Vattenfall’s decommissioning strategy for Ringhals 1 & 2 in Sweden

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Overview

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2. The **Business Unit Nuclear Decommissioning** (BUND)
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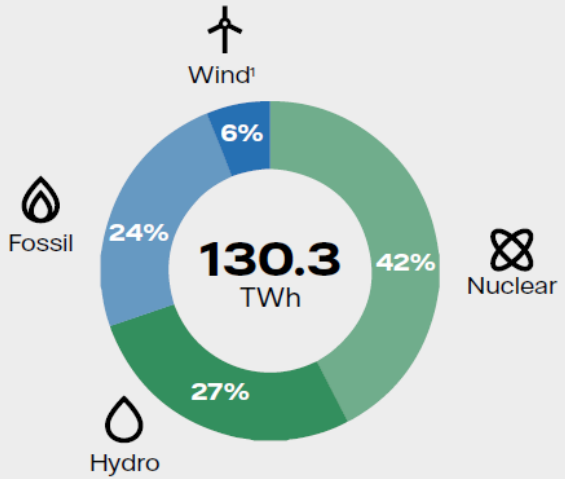
Vattenfall at a glance

Electricity generation breakdown by technology, 2018



[1]Wind includes biomass and waste generation (0.4 TWh)

6.5 million
Electricity customers

2.1 million
Heat customers

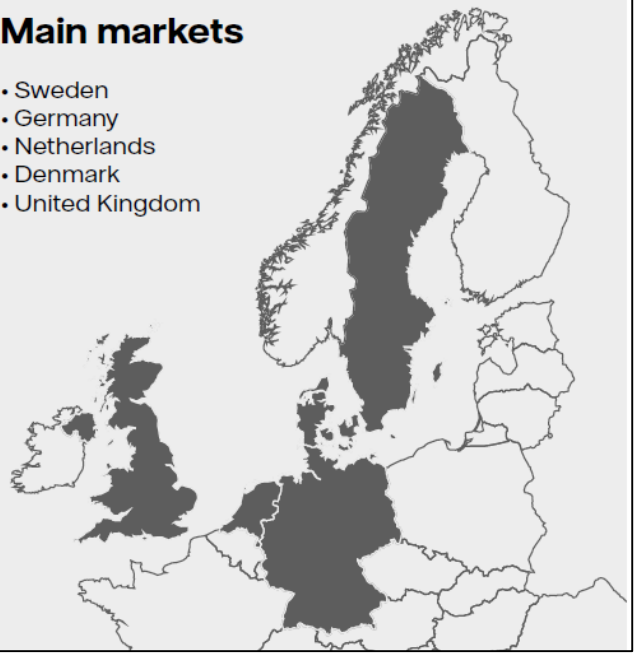
3.3 million
Electricity network customers

2.4 million
Gas customers

19,910
Employees

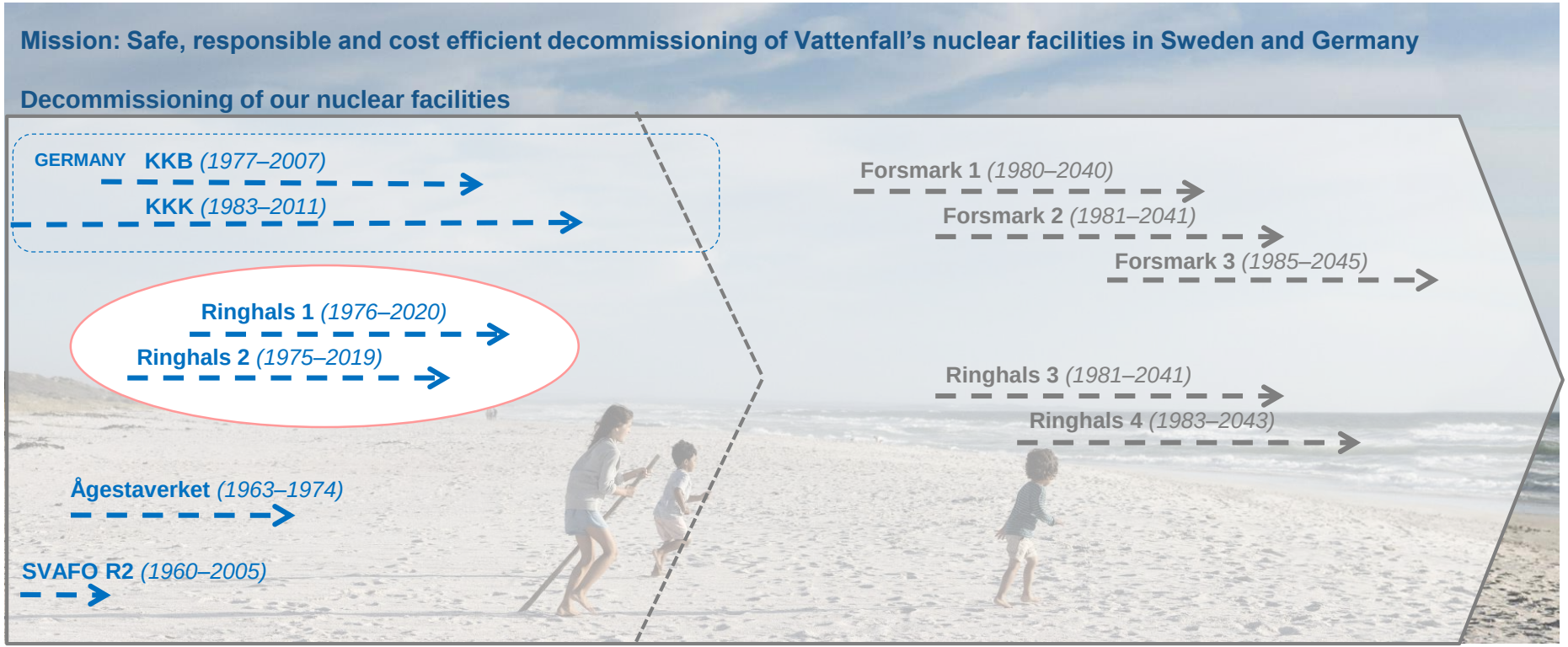
Main markets

- Sweden
- Germany
- Netherlands
- Denmark
- United Kingdom



Business Unit Nuclear Decommissioning (BUND)

Created by Vattenfall in 2016



Ringhals 1 & 2 Decommissioning

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Ringhals

- Ringhals is the largest Swedish NPP
- Covers approx. 20 per cent of the total demand for electricity in Sweden
- Operator: Ringhals AB
- Owners: Vattenfall (70,4 %) and Sydkraft Nuclear Power (29,6 %)
- Number of reactors in operation: 4
- Production capacity: approx. 30 TWh/year
- Installed power: 3951 MW
- No. of employees: ca 1300

- In 2015, Vattenfall decided to close Ringhals 1 & 2 some five years ahead of schedule
- Ringhals 3 & 4 are planned to continue to operate into the mid-2040s

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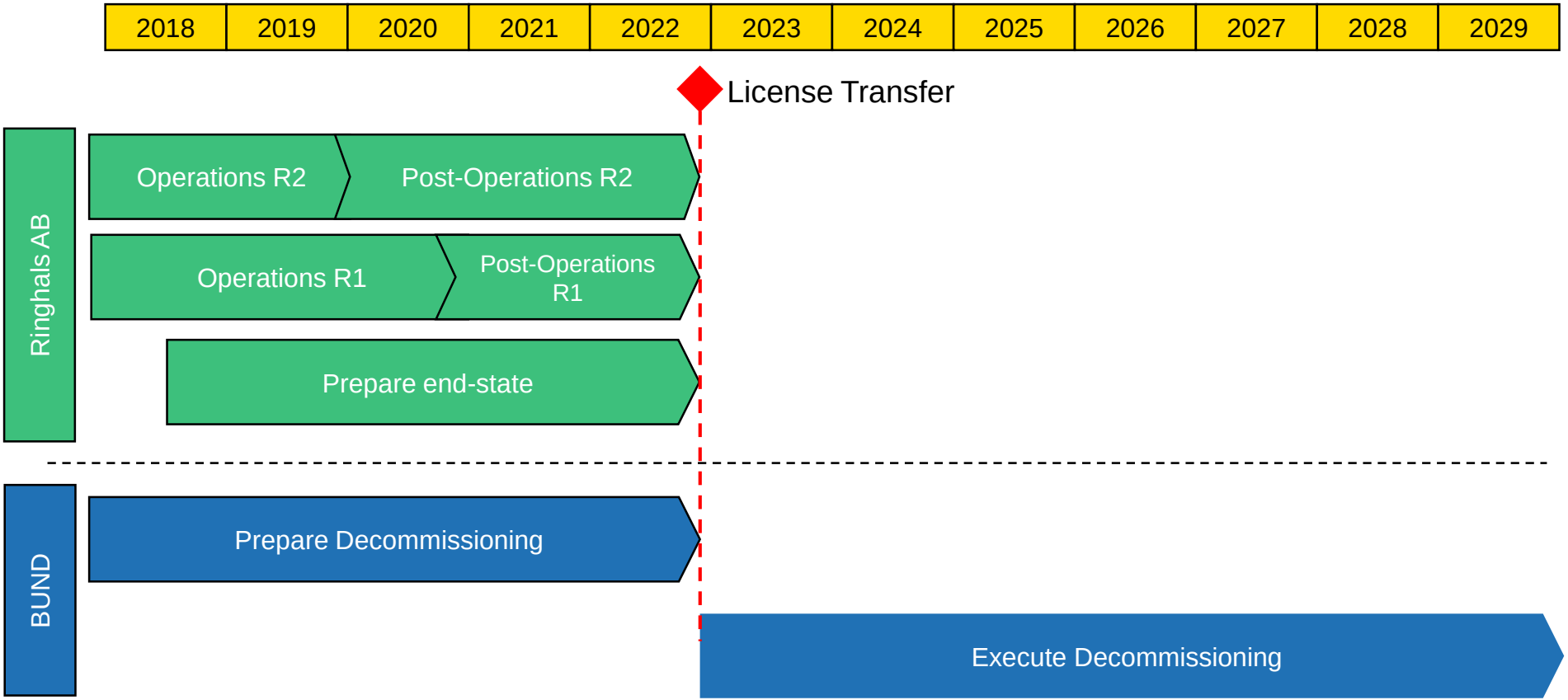
Division of responsibilities

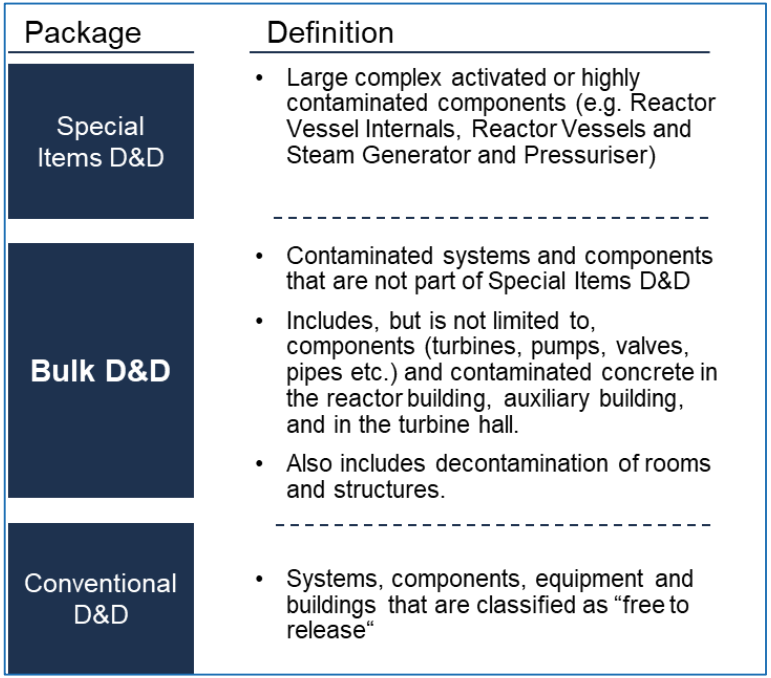
- **Vattenfall is the majority owner** of Ringhals but has the exclusive responsibility for the decommissioning
- **Strategic decision** to separate out continued operation of Ringhals 3 & 4 from the decommissioning of units 1 & 2
  - **Ringhals AB responsible for continued operation** at site
  - **Decommissioning to be managed by BUND**
  - **Vattenfall has applied for a transfer of the nuclear license** for units 1 & 2
  - **Functional separation at the site** is a key enabler
- Agreements between BUND and Ringhals AB for **“post-operational” activities** at units 1 & 2, and delivering agreed ‘state at licence transfer’
- **Cooperation between BUND and Ringhals AB** on staff retention & transfer

Responsibilities & timeline



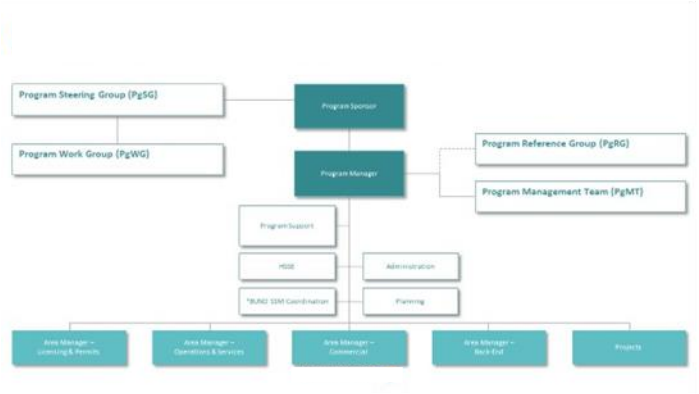
The decommissioning work at Ringhals 1 & 2

- Immediate decommissioning strategy
- “Inside-out” approach:
  - Starts with the more highly active & contaminated components inside the units
  - Progresses towards lesser active and uncontaminated plant sections
- Three broad categories of work:
  - Special Items D&D
  - “Bulk” D&D
  - Conventional D&D

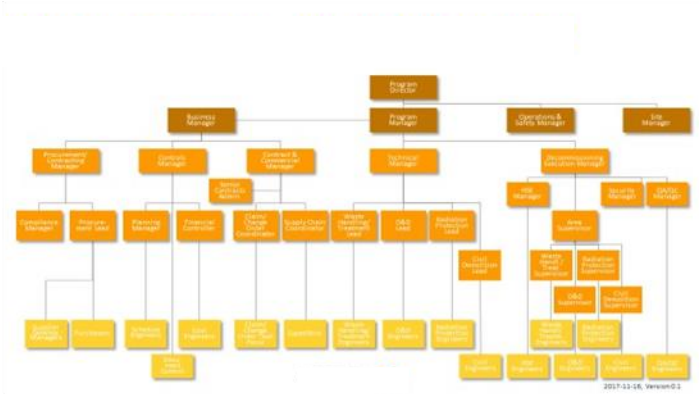


Evolving demands on the BUND organization

Developing from the planning phase …



… to the Execution phase



Strategy formulation	VS.	Strategy execution
Internal focus		External focus (Commercial, Suppliers, etc.)
Few stakeholders/interfaces		Many stakeholders/multiple interfaces
Minor cost		Major cost
Small organization / limited no. of resources		Large organization / extensive no. of resources
Simple risk mitigation		Complex risk mitigation

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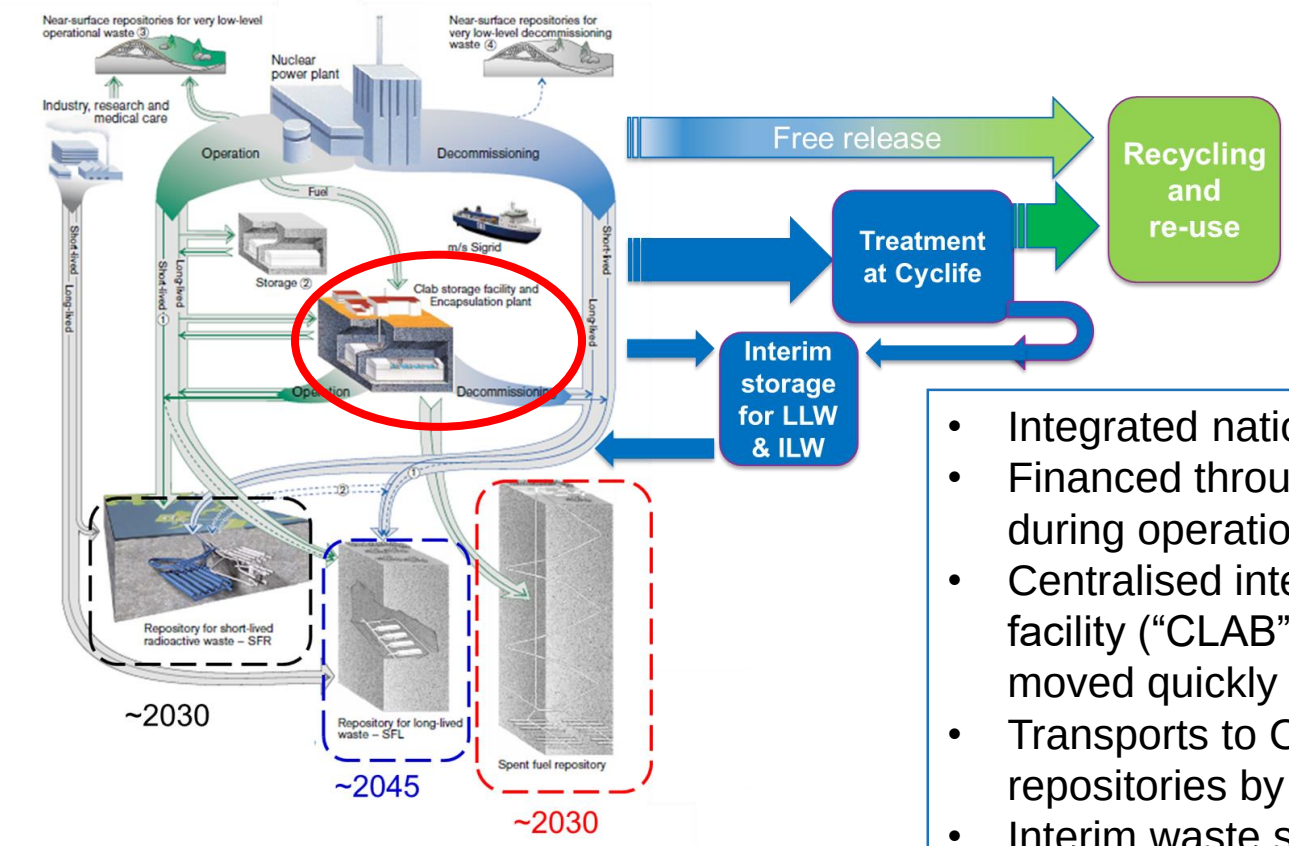
Swedish system for waste management



- Integrated national waste system
- Financed through a national Fund, built up during operation of NPPs
- Centralised interim spent fuel storage facility (“CLAB”) allows spent fuel to be moved quickly away from NPPs
- Transports to CLAB and central repositories by a special boat
- Interim waste storage at NPP sites

Security considerations

Arising from the legislative & regulatory context

Issue	Considerations
Suitability of decommissioning framework	**Comprehensive** legislative & regulatory framework
	Focus has been on ensuring **suitability for facilities in operation and modernisation/construction** **Not yet fully adapted** for implementation to **decommissioning**
	Efforts by regulator to provide **clarification on interpretation and implementation** for decommissioning
	Theoretically enables a **graded approach** where requirements are related to underlying risk levels (including for security) – including transition to lower security requirements
The **regulators**	**Two national regulators with responsibility for security** at nuclear installations – safety authority (Strålsäkerhetsmyndigheten, SSM) and police authority (Polismyndigheten)
	Staffing issues in security department (bottlenecks for decisions)

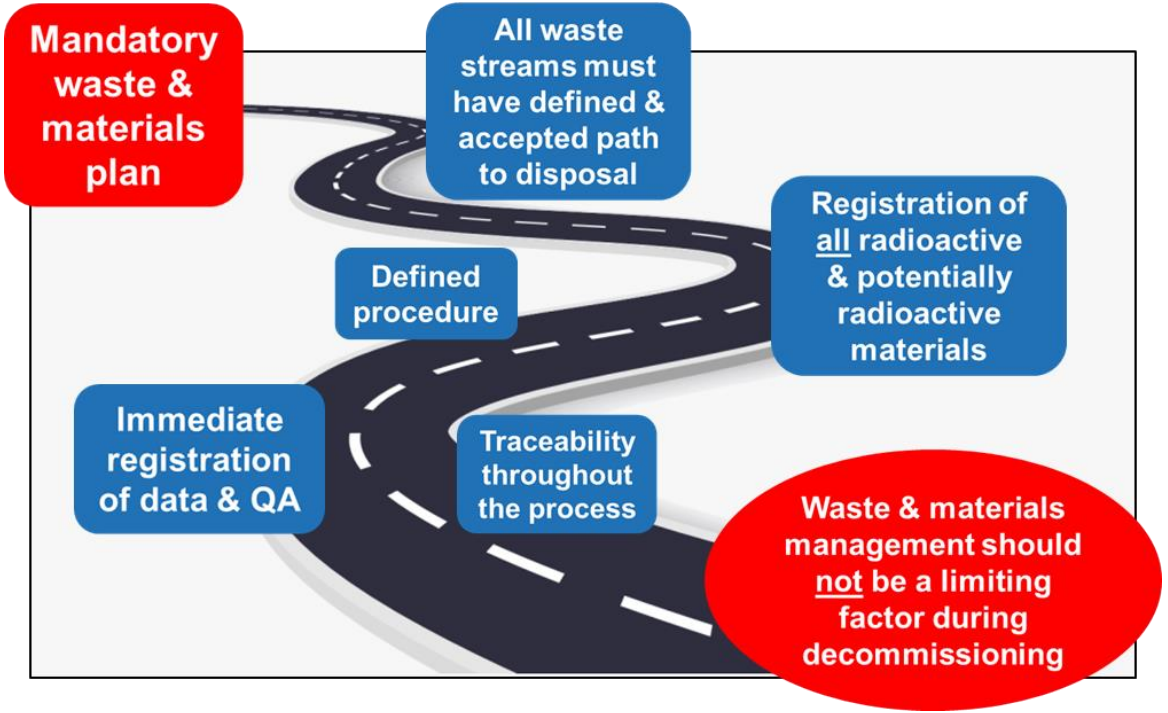
Arising from the licence transfer and division of responsibilities between Ringhals & BUND

Issue	Security considerations
Security during the post-operation phase (prior to licence transfer)	Remains the **responsibility of Ringhals**
Spent fuel management	Remains the **responsibility of Ringhals**
Separation of Ringhals 1&2 from 3&4	Security infrastructure and access controls developed for Ringhals site, will need to ensure separation and have systems for **both licensees**; Possibility for some **shared arrangements** but will need prior approval from regulators
BUND organisation as licensee for Ringhals 1&2	BUND organisation needs to **demonstrate its readiness** to be licensee **in advance of transfer,** including for security BUND will have **exclusive responsibility** for Ringhals 1 & 2 **after licence transfer**

Arising from Vattenfall's approach to decommissioning

Strategy issue	Security considerations
Personnel screening & security procedures suitable for decommissioning	Reliance on **external contractors** for work on site
	Site access & zoning, including transition to lower requirements as work progresses
Intellectual property	**IP ownership and control** between: • Ringhals & BUND • Ringhals, BUND and plant/equipment vendors • BUND and contractors
IT & data - access to systems & information; data modification & record-keeping	**Balance** between **ensuring integrity of systems** and information; and providing the **necessary degree of access** to facilitate the work
Security infrastructure	Need for ongoing **adaption of infrastructure** as facility modified as work progresses
Materials & waste management	*See following slide*

Materials & waste management fundamentals



Integrating these requirements into our planning from the outset minimises potential conflicts between security and effective delivery of our decommissioning projects.

Thank you!

Business Unit Nuclear Decommissioning

The safe, responsible and cost-efficient decommissioning and dismantling of Vattenfall's nuclear facilities