Lessons learned from application of the Swedish regulations for decommissioning of nuclear facilities - The regulator´s perspective

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Content – main issues

- When does “dismantling” start? What needs to be in place?
- How can regulations be adapted to the changing situation?
- How should documentation be structured and adapted to the changing situation?
- Which are the phases for a NPP undergoing decommissioning?

Decommissioning in Sweden – challenging in many ways
Ranstad uranium mining and milling facility
Studsvik material test reactors (R2 and R2-0)
Barsebäck NPP
In 2015 it was announced that 4 reactors are to shut down until 2020 due to low profits

- Ringhals units 1 (2020) and 2 (2019)
- Oskarshamn units 1 (2017-19) and 2 (2016)

Decommissioning is planned to be carried out with very short transition and care and maintenance periods
Phases of a nuclear power reactor according to Swedish regulations

- Normal operation
- Shutdown operation
- Care and maintenance
- Dismantling and demolition
- Release of buildings and site
- Future use

- Most regulations issued by the SSM on different aspects of nuclear facilities are applicable also during decommissioning
- Regulatory system based on self-assessment by the operator
Adaptation of the safety analysis report for care and maintenance after removal of nuclear fuel from the site

- The Safety Analysis Report (SAR) and the Operational Limits and Conditions should be adapted to the new situation.
- Exemptions can be given from several requirements concerning the no longer present nuclear fuel.
- The SSM has issued guidelines to facilitate the process of granting exemptions and reviewing the adapted SAR:s in 2015.
- The care and maintenance phase is not mandatory.
What is “dismantling”?

Disassembly or segmentation of major contaminated or activated components or structures

Does not include for example:
- removal of spent nuclear fuel
- management of operational waste and removal of loose objects,
- removal of contaminated, non-safety related components for reuse in other nuclear facilities,
- removal of non-contaminated, non-safety related components and structures,
- system decontamination with subsequent waste treatment.

Not clearly defined, interpretation by praxis
# Required documents and approvals before dismantling

<table>
<thead>
<tr>
<th>FINAL DECOMMISSIONING PLAN</th>
<th>General data according to Article 37 of the Euratom Treaty (to be submitted to the European Commission)</th>
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<tr>
<td>SAR for dismantling</td>
<td>Waste management plan and waste type descriptions (Regulatory approval required)</td>
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<td>Characterisation report (implicitly required)</td>
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Final decommissioning plan

Purpose: Describe and justify the planned decommissioning activities

Main issues:
- What needs to be taken care of?
- What are the boundary conditions?

Basis for other documents:
- Detailed measures and procedures for
  - Characterisation
  - Dismantling
  - Waste management
  - Radiation protection
  - Safety
  - Security
  - Etc.

Importance of Decom Plan once other documents in place??
Safety analysis report for dismantling

- Description of the facility and its functions (those relevant during dismantling), radioactive inventory, hazards, organisation and planned safety and protection measures.
- Content not well specified in regulations.
- More details on safety can be analyzed and described by the licensee in advance of each work package or subproject within the decommissioning project (no formal approval needed).
- Alternatively, the licensee may adopt the SAR for a specific dismantling stage or period of time only.

The SSM plans to prepare guideline on this issue before new regulations are in place.
Waste management plan

Purpose:
Describe and justify the planned waste management activities

Depends heavily on

- Characterisation of the facility
- Identification of all applicable requirements
- Waste acceptance criteria
- The decommissioning plan
Waste type descriptions (WTD)

- Documents that define typical waste packages and describe the methods for ensuring that they fulfill the waste acceptance criteria of the repository.
- For waste without existing repository, preliminary waste acceptance criteria have to be established.
- New procedure for elaboration of WTD was recently established. Implementation ongoing.

Depends heavily on waste acceptance criteria, thus difficult for waste without existing repository
General data according to Article 37 of the Euratom Treaty

- Report to the European Commission needed for the dismantling of nuclear reactors, mixed-oxide fuel fabrication plants and reprocessing plants
- To be submitted to the Commission not less than six months before “any authorisation for the discharge of radioactive waste is granted by competent authorities”
- The SSM awaits any review comments from the Commission before approving the SAR for dismantling or partial demolition projects

The SSM is currently streamlining its internal processes in anticipation of the increased number of decommissioning projects
Main experiences

- Difficult to foresee the full impact of regulations before they have been put in practice (a “journey” for both regulators and licensees).
- Important to characterize the facility carefully and prepare for waste routes in correspondence with the existing or planned waste management system.
- Flexibility and preparedness for changes needed, to manage new information and change in plans (licensee and SSM).
- The decommissioning plan becomes more or less obsolete once the SAR and waste management plan has been approved.
- Industry intention: Immediate partial dismantling projects, with spent fuel in the facility.
Summary

- During 2015 NPP owners decided to shut down four of Sweden’s ten remaining nuclear reactors by 2020, Oskarshamn units 1&2, Ringhals units 1&2.
- Intense period of decommissioning in Sweden over the next 10-15 years.
- Parallel development of guidelines and new regulations to tackle the increasing workload as well as streamlining internal processes.
- Our own lessons learnt are very valuable, but more international collaboration and exchange of experience would be beneficial for SSM.
Thank you for your attention!

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