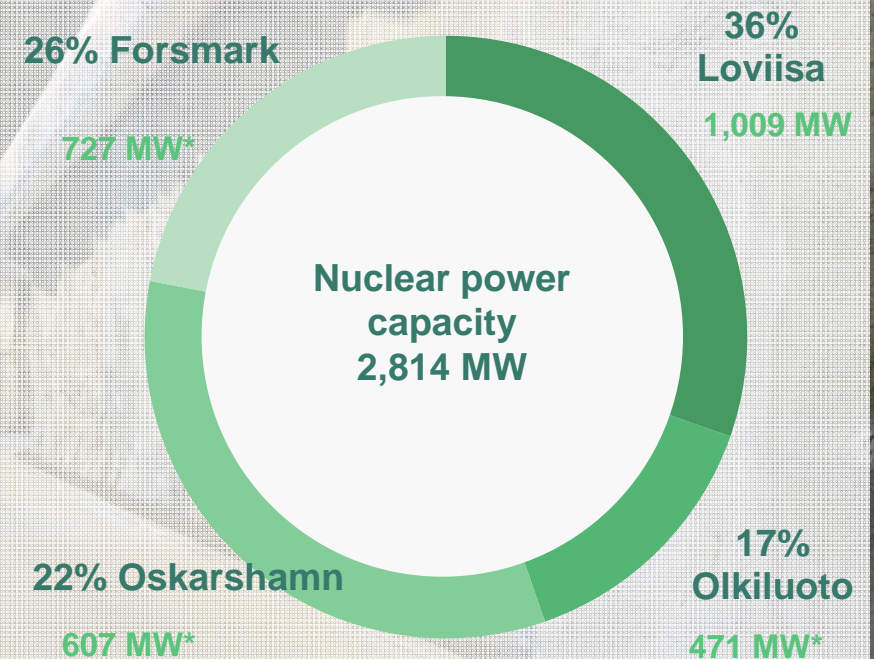
Policies and responsibilities for safe nuclear waste management in Finland



Fortum has gained hands-on nuclear experience since the 1960's

Result: Unique position in the nuclear industry

- Nuclear license holder
- Nuclear power plant & waste management operator
- Nuclear service & technology provider
- Strong in-house nuclear know-how and expertise
 - several NPP technologies
 - all phases of the plant lifecycle



*) Fortum's share

Managing Low and Intermediate level waste from the controlled area at Loviisa NPP, Finland

All waste generated in the controlled area



Activity below the exemption limit

Activity above the exemption limit

Metal, wood, cardboard

Waste

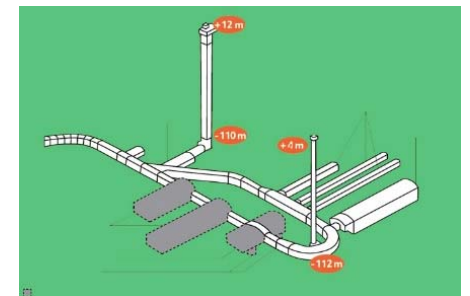
Hazardous waste

To recycling

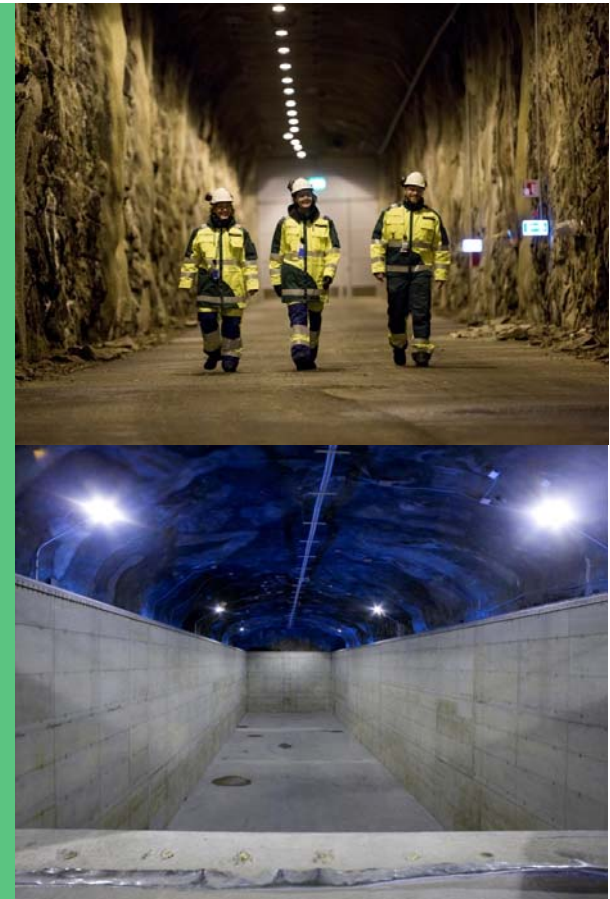
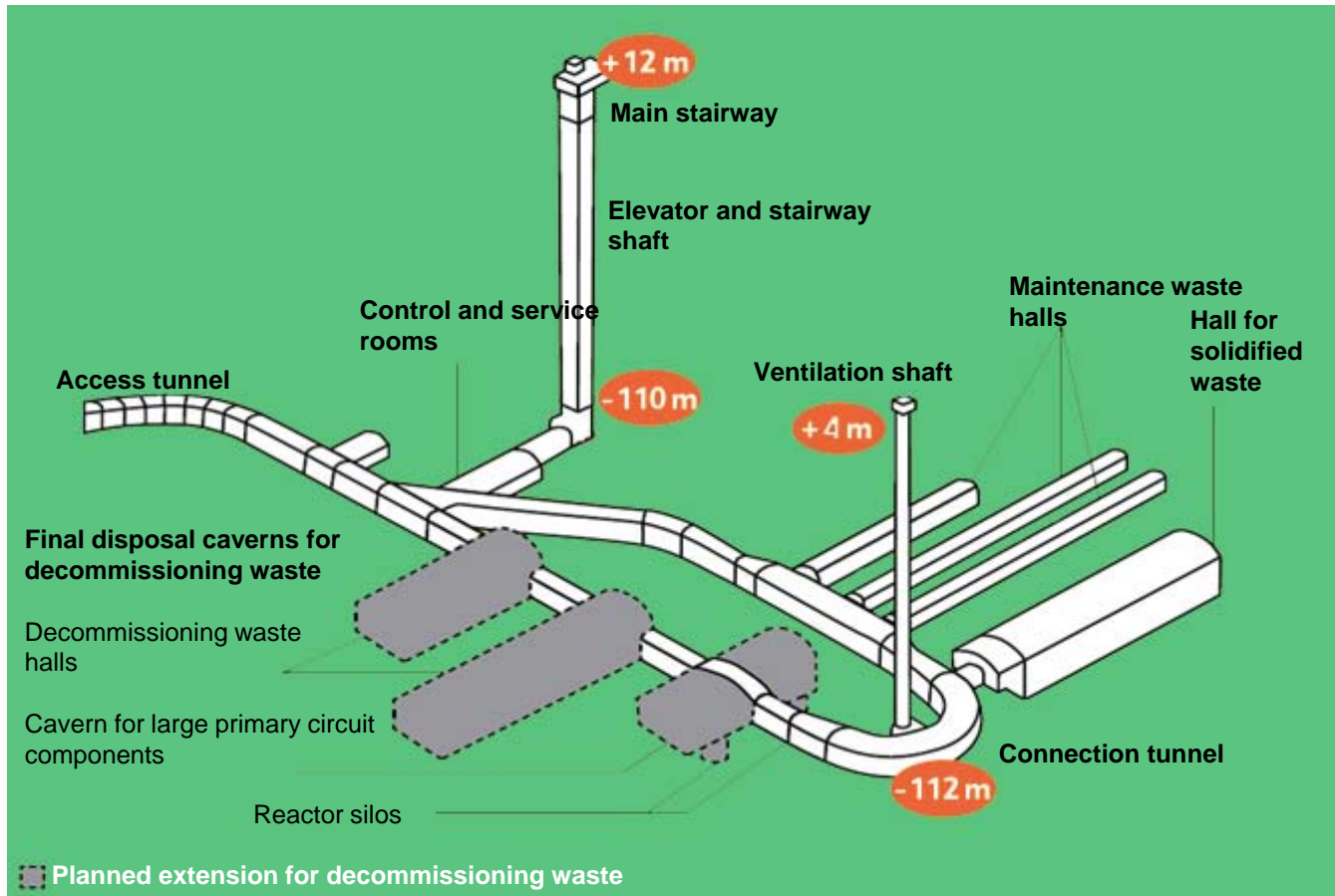
To landfill

To hazardous waste treatment plant

To final disposal into the final repository (VLJ)

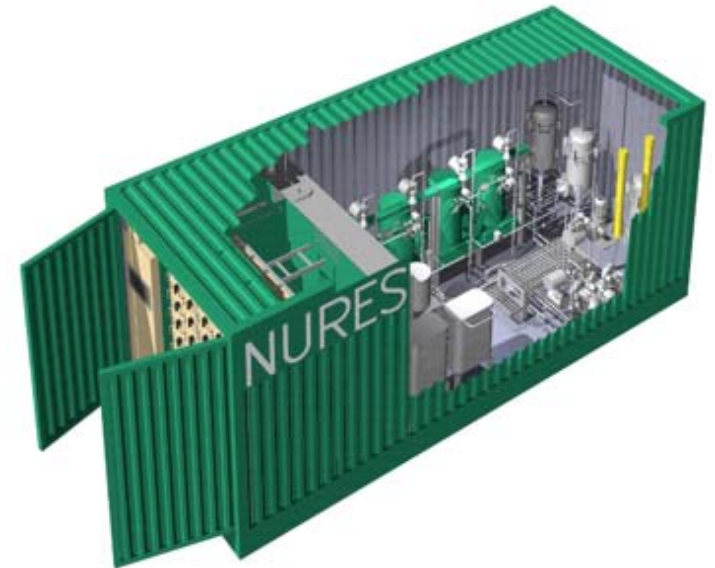


Final Repository for Low and Medium Level Waste



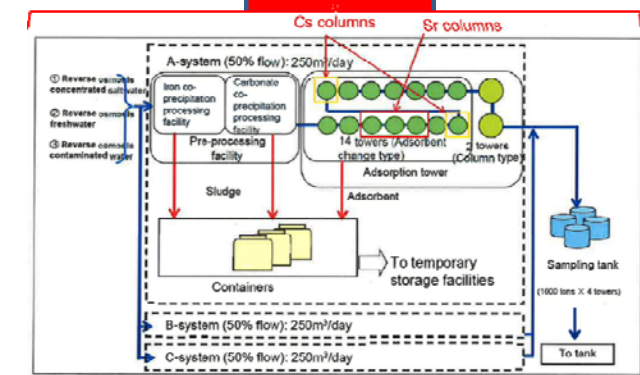
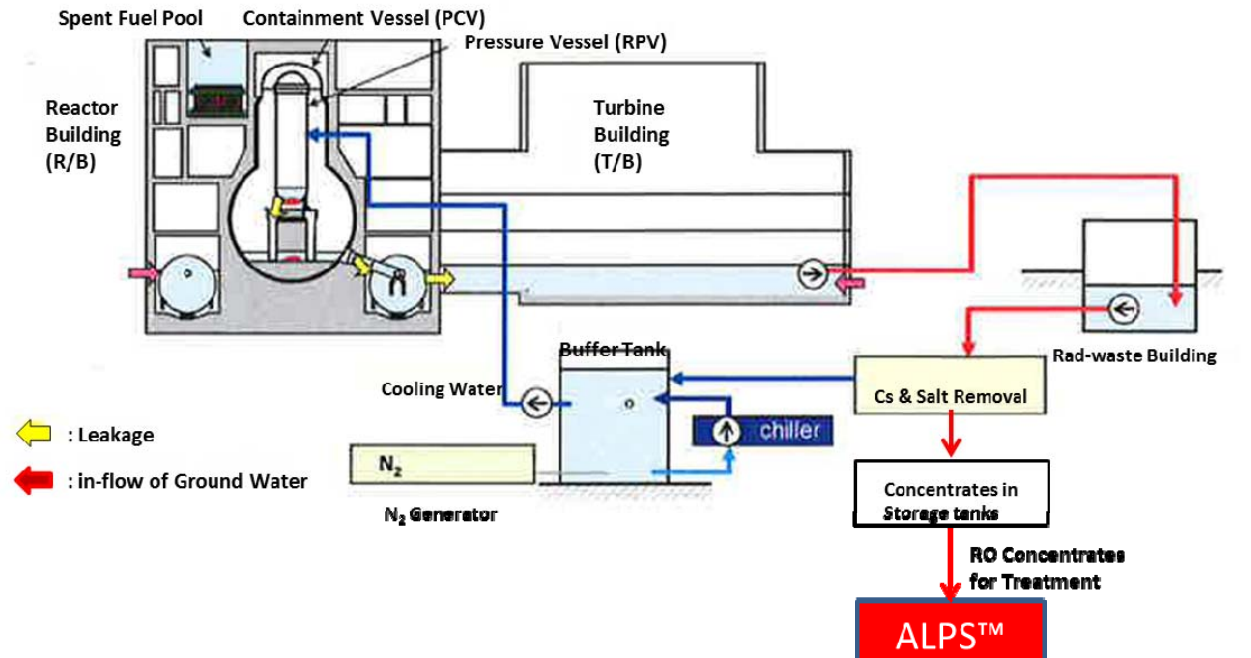
Nures® for purifying radioactive waters

- The best available technology for removing cesium, cobalt, strontium and antimony
- Nures® purifies liquid radioactive waste to a fraction of the original waste volume
- Effective purification results and significant savings in waste treatment costs
- Supplied to over 60 customers around the world since the 1990's
- Significant volumes to Fukushima, Japan, to solve the wastewater problem



NURES[®] technology used as a part of ALPS[™] system in Fukushima, Japan

- About 1000-1200 m³ cleaned a day
- Record decontamination factors have been achieved!
 - Max decontamination factor for cesium has been over 8 000 000
 - Max decontamination factor for strontium has been over 165 000 000 (precipitation + SrTreat[®])



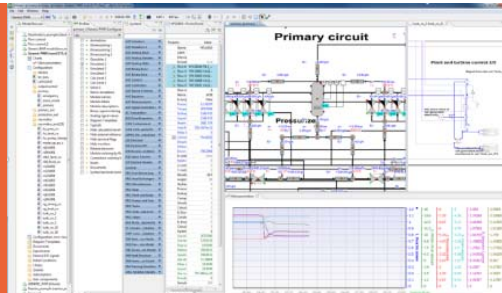
The pic of TEPCO

Reference: Topco website

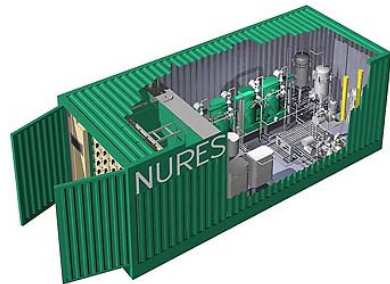
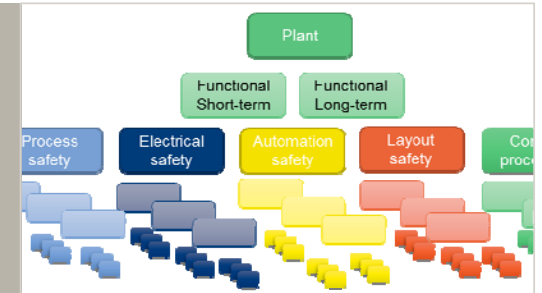
We offer a wide range of nuclear services

Our expertise is based on nuclear experience since the 1960's

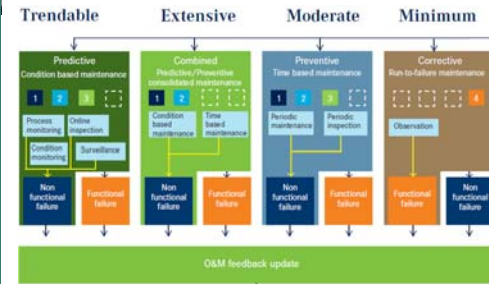
Highly efficient software **Apros®** for simulating all processes of a power plant and testing I&C; different simulators.



Method of system engineering **ADLAS®** for licensing and safety systems design. Consulting for safety upgrade, power upgrade, lifetime extensions, new-build projects.



One of the World's most effective solutions for purification of radioactive liquids **NURES®**



Methods **ReMaint®** for optimization of maintenance activities and execution of annual outages to increase nuclear plants availability and safety.

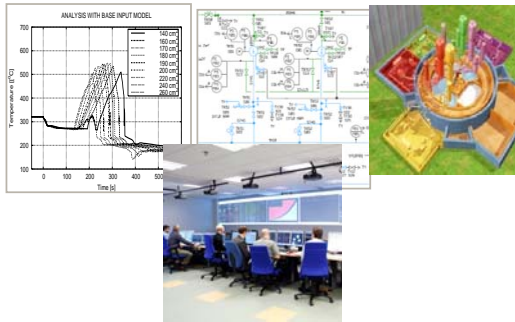
Solutions for interim storage and final disposal of nuclear waste. Decommissioning services.



Applications of **virtual reality, augmented reality, 360 video** for training and more efficient maintenance and projects execution.



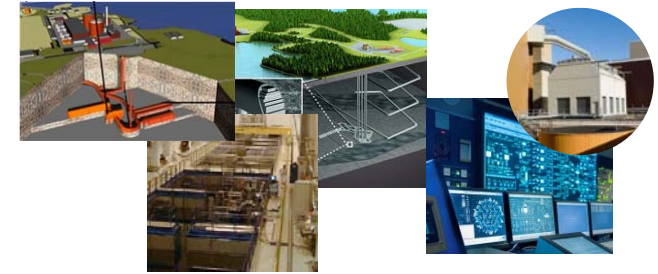
Overview of Fortum's current nuclear solutions



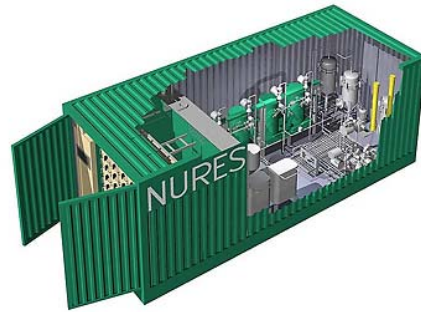
Apros - Full scale, multi-purpose advanced process simulator



ADLAS® – Advanced Licensing and Safety method for NPPs



Design – Nuclear waste management facilities, high density fuel racks, control rooms, etc.



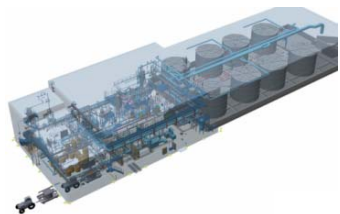
Nures – purification of radioactive liquids



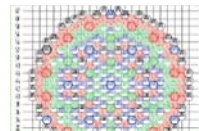
Consulting – expertise from nuclear waste management and nuclear safety to plant performance and modernizations etc.



Virtual Panels – Innovative human machine interface for nuclear power plant simulators



Solidification plant design – Design and support in setting up facility for handling all liquid waste



PATI – Nuclear material management system



Maintenance concept – 12-step management model to improve NPP maintenance



Thank you!

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