



Decommissioning of Loviisa NPP

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Loviisa NPP

- 2 x VVER-440 PWR reactor
- Commercial operation 1977 and 1980
- First operating license 30 years
 - Extended 20 years
- Permanent shutdown 2027 and 2030
- Disposal facility for low and intermediate waste at plant site
- Own solidification plant for liquid waste
- Spent fuel is stored at plant site in storage pools
 - After shutdown fuel will be transported to Olkiluoto (Posiva)



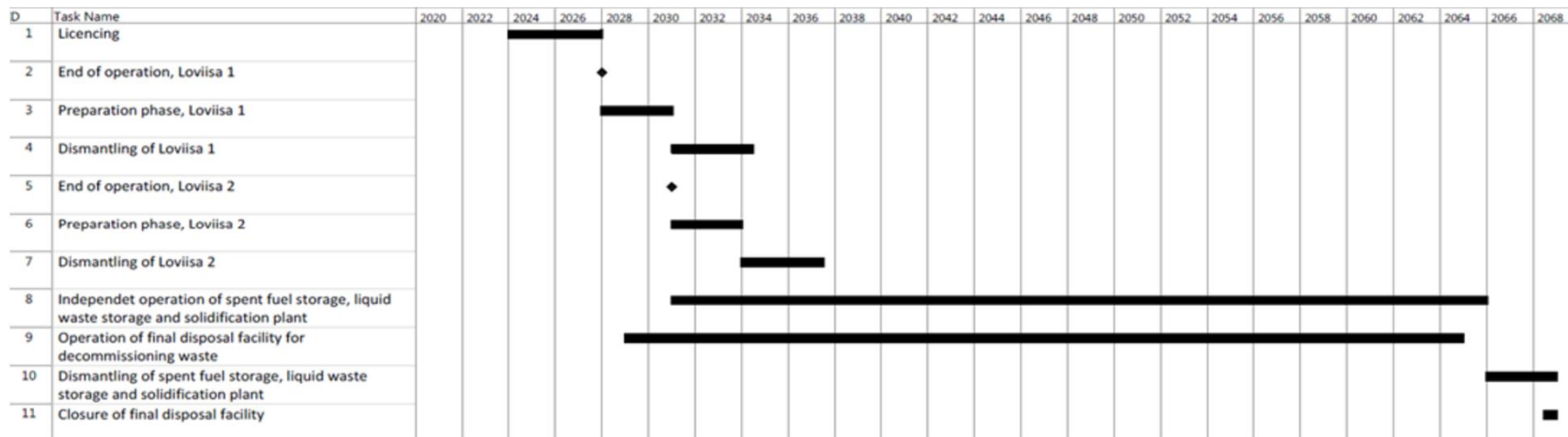
Decommissioning principles of Loviisa NPP

- Immediate dismantling
- Brownfield / Greenfield
 - There is limitations for reuse of plant site / Plant site is restored to the conditions existing before
 - Contamination, chemicals, remains of permanent structure
 - Buildings can be utilized later
- Free release limits
 - 0,4 Bq/cm² or 4 Bq/g
 - Goal is to remove all existing activity (above free release limits)
- Big components in one piece
 - Pressure vessel, steam generators, pressurizer, TH-tanks (boron water tanks)

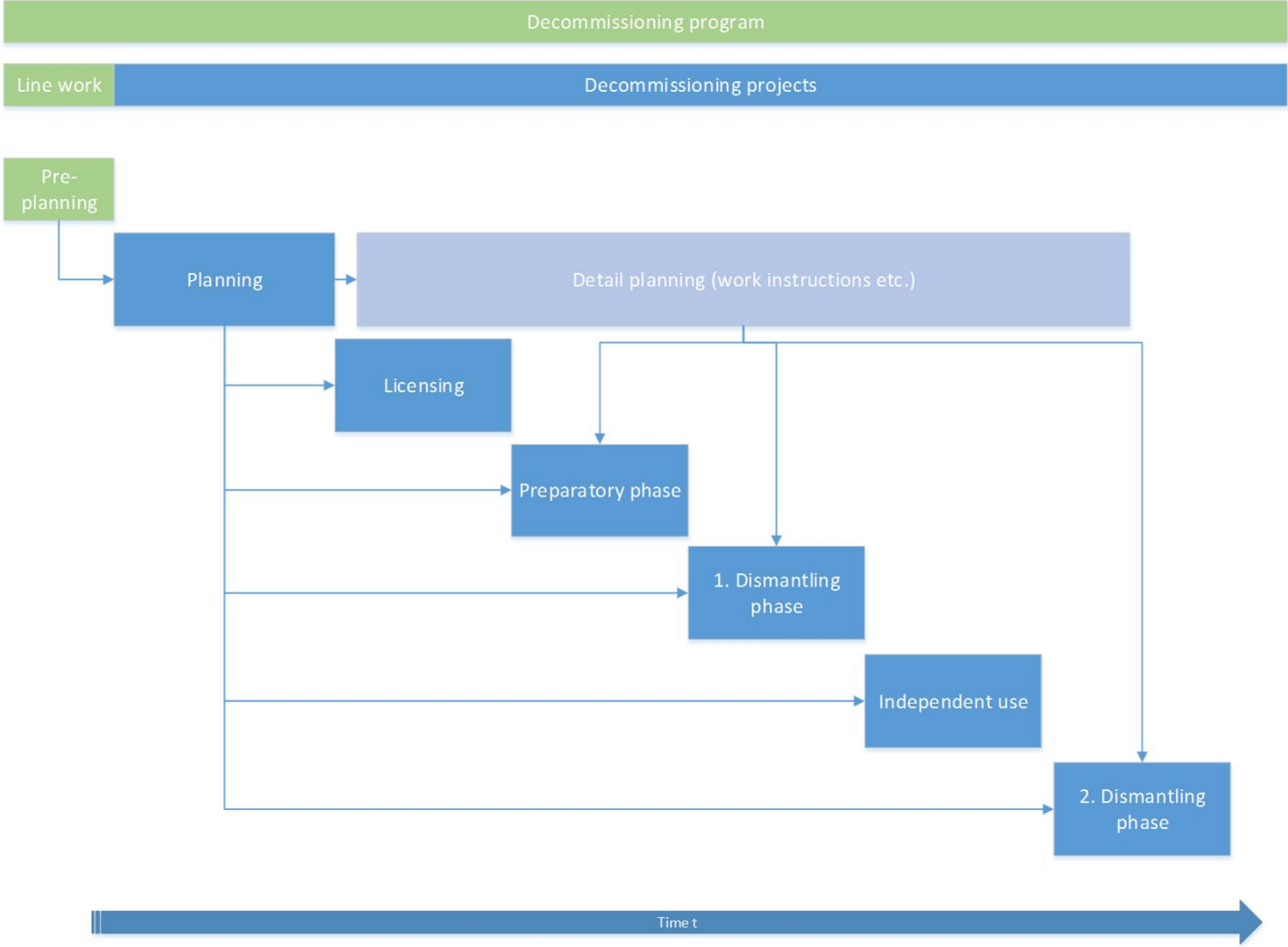


Decommissioning schedule

- Licencing phase 3 years before shutdown of Loviisa 1
 - Output is decommissioning license
- Shutdown is followed 3 years long preparatory phase
 - Transport of spent fuel, decontamination of primary circuit, clarification of radiation levels, preparation of hauling routes
- First dismantling phase lasts about 3 years
 - Dismantling of all activated and contaminated components, systems and structures from reactor building
- First dismantling phase is followed independent operation
 - Spent fuel storage, solidification plant, liquid waste storage
- Second dismantling phase lasts about 3 years
 - Dismantling of all activity from auxiliary building, spent fuel storage, solidification plant, liquid waste storage
 - Closure of disposal facility
 - Clarification measurements

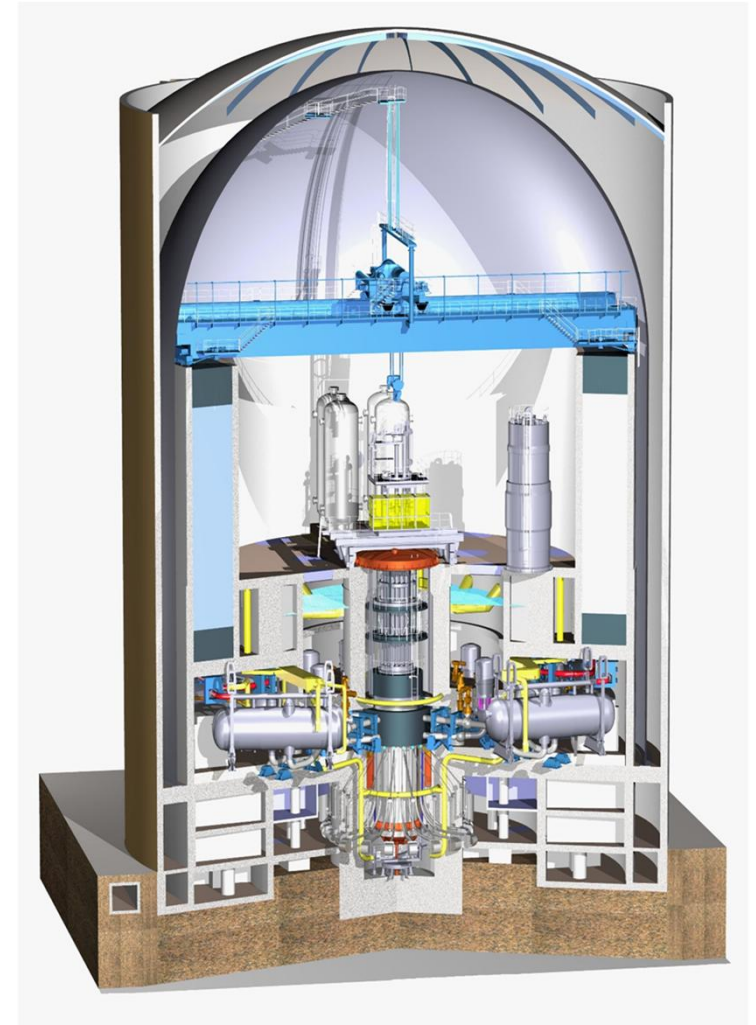


Decommissioning project management



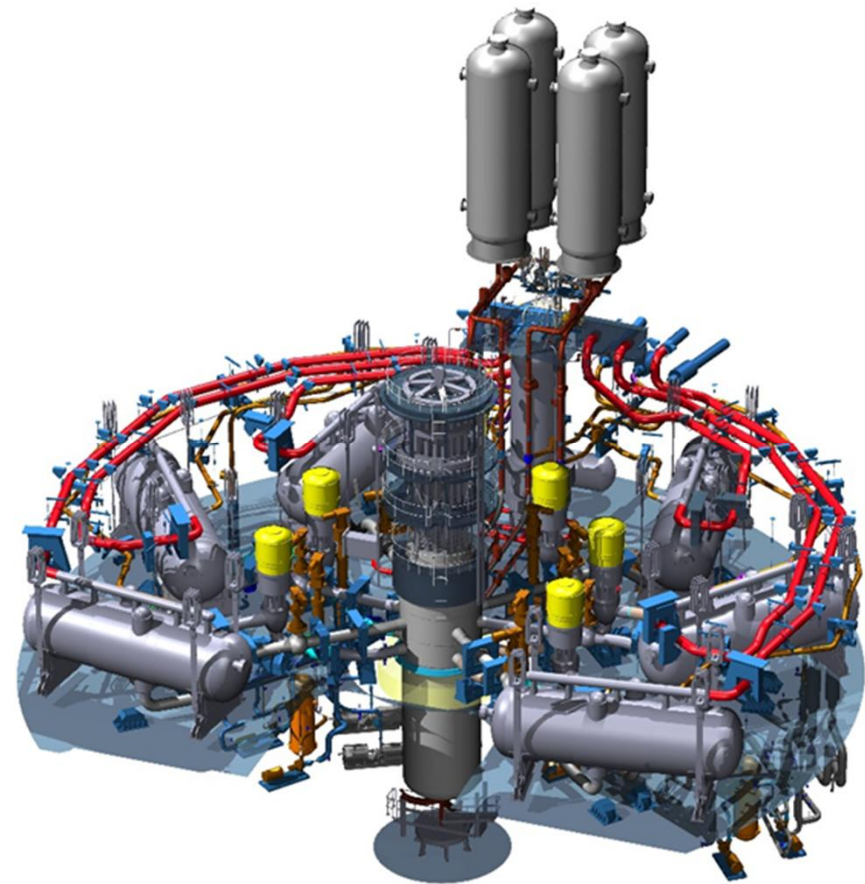
Planning

- First decommissioning plan 1984
- Update after every 6 years
- Feedback and comments from regulatory
- Last update completed at the end of year 2018
 - Included: Decommissioning strategy, organization, schedules, demolition plan, radiation protection plan, waste management plan, long term safety of radioactive waste, cost estimate etc.
- Next update will be last before final decommissioning plan
 - More detailed planning
- One big question is possible lifetime extension



Preparatory phase

- Last 3 years per plant unit
- Cooling spent fuel in reactor building (18 months)
- Handling of process waters
 - 6 000 m³
 - Evaporation / Storage
 - Nures© treatment
- Decontamination of primary circuit
- Preparation of RCA
 - Hauling paths
 - Packaging stations
 - Clarification of radiation levels

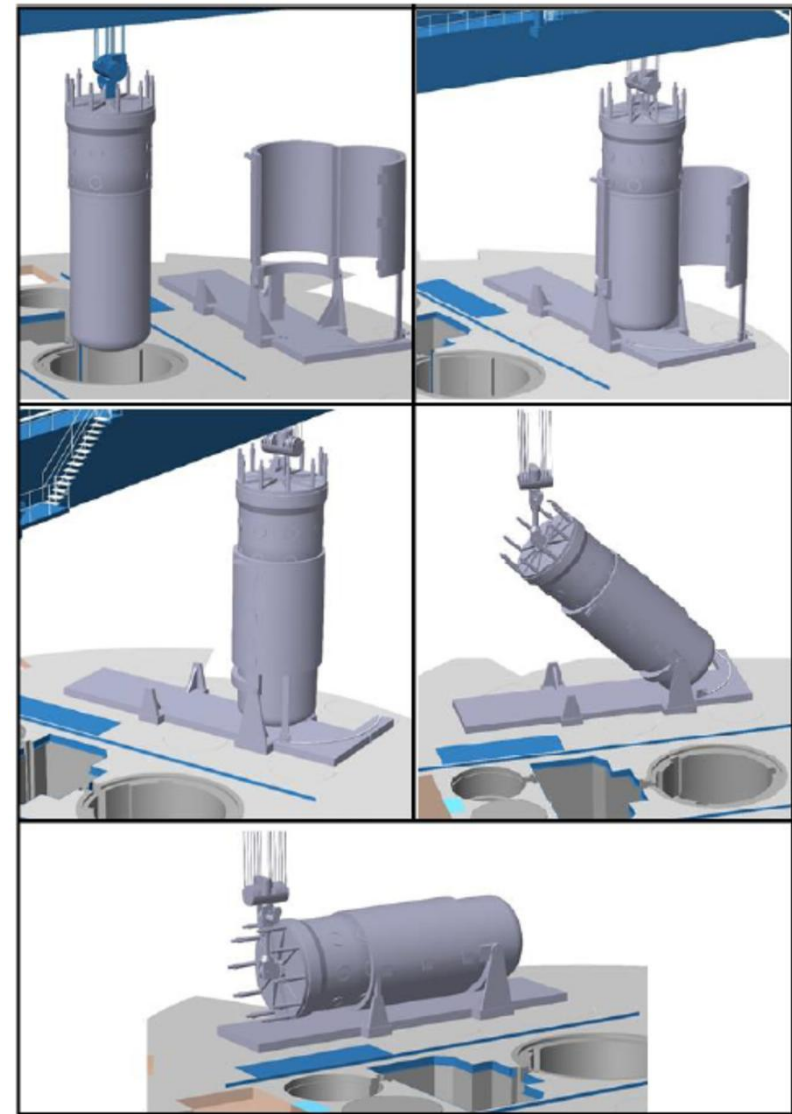


First dismantling phase

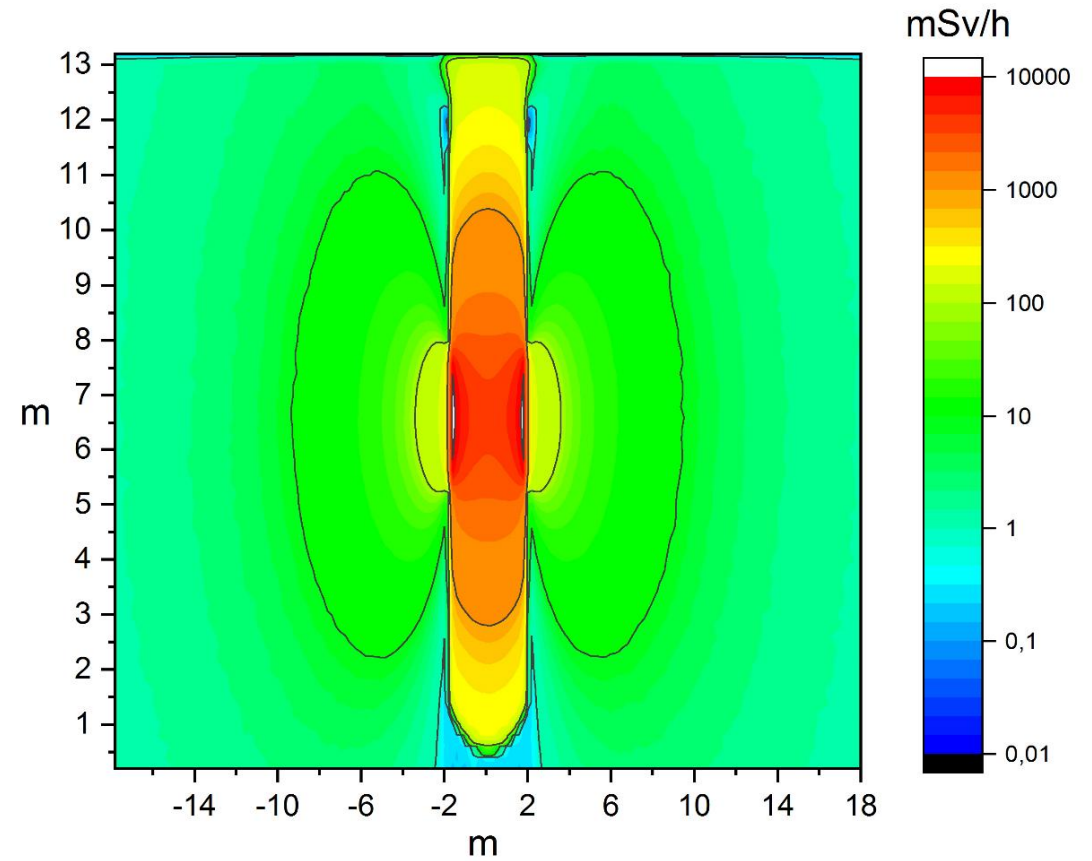
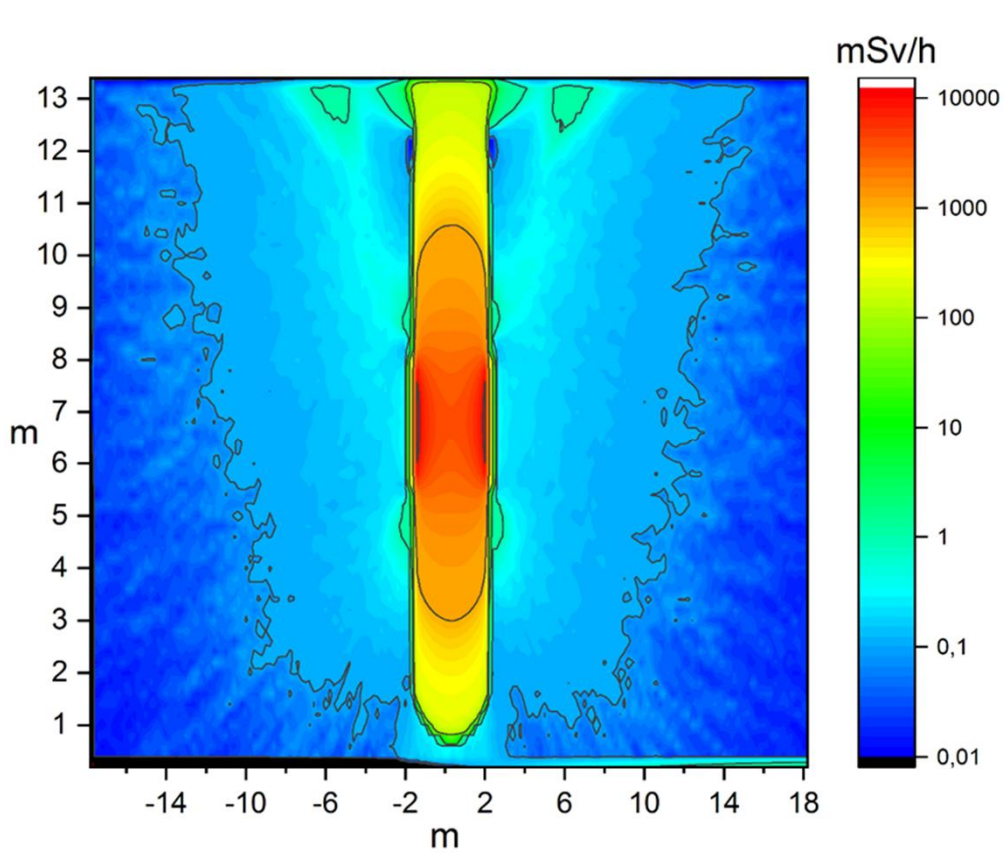
- Dismantling starts from reactor buildings
- Dismantling of all activated and contaminated components, systems and structures
 - Inner parts of reactor
 - Pressure vessel
 - 6 steam generators
 - Pressurizer
 - TH-tanks (Boron water tanks)
 - Piping of primary circuit and support systems
 - Concrete around reactor
 - Concrete floor of steam generator space
- Big components dismantled and disposed in one piece

Pressure vessel

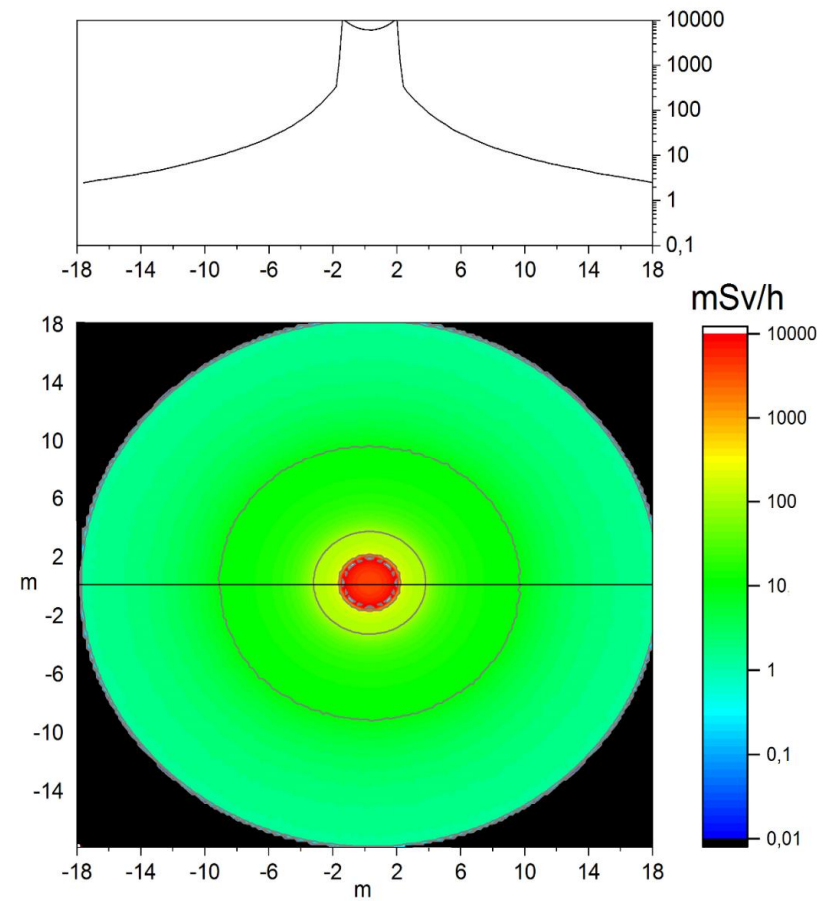
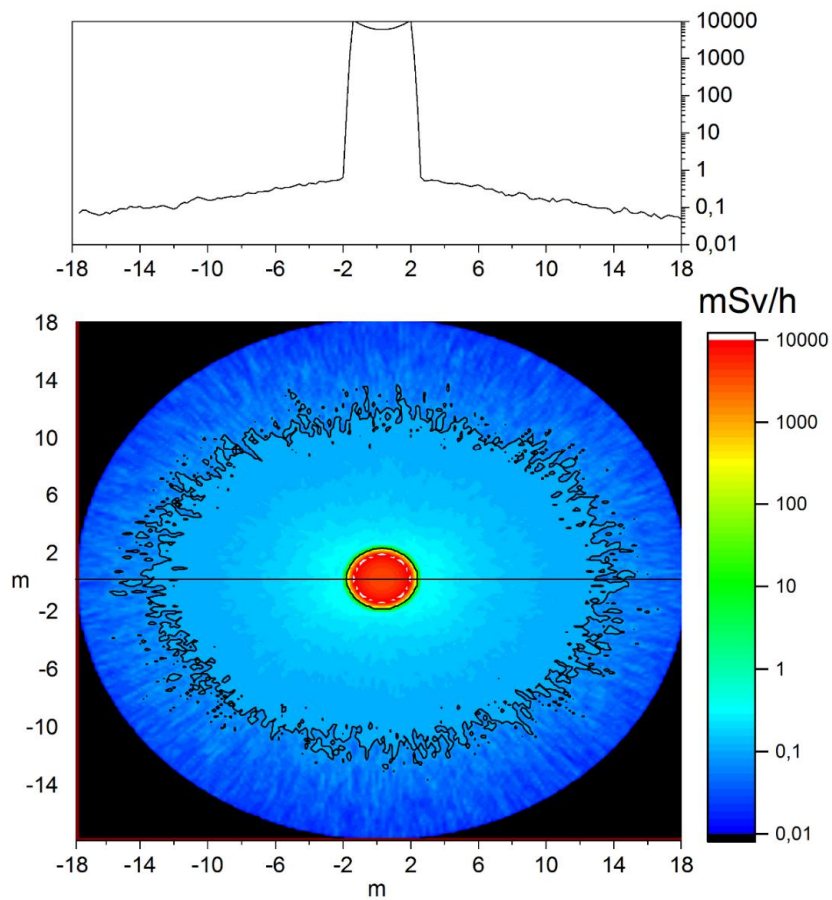
- Same pressure vessel during whole operation time
- 50 years exposure to neutron radiation
- Logistical challenges
 - 215 tons
 - 12 meter long
 - Diameter 4 meters
 - High radiation levels
- Total activity about 500 TBq
- Dose rate about 300 mSv/h (1 meter away from reactor)



Pressure vessel

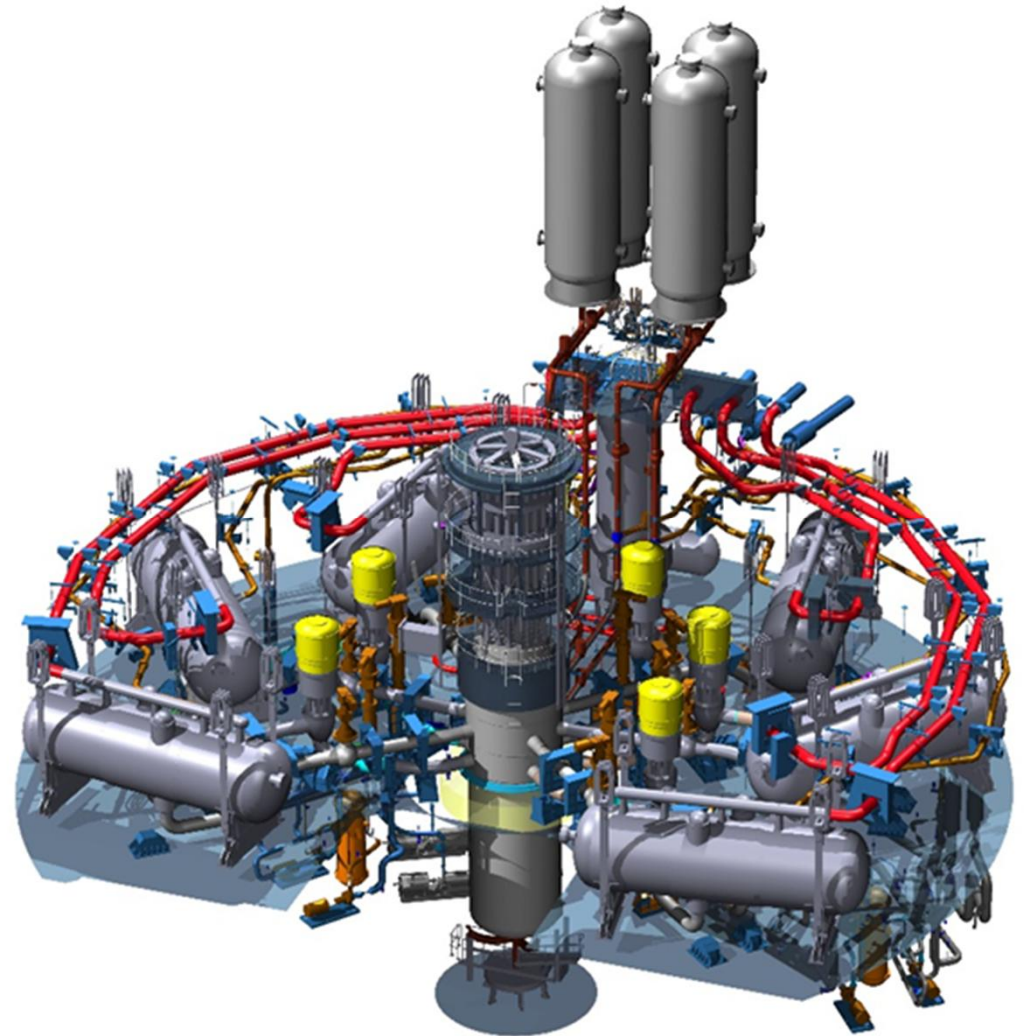


Pressure vessel



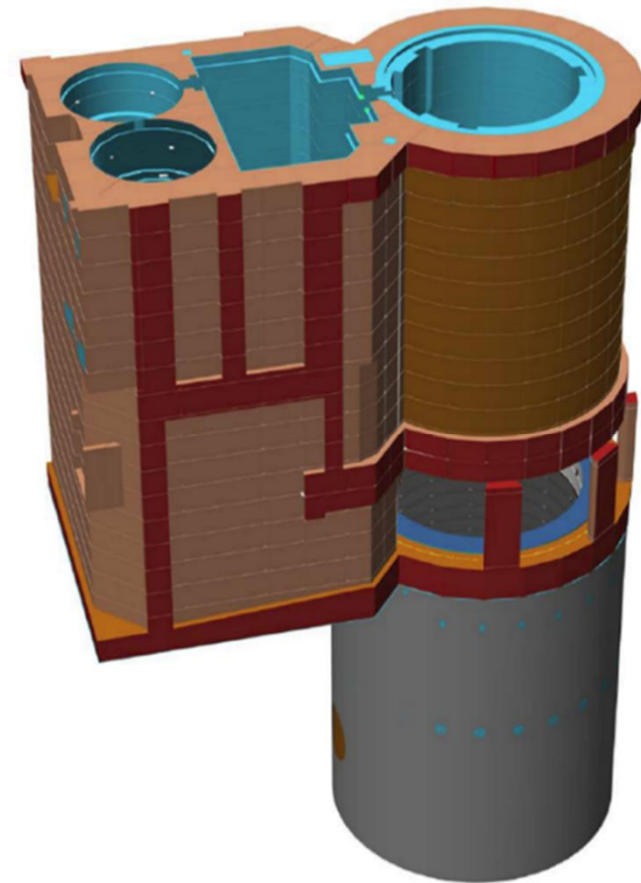
Big components

- Primary circuit big components
 - Lots of cutting
 - Decontamination
 - Hauling methods
 - Heavy lifting



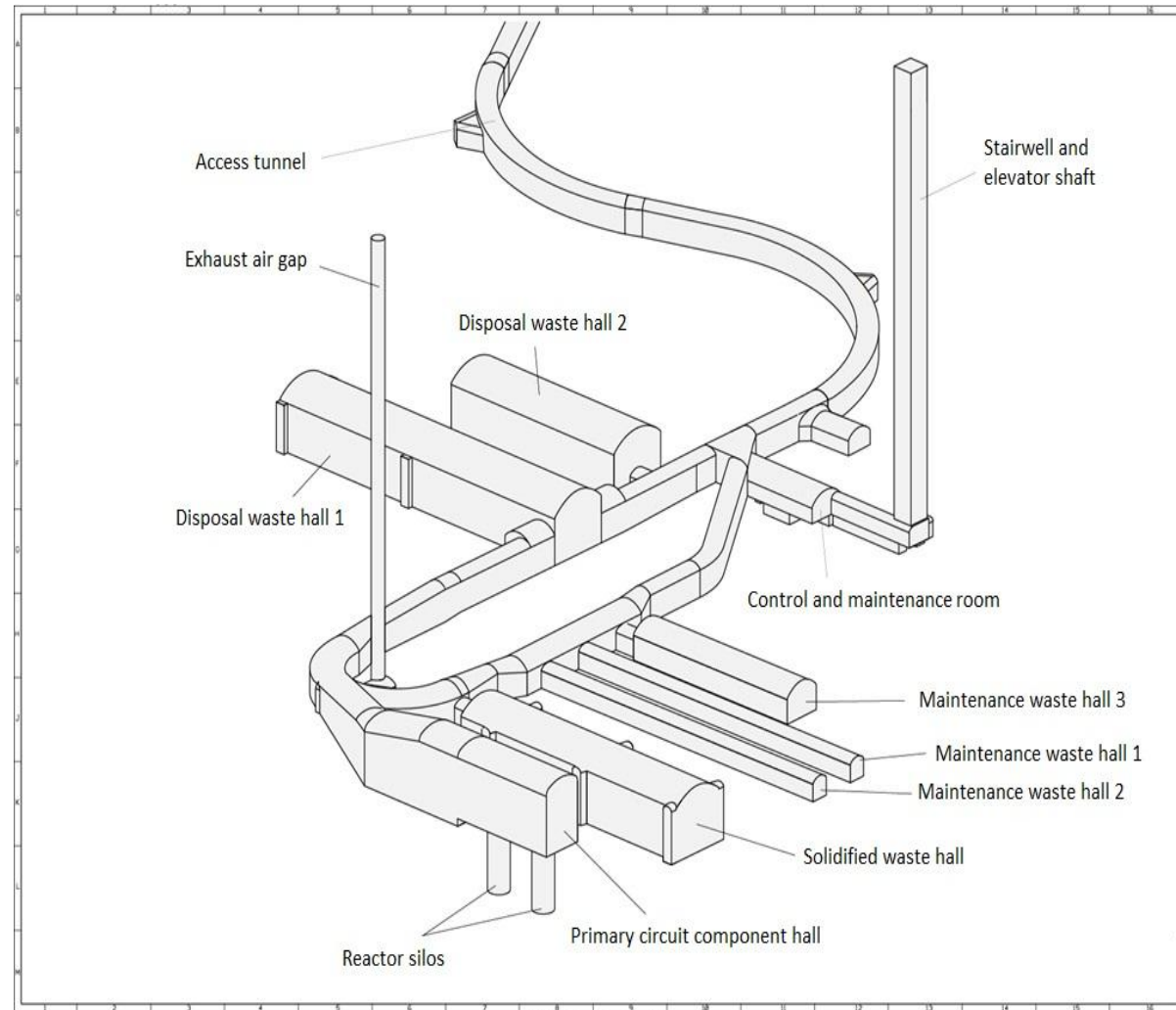
Concrete structures

- Activated concrete near reactor
 - Remote dismantling
- Contaminated concrete
 - Reactor building, auxiliary building
 - Pipelines inside concrete
 - Concrete around pools and storage tanks



Disposal

- 3 new caverns for decommissioning waste
- Primary circuit component hall
 - Pressure vessels, steam generators, pressurizers
- Disposal waste hall 1
 - Control rods, in-core instrumentations, activated concrete, dry silos
- Disposal waste hall 2
 - Activated and contaminated concrete structures



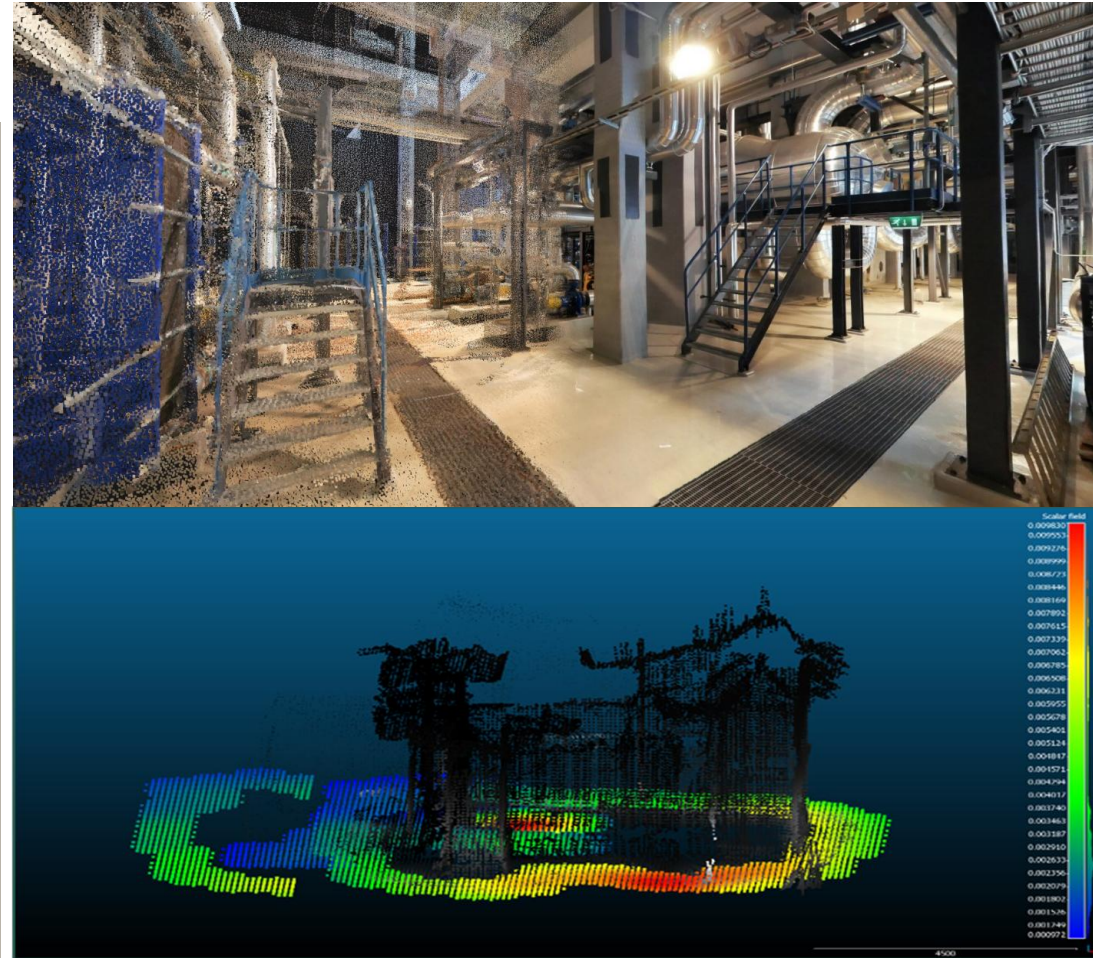
Decommissioning project

- Total 3000 man-years needed
- Cost estimate about 400 M€
- Dose estimate about 10 manSv
- Handling of spent fuel is excluded from scope
 - Posiva

Year	Power plant's decommissioning organization, man-years	Workload of the decommissioning sub-contractors, man-years	Decommissioning workload, man-years
2028	66	10	76
2029	66	15	81
2030	66	15	81
2031	253	87	340
2032	253	101	354
2033	253	131	384
2034	166	115	281
2035	166	86	252
2036	166	120	286
2037	83	33	116
2066	72	279	351
2067	72	242	314
2068	72	39	111
Total	1 754	1 273	3027

Utilization of new technologies

- New technologies are developed and tested
 - Reduce costs and absorbed dose
 - Make work phases faster and safer
- VR solutions for Decommissioning
 - Laser scanning, 360-video, 3D-model, gamma camera, VR-tools
- Laser decontamination
- Simulations
- MCNP-modeling
- More information available in Fortums stand



Thank you!

