



Strål  
säkerhets  
myndigheten

Swedish Radiation Safety Authority

# **Decommissioning status, challenges and solutions in Sweden**

A regulator's perspective

NKS-B Radworkshop 2018

Session 1: legislation and status

8 – 10 October 2018

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Section for operation and decommissioning

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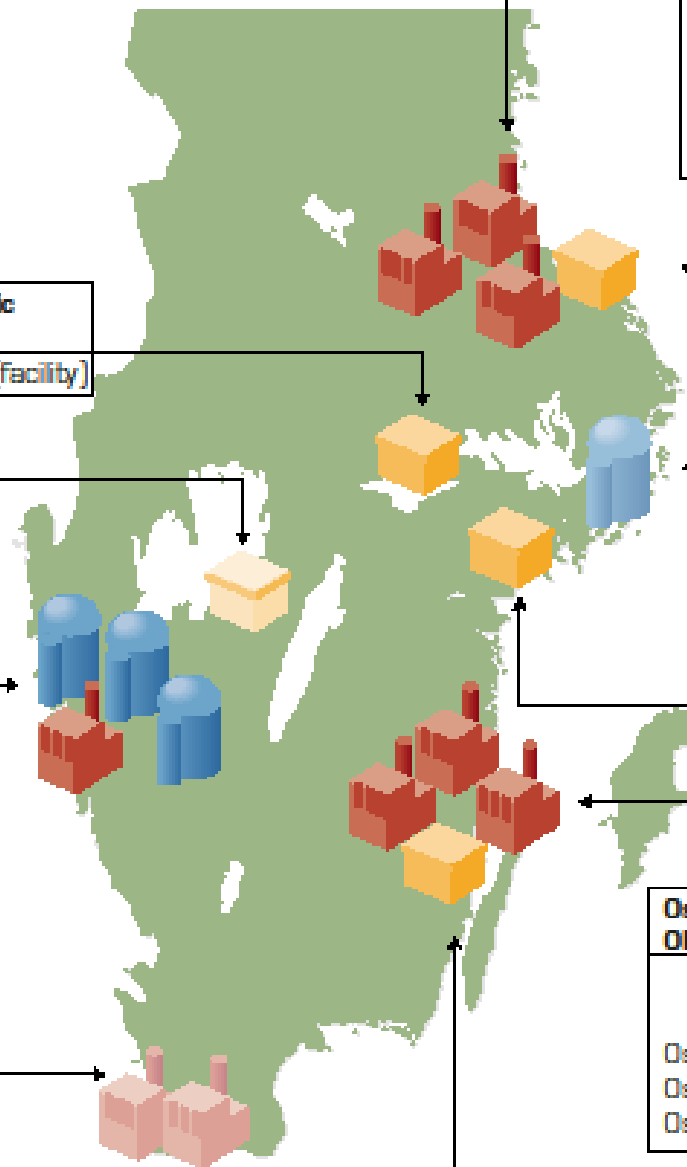
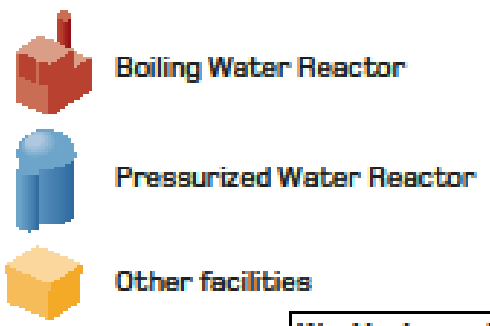
# Outline

- ➔ status of the decommissioning projects and the Swedish legislation
- ➔ open legal questions and practical challenges for SSM
- ➔ practical solutions



# **Part 1 - status of the decommissioning projects and the Swedish legislation**

# Nuclear Facilities in Sweden



**Forsmark NPP**  
**Forsmarks Kraftgrupp AB**

	Capacity MW(th)	In operation since
Forsmark 1	2 982	1980
Forsmark 2	3 253	1981
Forsmark 3	3 300	1985

**SFR**  
**Swedish Nuclear Fuel and Waste Management Co (SKB)**

Final repository for radioactive operational waste

**Ågesta PHWR**  
**Vattenfall AB**

Capacity MW(th)	In operation
80	1964-1974

**Studsvik**  
**Studsvik Nuclear AB, AB SVAFO**

Facilities for fuel and materials testing, waste management and storage including two shut-down material test reactors

**Oskarshamn NPP**  
**OKG AB**

	Capacity MW(th)	In operation since
Oskarshamn 1	1 375	1972
Oskarshamn 2	1 800	1975
Oskarshamn 3	3 900	1985

**Westinghouse Electric Sweden AB**

Fuel fabrication plant (facility)

**Ranstad**  
**Ranstad Industricentrum AB**

Former Uranium mining and milling facility

**Ringhals NPP**  
**Ringhals AB**

	Capacity MW(th)	In operation since
Ringhals 1	2 540	1976
Ringhals 2	2 660	1975
Ringhals 3	3 144	1981
Ringhals 4	2 783	1983

**Barsebäck NPP**  
**Barsebäck Kraft AB**

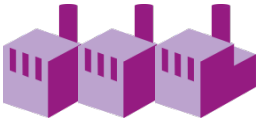
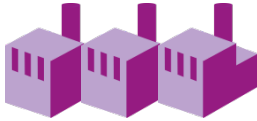


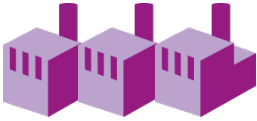

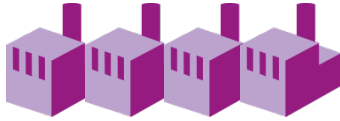

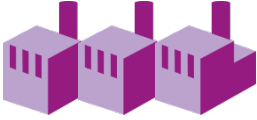
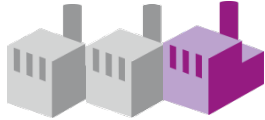
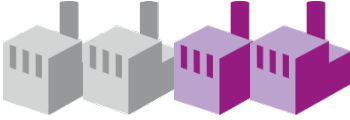





	Capacity MW(th)	In operation
Barsebäck 1	1 800	1975-1999
Barsebäck 2	1 800	1977-2005

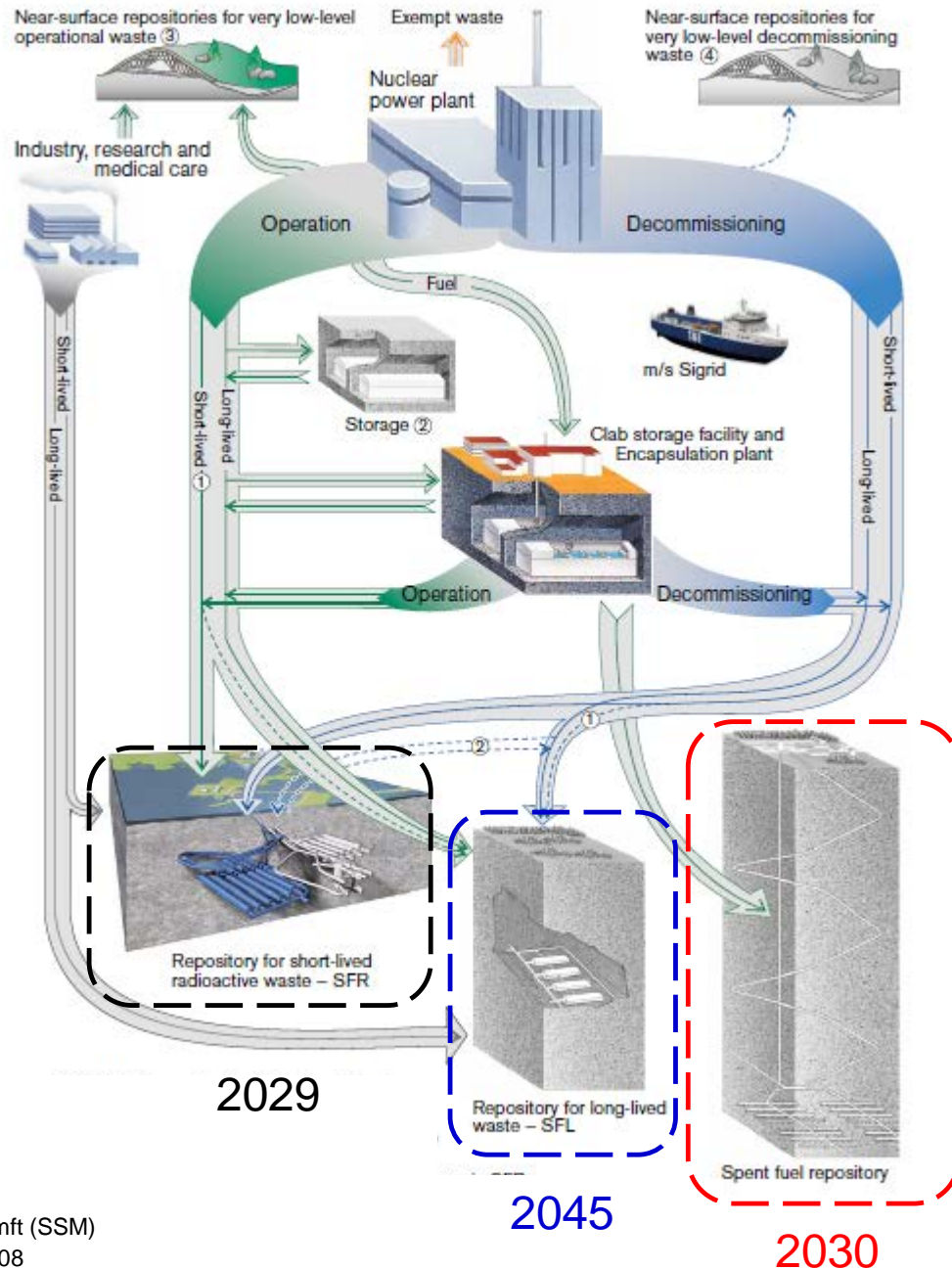
**CLAB**  
**Swedish Nuclear Fuel and Waste Management Co (SKB)**

Central interim storage facility for spent nuclear fuel



# Operating and shut down NPPs

	Forsmark 1-3	Oskarshamn 1-3	Ringhals 1-4	Barsebäck 1-2	
2015					10+2
2017					8+4
2020					6+6
~2045					12



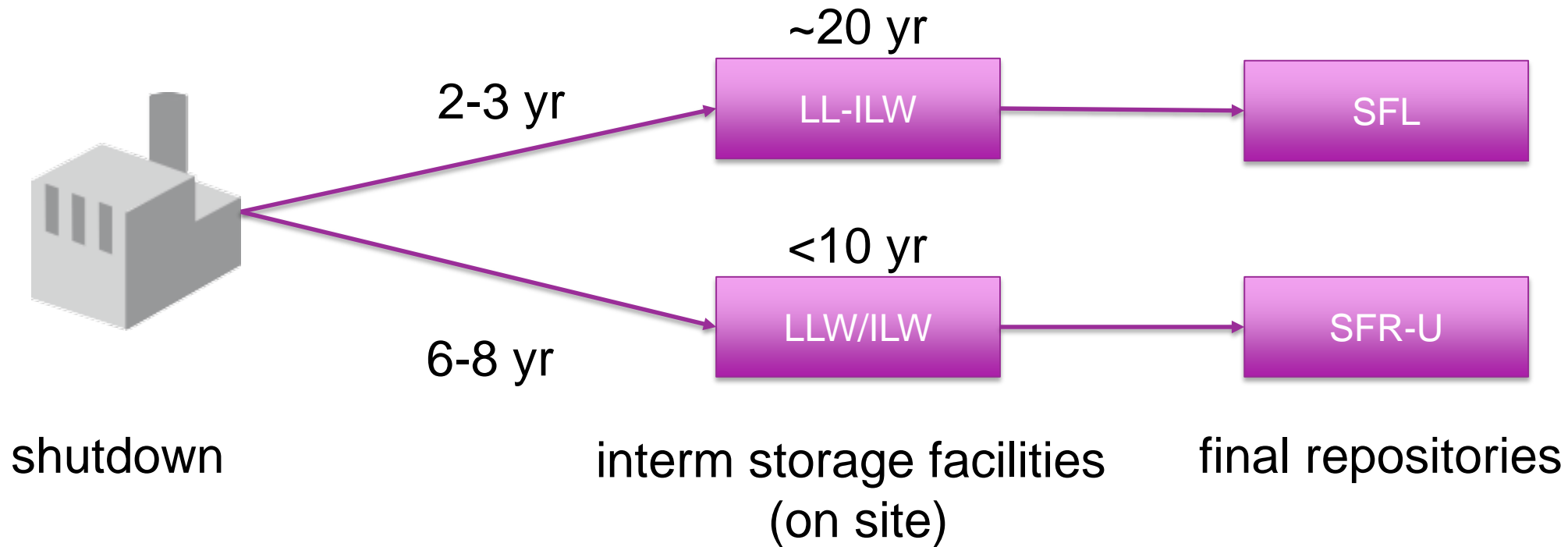
# Swedish system for management and disposal of radioactive waste

Martin Amft (SSM)  
2018-10-08

(Source: SKB)



# LLW and ILW streams from D&D





# Former uranium milling facility in Ranstad

- ➔ shut down 1984/2009
- ➔ D&D and clearance measurements essentially completed
- ➔ currently production of the final decommissioning report and an archive
- ➔ environmental surveillance of tailings





# Studsvik materials research reactors

- ➔ shut down 2005
- ➔ D&D commenced in 2015 and essentially completed for systems and components
- ➔ decontamination and clearance of structures ongoing



# Ågesta reactor (PHWR)

- shut down 1974, since then in care and maintenance operation
- D&D-applications planned in 2019
- preparatory activities ongoing, e.g. radiological characterization
- large-scale D&D planned to commence ~2022



# Barsebäck NPP (BWR)

- shut down: 1999 (unit 1) and 2005 (unit 2)
- segmentation of reactor internals completed in unit 2 and ~70% completed in unit 1
- D&D-applications in Dec 2018
- application for new LLW-interim storage facility 2019
- preparatory activities, e.g. radiological characterization
- large-scale D&D planned to commence 2020



# Oskarshamn NPP (BWR)

- shut down: 2017 (unit 1) and 2016 (unit 2)
- preparatory activities, e.g. defueling, radiological characterization, adapting organization, separation from unit 3
- segmentation of reactor internals ~70% completed in unit 2
- D&D application for unit 1 under review
- D&D application for unit 2 in Oct 2018
- large-scale D&D planned to commence in 2019



# Ringhals NPP (BWR and PWR)

- ➔ final shutdown planned in 2020 (unit 1) and 2019 (unit 2)
- ➔ application of license transfer to Vattenfall in Dec 18
- ➔ (initialization of) preparatory activities, e.g. radiological characterization and separation from units 3&4
- ➔ large-scale D&D planned to commence after license transfer in 2022



# Regulatory framework for decommissioning (1/3)

- ➔ Environmental Act (1998:808)
- ➔ Act on Nuclear Activities (1984:3), Ordinance (1984:14)
- ➔ Radiation Protection Law (2018:396), Ordinance (2018:506)
- ➔ Additional licensing conditions for decommissioning of nuclear power reactors (SSM2016-5866-8)

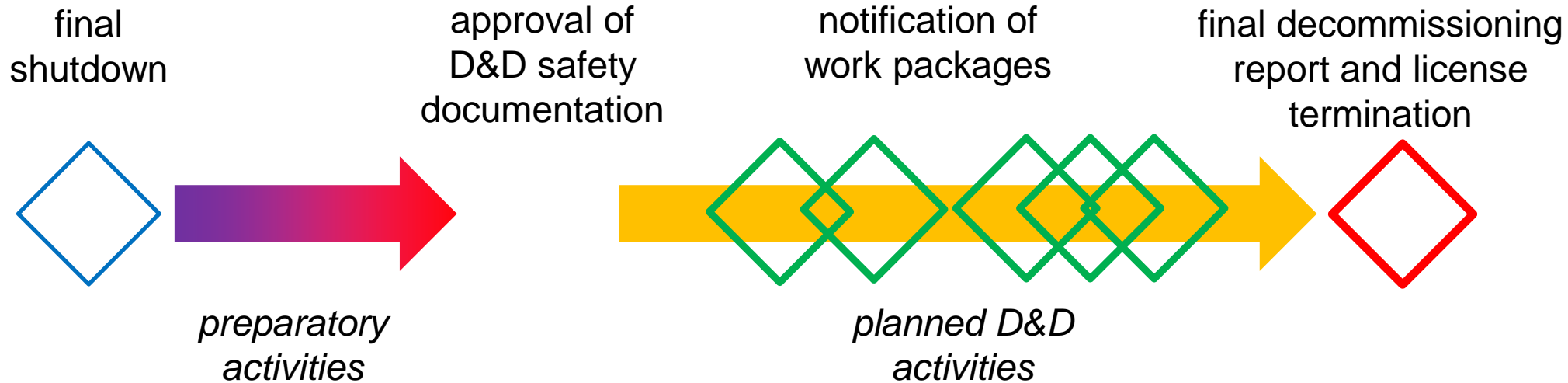


# Regulatory framework for decommissioning (2/3)

- The Swedish Radiation Safety Authority's regulations (SSMFS 2018:1) concerning basic provisions applying to licensed activities involving ionising radiation
- The Swedish Radiation Safety Authority's regulations (SSMFS 2008:1) concerning Safety in Nuclear Facilities
- The Swedish Radiation Safety Authority's regulations (SSMFS 2018:3) concerning exemptions from the Radiation Protection Act and concerning clearance of materials, building structures and areas



# Regulatory framework for decommissioning (3/3)







# approval of D&D safety documentation





# notification of work packages





## Status of the regulatory framework

- 1 Aug 2017 implementation of 2014/87/EURATOM in Act on Nuclear Activities
- 1 June 2018 implementation of 2013/59/EURATOM in Radiation Protection Act, Ordinance, and SSM's regulations
- Committee (M 2017:05) reviewing the Act on Nuclear Activities
- ~2020 new SSMFS concerning nuclear waste



# **Part 2 – open legal questions and practical challenges for SSM**



## **(Some of the) open legal questions (1/2)**

- How to handle exemptions from legal requirements (in an efficient way)?
- Who is terminating the nuclear license, the Government or SSM?
- What are the detailed requirements for license termination after decommissioning?



## **(Some of the) open legal questions (2/2)**

- ➔ Is it reasonable that the licensee is responsible for its nuclear waste until the closure of the final repository?
- ➔ Can the licensee be responsible for the safety of nuclear waste after its transfer to an external interim storage facility or final repository?
- ➔ How to manage the long-term (decades long) environmental surveillance of land fills for VLLW?
- ➔ Is the incineration of VLLW in conventional district heating facilities legal and acceptable?



## **Practical challenges for SSM (1/2)**

1. timely recruitment and training of new staff to supervise four large-scale D&D projects in parallel
2. reviewing and approving four D&D applications within <18 months
3. reviewing license transfer application for Ringhals units 1 and 2
4. timely review and approval of waste type specifications



## **Practical challenges for SSM (2/2)**

5. adapting supervision procedures for D&D
6. reviewing and approving clearance of structures, building, and areas on four different sites
7. knowledge management and transfer during 2030 and ~2040





# Part 3 – practical solutions

Martin Amft (SSM)  
2018-10-08



1. timely recruitment and training of new staff → *few competent candidates, SSM at two (three) locations*
2. reviewing and approving four D&D applications within <18 months → *generic review plan and reliance on existing supervision results*
3. reviewing license transfer application for Ringhals units 1 and 2 → *review on previous license applications and coordination with WSE's license renewal*



4. timely review and approval of waste type specifications → *concentrated and standardized review periods; prioritization; recruitment*
5. adapting supervision procedures for D&D → *trial & error; pilot inspections according to new routines in 2019*
6. reviewing and approving clearance of structures, building, and areas on four different sites → *standardized processes; recruitment*
7. knowledge management and transfer during 2030 and ~2040 → *prerequisite: traceable, readable, searchable documentation*



# 6<sup>th</sup> Decommissioning Seminar

13 - 14 March 2019 in Stockholm

Preliminary topics:

- waste management during D&D (1.5 days)
- D&D of small (non-nuclear) facilities (0.5 days)

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# Thank you for your attention!

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