Authorization for and regulatory control of decommissioning in Sweden

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Martin Amft and Christoffer Forss
Swedish Radiation Safety Authority
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### Nuclear Facilities in Sweden (under decommissioning)

#### (1) Barsebäck NPP
**Barsebäck Kraft AB**
- **Unit 1 (BWR)**: 1975-1999
- **Unit 2 (BWR)**: 1977-2005

#### (2) Ringhals NPP
**Ringhals AB**
- **Unit 1 (BWR)**: 1976-31 dec 2020
- **Unit 2 (PWR)**: 1975-31 dec 2019
- **Unit 3 (PWR)**: 1984-
- **Unit 4 (PWR)**: 1983-

#### (3) Oskarshamn NPP
**OKG AB**
- **Unit 1 (BWR)**: 1972-2017
- **Unit 2 (BWR)**: 1975-2016
- **Unit 3 (BWR)**: 1985-

#### (4) Ågesta NPP
**Vattenfall AB**
- **Unit 1 (PHWR)**: 1964-1974

#### (5) Forsmark NPP
**Forsmarks Kraftgrupp AB**
- **Unit 1 (BWR)**: 1980-
- **Unit 2 (BWR)**: 1981-
- **Unit 3 (BWR)**: 1985-

#### (6) CLAB
**Swedish Nuclear Fuel and Waste Management Co (SKB)**
Central interim storage for spent nuclear fuel

#### (7) Ranstad
**Ranstad Industricentrum AB**
Former uranium mining and milling facility

#### (8) Studsvik site
**Studsvik Nuclear AB, AB Svafo, Cyclife Sweden AB**
Facilities for fuel and materials testing, waste management and storage and former facility with two decommissioned materials test reactors

#### (9) Fuel factory
**Westinghouse Electric Sweden AB**
Fuel fabrication plant

#### (10) SFR
**Swedish Nuclear Fuel and Waste Management Co (SKB)**
Final repository for short-lived radioactive waste from operation

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**Diagram:**
- **Boling water reactor**
- **Pressurized water reactor**
- **Other facilities**
Decommissioning of NPPs - the big picture

- Immediate dismantling required by the Radiation Protection Act
- Within 18-24 months after permanent shutdown spent nuclear fuel, control rods, and core instrumentation are transported to CLAB
- Onsite interim storage of LLW and ILW from D&D
- D&D activities from “hot” to “cold” systems and structures
- Planned end-state for industrial use or energy production
- Vattenfall and Uniper chose different D&D management strategies
D&D management strategies

**Vattenfall**
- Sweden: 1 BWR, 1 PWR, 1 PHWR
- Germany: 2 BWR
- One licence holder
- Separate decommissioning from operation (Ringhals)
- Synergies between sites in Sweden and Germany

**Uniper**
- 4 BWR
- Two licence holders (BKAB and OKG)
- “Fleet approach”
  - common D&D strategy
  - joint tenders
  - D&D projects in sequence
- D&D projects managed by departments within the licensee’s organization
Dismantling and demolition of a nuclear power reactor requires **three authorizations**

1. A new licence according to the Environmental Code, issued by the regional Land and Environment Court

2. SSM’s approval of the safety report and supporting documents for dismantling and demolition

3. SSM’s approval of a radiological environmental monitoring programme
SSM’s regulations concerning safety in nuclear facilities (SSMFS 2008:1)

- Applicable for all nuclear facilities and the whole life-cycle but primarily developed for NPPs in power operation.

- No mechanism for automatic lifting of requirements after SNF is removed → SSM guideline containing an assessment of which requirements that remain applicable following the removal of SNF.
SSM’s basic requirements relating to decommissioning

SSMFS 2018:1
- Decommissioning plan
- Documentation of incidents etc. relevant for decommissioning

SSMFS 2008:1 Chapter 9
- Content of decommissioning plan
- Approval of safety report for D&D
- Work-package notifications and reports
- Decommissioning report
Additional licence conditions for decommissioning of NPPs

- Requirements in licencing conditions replace or supplement the existing requirements in SSM’s regulations, especially SSMFS 2008:1
- Specifying requirements e.g.
  - Preparatory measures
  - Safety report for D&D
  - Operational Limits and Conditions
  - Final decommissioning plan
  - Work-package notification
  - Work-package report
SSM’s approach to review D&D applications

Covers all aspects of D&D within the regulatory framework, with focus on

- Integrated management system
- Planned D&D measures
- Waste management, treatment, logistics, and interim storage
- Safety analysis
- Radiation protection and radioactive discharges
Definition of D&D activities that require SSM’s approval

General principle
SSM’s approval is needed for all measures after the permanent shutdown to dismantle or demolish activated or contaminated systems, structures, or components.

Exceptions
To facilitate safety, security and radiation protection, SSM specified 16 accepted preparatory activities in the additional licence conditions, e.g.
- Removal of SNF, control rods and core instrumentation
- Shutdown, drainage etc. of systems
- Measures for radiological characterization
Purposes of the work-package notifications

1. If necessary: Supplement the previously approved safety report, operational limits and conditions, and waste (management) documentation

2. Describe the D&D measures in more detail than in the final decommissioning plan

3. List all (sub-) contractors implementing the D&D measures

4. Specify additional radiation protection, safety, and security measures
Principles of SSM’s regulatory control during decommissioning

1. Implement an adaptation, concerning focus areas and periodicity of inspections, of the basic inspection programme for NPPs in operation

2. Inspection of specific issues during the preparation and implementation of the work-packages, e.g. D&D techniques or temporarily installed equipment
Thus, SSM has the capacity to deal with the seven large-scale D&D projects taking place in parallel at four different sites over the forthcoming years.

Conclusions

- SSM’s regulatory framework for decommissioning is robust and sufficiently flexible
- SSM’s authorization process for D&D is effective
- SSM’s regulatory control of hitherto implemented work-packages (segmentation of reactor internals) has been effective and scalable
Thank you for your attention!

Martin Amft (Martin.Amft@ssm.se)
Christoffer Forss (Christoffer.Forss@ssm.se)

Swedish Radiation Safety Authority
Section for operation and decommissioning