

Decommissioning Waste Management and Clearance

Challenges and Lessons Learned

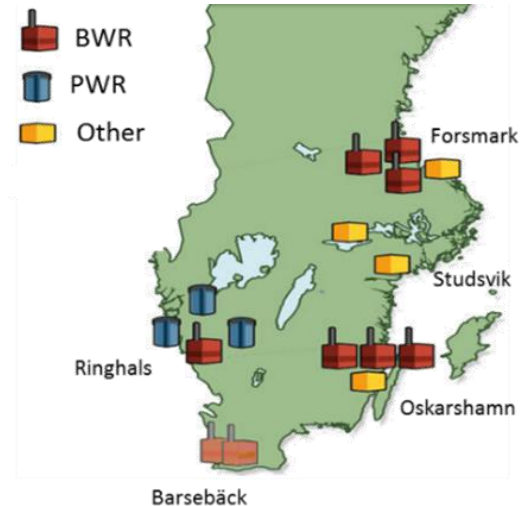
Swedish NPP:s

- Forsmark Kraftgrupp AB (In operation)
- Ringhals AB (Defueling operation R1&2, R3&4 in operation)
- AB SVAFO
 - ✓ R2/R2-0 research reactor at Studsvik (Decom ongoing)
- Vattenfall AB
 - ✓ Ågesta (Decom ongoing)

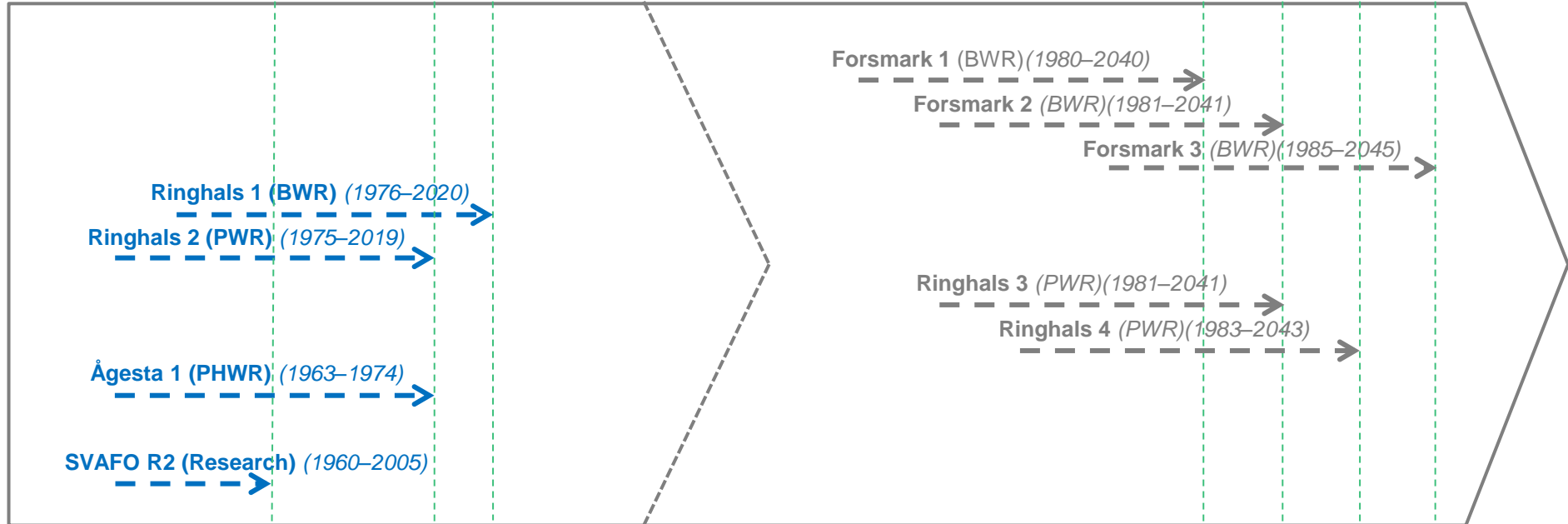
NOTE: IN GERMANY: KKB and KKK – Vattenfall responsible for decommissioning

Barsebäck Kraftgrupp AB (Decom ongoing)

Oskarshamns Kraftgrupp AB (Decom ongoing for O1&2, O3 in operation)



VATTENFALL DECOM ROADMAP



Vattenfall Decom SWE – First Wave

Ringhals 1&2



Ringhals 12
Decommissioning Program

Ågesta



Ågesta Decommissioning
Program – BULK 1 and
operational wastes- ongoing

RPV-internals and RPV

SVAFO R2



SVAFO R2 Decommissioning
Project – stage 1 closed

SVAFO R2 Decommissioning
Project – stage 2 closed

SVAFO R2 Decommissioning
Project – stage 3 ongoing...

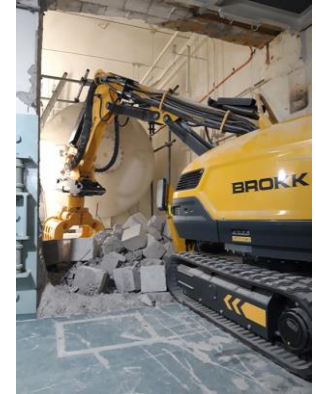
R2 research reactor(s) – Decom soon to be finalized

- SVAFO license holder for the Studsvik reactor R2, the legacy waste and some other facilities at the Studsvik location. Vattenfall is majority owner of SVAFO.
- Two research reactors R2 and R2-0 used for fuel research, material research, neutron research, isotope manufacturing, cancer treatment etc.
- Reactors shut-down in 2005.
- Decommissioning in three stages
 - Dismantling of the reactors
 - Dismantling of biological shield, parts of primary systems (mainly)
 - Dismantling and demolition of remaining systems and parts of buildings



Ågesta NPP – Decom started

- Sweden´s first commercial NPP. In operation 1964-1974. Service operation 1974 – 2020. Decommissioning operation since 2020.
- Reactor type PHWR (Pressurized Heavy Water Reactor) located in rock cavern owned by the city of Stockholm.
- Vattenfall AB is license holder and in this capacity responsible for decommissioning and management of waste.
- All fuel removed after shut-down.
- All heavy water removed after shut-down.
- Used control rods and reactor parts remaining in the facility.
- Primary circuit with originally 4 heat exchangers – 2 remaining (2 decommissioned 1992).



Waste Management and Clearance Challenges and Lessons Learned

The planned Swedish back-end system for decommissioning wastes not yet in operation

- Expansion of existing operational waste repository concept for short-lived waste awaiting government approval
- Modification of existing transportation system
- Timing for final conditioning of wastes not finalized

Waste Management and Clearance Challenges and Lessons Learned

Up-scaling/modifying current waste management practice

- Direct decommissioning strategy for Ringhals 1&2, start as soon as fuel removed from site (within 3 y from shut-down)
- 7 of the 13 Swedish NPP:s in decommissioning – 6 still in continuous full operation
- Introduction of new waste packages and optimization of existing WM processes and IT-systems

Waste Management and Clearance Challenges and Lessons Learned

Development of nuclide vectors as early as possible

- Resulting nuclide vectors may influence preferred order for system dismantling (grouping of systems etc.)
- Size of waste management routes - number of waste packages – size of (buffer) storage areas etc.



Waste Management and Clearance Challenges and Lessons Learned

End-state for clearance of rooms, buildings and end-state for the site

- Early organizational focus on clearance requirements
- Systems to be dismantled before clearance of site
- Site-specific clearance levels for area

