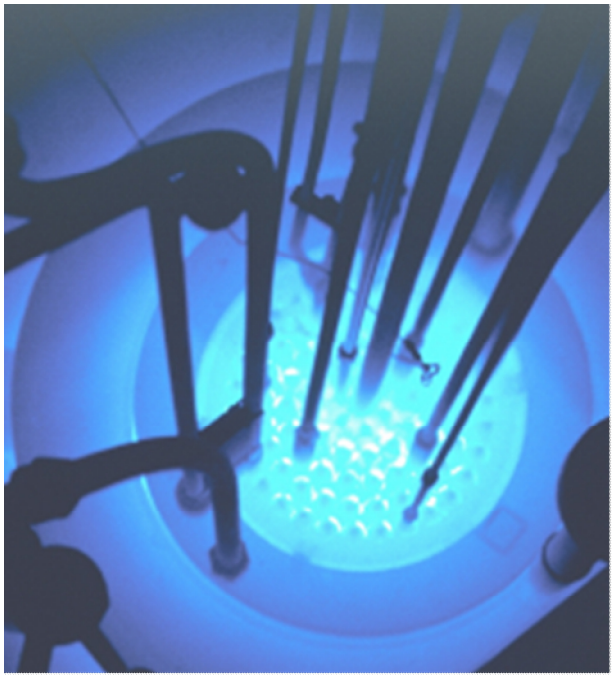

FiR 1 TRIGA research reactor decommissioning project

Current and Emerging Methods for Optimising Safety and Efficiency in Nuclear Decommissioning,
Sarpborg, Norway. 7.2.2017

Antti Räty (antti.raty@vtt.fi)

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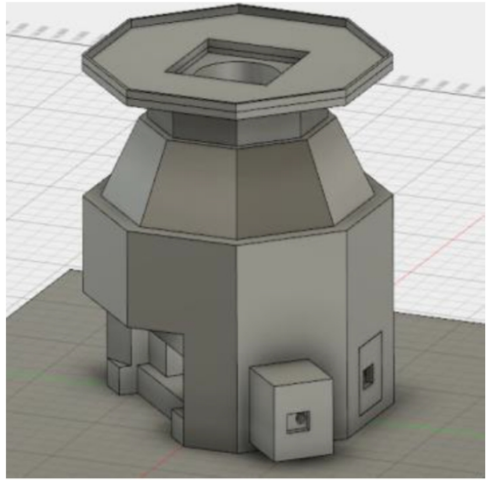
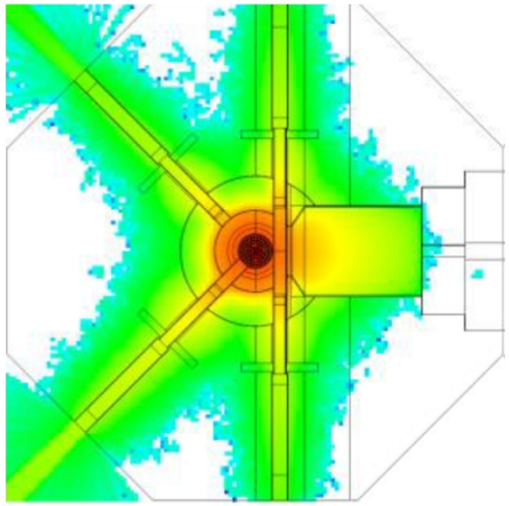
- Project road map and recent progress
- Waste characterisation
- Planned dismantling techniques
- Licence application
- Challenges and lessons learned





FiR1 research reactor (TRIGA Mark II, 250 kW)

- Operation for years 1962-2015. Around 11500 MWh.
- **Early operation:** intensive neutron beam research, activation analysis
- **In-core irradiations** for isotope production (^{82}Br, ^{24}Na, ^{140}La etc.), activation analysis and irradiation testing
- Facility for **Neutron Capture Therapy** constructed
  - BNCT treatments (> 200 patients) in **1997–2012**
  - Special materials to be managed in decommissioning
- **Operating license** valid until **2023**

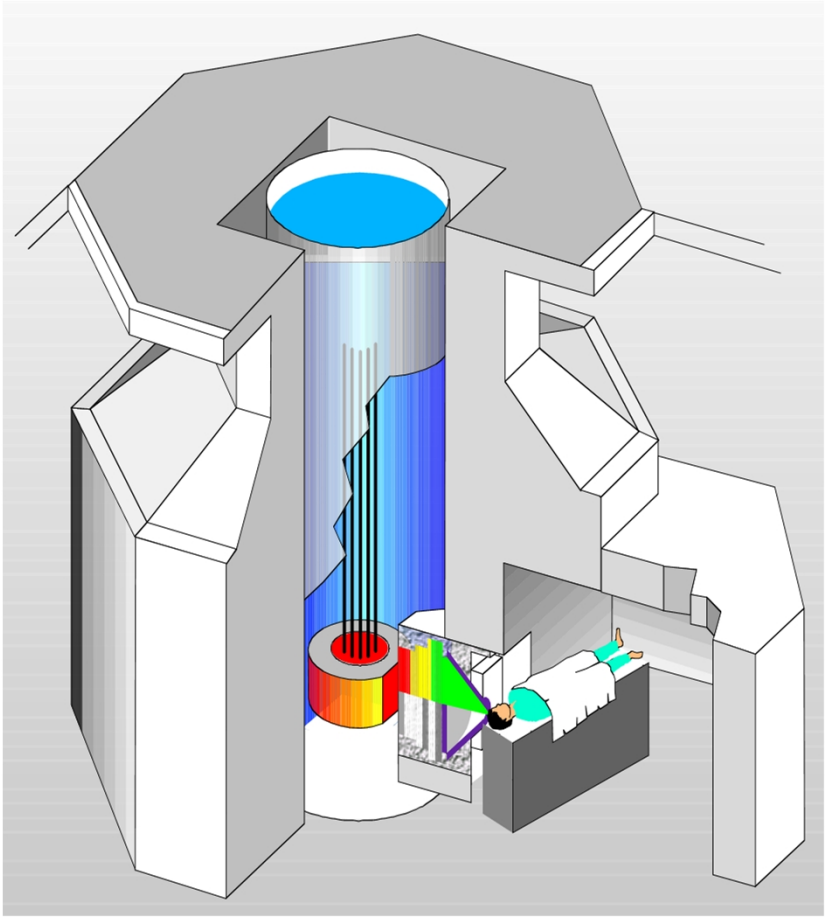
  Final shutdown 30.6.2015

  → License to be amended for decommissioning
- **Inventory** estimates (excluding fuel):

  Mass 75 tons (mainly concrete)

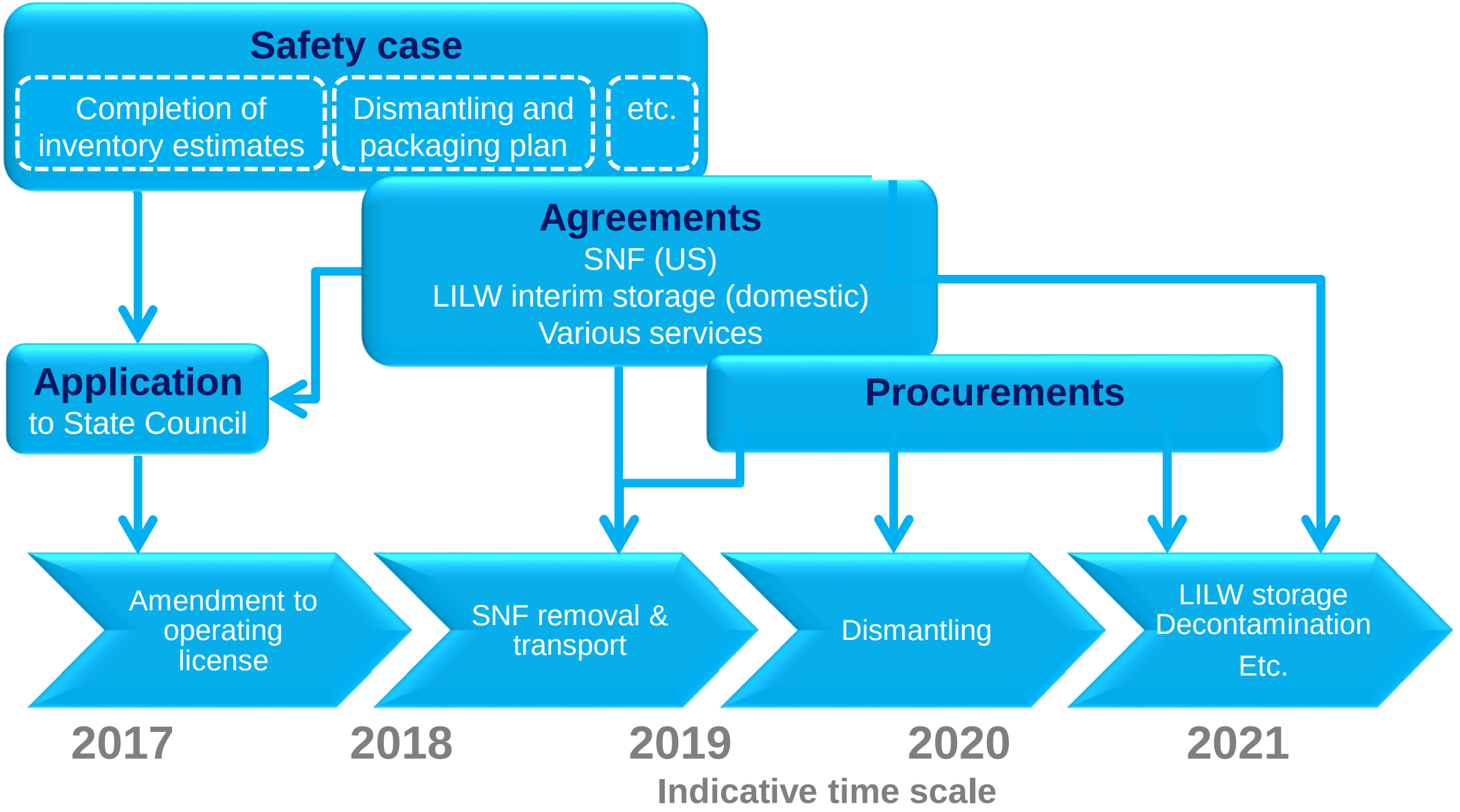
  Volume 40 m^3

  Activity ~5 TBq (BNCT moderator and steel > 1 TBq)



http://www.vttresearch.com/services/low-carbon-energy/nuclear-energy/decommissioning-of-finlands-first-nuclear-reactor

Decommissioning project road map

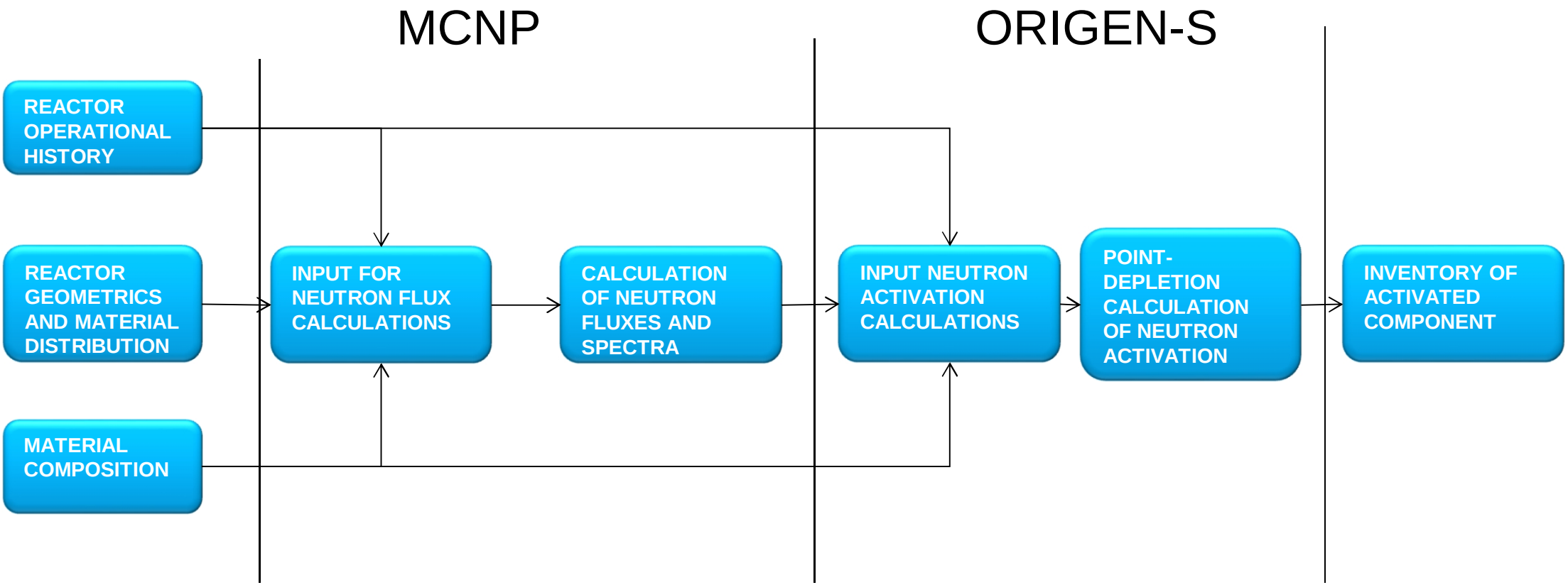


http://www.vttresearch.com/services/low-carbon-energy/nuclear-energy/decommissioning-of-finlands-first-nuclear-reactor

Recent progress and on-going work

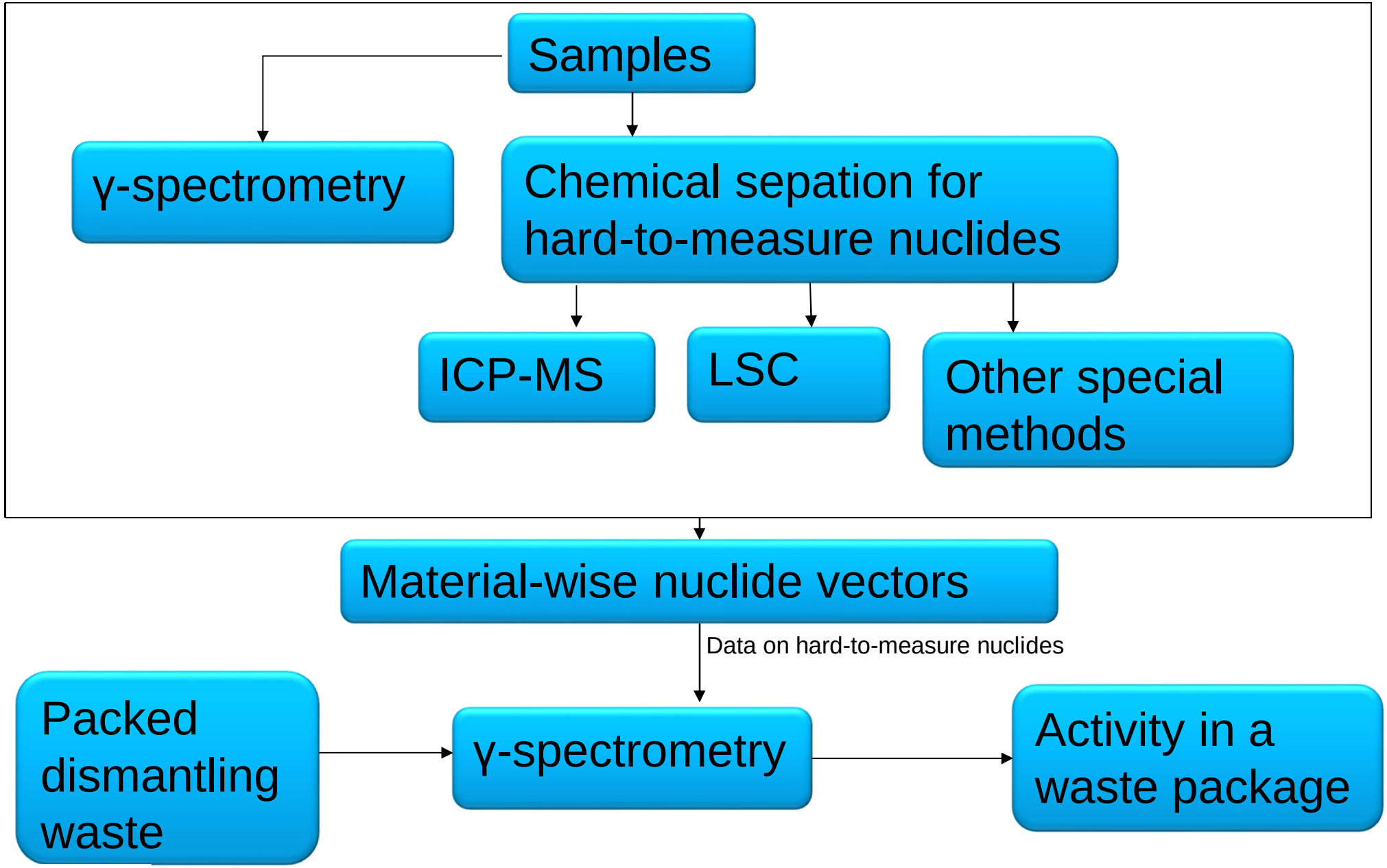
- Fuel inspection by Idaho National Laboratories in 4/2016
- Technical dismantling plan and work instruction finalised in 1/2017
- Decommissioning licence application to be send in spring 2017
- On-going negotiations on options for SNF and dismantling waste intermediate and final disposal.
- Material characterisation by measurements to validate computational estimates.

Radionuclide inventory calculation at VTT



Component-wise calculations. Altogether around 200 cases.

Measurement scheme



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Dismantling planning by BNG

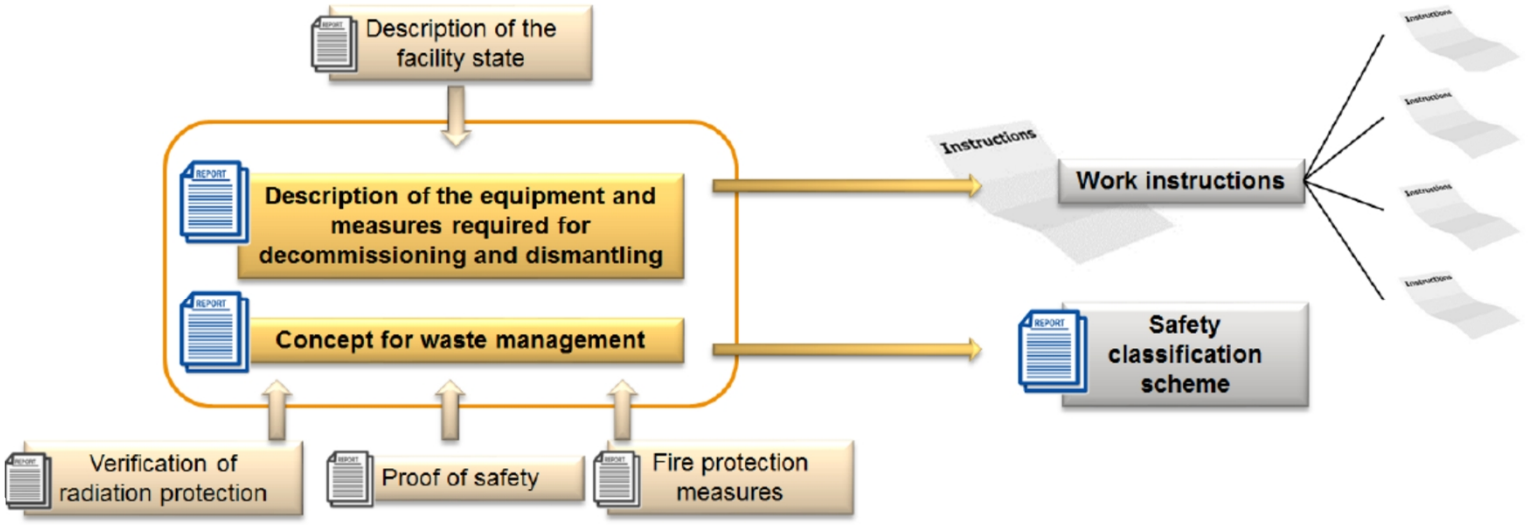
Phase	Work	Duration (weeks)
1	Preparatory measures	4
2	Dismantling of reactor than internals (high activity)	8
3	Dismantling of cooling circuits and heat exchangers	4
4	Dismantling of beam tubes and active concrete	13
5	Dismantling of rest of the systems (low activity)	6
6	Concluding measures	4
7	Clearance measurements	13
SUM		52

- Remove active parts and continue with normal industrial dismantling

http://www.vttresearch.com/services/low-carbon-energy/nuclear-energy/decommissioning-of-finlands-first-nuclear-reactor

Decommissioning licence applications

- First nuclear facility to be decommissioned in Finland
- Environmental Impact Assessment was carried out in 2014-15
- Decommissioning licence application to state council in spring 2017. Evaluation takes about a year.
- Application requires reports e.g. on dismantling plan, risk analysis, safety & security, decommissioning organisation etc.



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Challenges and lessons learned

- Project requires several agreements on SNF and decommissioning waste. Keep all the options open.
- SNF nuclear fuel still in the reactors restricts many actions.
- Lack of operational and material data. Prepare for suprises and pay attention to documentation.
- Research reactors are also nuclear facilities, same requirements for licencing and documentation as for NPP’s.
- Waste activities and masses are small, but research reactors often include special materials. Especially important in waste final disposal planning.
- Train personnel for waste characterisation methods, clearance measurements etc. before starting the dismantling.

Thank you for your attention!