Government Offices of Sweden

Strål säkerhets myndigheten
Swedish Radiation Safety Authority

Sweden's National Presentation (Country Group 7)

Eighth Review Meeting of the Joint Convention

Vienna, 18 March 2025

Statement on the Review Process

- According to Article 32 of the Joint Convention, Contracting Parties shall submit their national reports addressing the measures taken to implement their obligations under the Convention.
- The process of revision of national reports of other Contracting Parties, as foreseen under article 30 of the Joint Convention, revealed that one Contracting Party has reported on measures taken in respect of facilities that are located on another Contracting Party's territory.
- To ensure an effective review process and in line with the continuous practice of previous review meetings, the Contracting Parties should only report on facilities that are situated on their territory recognised under international law, and should refrain from reporting on facilities located on other Contracting Parties' territories.

Regulatory body / Waste management company – mandates and roles

- **Swedish Radiation Safety Authority (SSM)**
  - Policies, regulations and harmonisation
  - Licensing
  - Inspection and enforcement
  - Emergency preparedness and response
  - Knowledge management

- **Swedish Nuclear Fuel and Waste Management Co (SKB)**
  - Safe handling and disposal of spent nuclear fuel and radioactive waste
  - Safe decommissioning and dismantling of nuclear facilities
  - RDD programme – Research, Development and Demonstration
  - Cost calculations and funding of management and disposal of spent nuclear fuel and radioactive waste

Presentation outline

Overarching Issue 7th RM

- Introduction
- **Summary of basic information**
- Developments since the last review meeting
- Sweden’s disposal programme – status and plans
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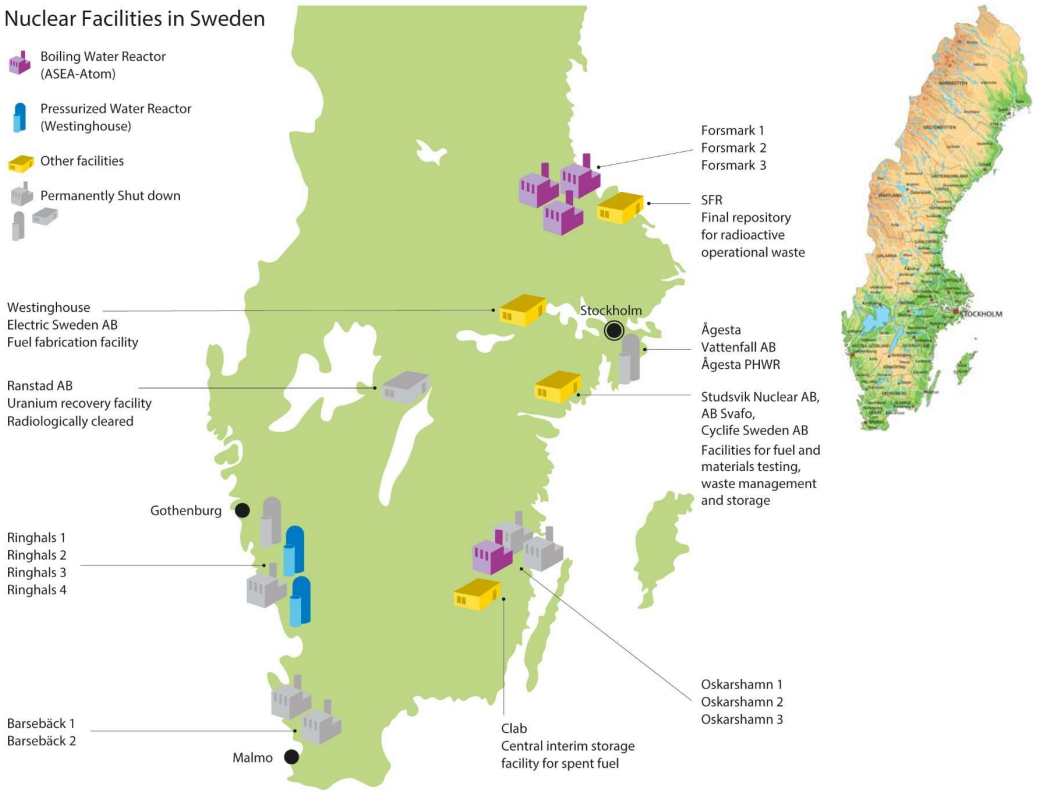
Sweden’s nuclear programme



- Six power reactors in operation
- Decommissioning
  - Six power reactors
  - Ågesta PHWR
  - Research reactors (Studsvik)
- Central interim storage facility for spent fuel (Clab)
- Final repository for short-lived LILW (SFR)
- Fuel fabrication plant (WSE)
- Waste treatment and materials testing facilities (Studsvik)
- Ranstad uranium extraction facility (released from regulatory control)

Non-nuclear activities that generate radioactive waste

- 500 industrial facilities
- 70 laboratories with unsealed radioactive sources
- 60 radiography companies
- 20 clinics for radiotherapy
- 10 cyclotrons for production of medical radioisotopes
- Four facilities with particle accelerators
  - one under decommissioning
  - one has applied for trial operation

Legacy waste

- The legacy waste at the Studsvik site originates from:
  - nuclear activities, mainly research and waste treatment at the Studsvik Tech Park, and
  - non-nuclear related activities, such as hospitals, industry, armed forces, and research
- In 1988, the NPP licensees became financially responsible for the legacy waste
- In 1992 AB Svafo, a company jointly owned by the NPP licensees, applied to the Swedish Government to take over responsibility of legacy waste produced before June 30th 1991.
- There is some remaining disagreement on what parts of the legacy waste that fall under the responsibility of AB Svafo.

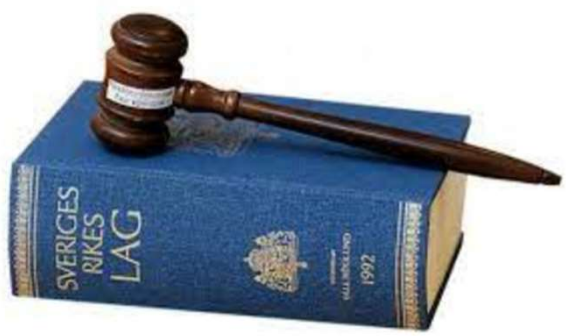
National policy

- Generators of spent fuel and radioactive waste are responsible for safe decommissioning, management and disposal
- Generators shall also bear the associated costs (polluter pays principle)
- Swedish spent fuel and radioactive waste shall be disposed of in Sweden
- Foreign spent fuel and radioactive waste is, as the main rule, prohibited to be disposed of in Sweden
- Spent fuel is not reprocessed, i.e., direct disposal of SF
- The State has the ultimate responsibility (after closure of the repositories)

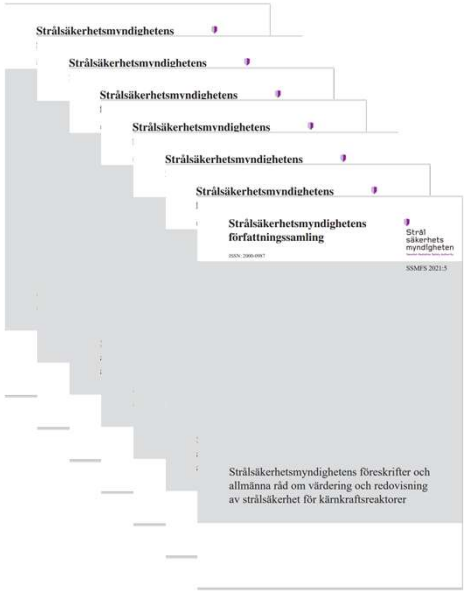
Legislative and regulatory framework

- All articles in the Joint Convention are covered in Swedish legislation

Swedish law



SSM's Code of Statutes



Key elements and efforts

- Stable financing system since early 1980s
- Clear allocation of responsibilities
- Legal requirement since early 1980s on conducting Research, Development and Demonstration programme (RD&D)
- Provisions for stakeholder involvement

- Successful implementation of storage and disposal solutions:
  - Interim storage facility for spent nuclear fuel (CLAB) since 1985
  - Repository (SFR) for final disposal of LILW in operation since 1988
  - Spent nuclear fuel repository approved by Government in 2022
  - Shallow land burial facilities for VLLW at NPP sites

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New energy policy 1(2)

- Following the general elections in September 2022 the Government announced a new energy policy to achieve climate objective of net-zero emissions by 2045
- Included replacing “renewable” by “fossil free” in the national energy policy
- The new policy allows and encourages new-build of nuclear power reactors
- Aims for new nuclear with installed electrical capacity equal to
  - two large-scale reactors in operation by 2035
  - ten new large-scale reactors in operation by 2045

New energy policy 2(2)

- The Government has initiated a large number of actions to prepare for new nuclear.
- Some examples of actions:
  - Assignment of a National coordinator for new nuclear
  - Proposal of necessary changes in the legal framework
  - Proposal of financing system including loans and contract for difference
  - Development of more efficient licensing process
  - Strengthening of national competence provisions, incl. possible TSO
  - Strengthening of resources at the regulator (SSM)
  - Inquiry on management of waste from new nuclear (including fees and financing of disposal)

Strengthening national competence

Overarching Issue 7th RM

- Assignment to SSM to strengthen the authority's competence as well as contributing to strengthen the national competence in the field of safe nuclear power (2023-2025)
- Increased funding to SSM for additional staffing as well as for funding of research activities

INCREASED FINANCING TO SSM [M€uro]		
YEAR	STAFFING	RESEARCH
2023	2,5	2,0
2024	5,0	4,0
2025	5,0	4,0

Inquiry on establishment of a TSO

Overarching Issue 7th RM

- As part of its actions to improve national competence, the Government in 2024 gave the Swedish Agency for Public Management an assignment to examine the effectiveness and efficiency of technical support for nuclear safety and radiation protection, e.g.
  - To review the need for both SSM and the industry for increased technical support (TSO)
  - To review existing arrangements for technical support for SSM and identify strengths, weaknesses and vulnerabilities
  - To review arrangements in other countries
  - To propose an arrangement beneficial for both SSM and the nuclear industry that provides effective support in the long term
- The resulting proposal (January 2025) is to establish an internal TSO function within SSM; the proposal is currently out for referral.

Developments in legislation

- As part of to the Government’s plans for new nuclear, extensive investigations are conducted to propose changes of the legal framework, including to:
  - modify the licensing fee basis to accommodate new reactor types (reported January 2025)
  - make the licensing process more efficient (reported January 2025)
  - adapt and develop the existing nuclear waste programme for the management of waste from new reactors (to be reported 29 August 2025)
  - adapt emergency preparedness requirements (to be reported 27 February 2026)
  - propose amendments to the current Act on Nuclear Activities

Regulations

- Major revision of the SSM Regulatory Code (started 2013), now in final stages
- Regulations issued since last RM
  - Regulations on predisposal management of radioactive waste from nuclear facilities (SSMFS 2021:7)
  - Regulations on design, assessment and operation of nuclear power plants (SSMFS 2021:4, SSMFS 2021:5 and SSMFS 2021:6)
- Planned regulations
  - Regulations on design, assessment and operation of non-NPP nuclear facilities, e.g., management and disposal facilities (expected to enter into force 2026)
  - Regulations on specific activities and design aspects, for example building structures and lifting equipment (no forecast for entry into force)

Decommissioning

- Ranstad uranium mining and milling facility released from regulatory control after radiological clearance in 2019
- Seven nuclear reactors are under decommissioning and large-scale dismantling is ongoing
  - all spent nuclear fuel has been transported to the Clab interim storage (within about a year after final shut-down)
  - Barsebäck 1 & 2, Oskarshamn 1 & 2 appr. 50 % completed
  - Ringhals 1 & 2, dismantling started in 2024
  - Ågesta reactor, dismantling almost completed, clearance is ongoing
- The two Studsvik materials research reactors have been cleared, and demolition of the building structures is ongoing
- New interim storage facilities for decommissioning waste established at several sites

Developments in spent fuel and RW management

- Increased storage capacity at CLAB (8,000 → 11,000 tonnes spent fuel)
  - SSM approval February 2024
- Extension of SFR repository for short-lived LILW radioactive waste to accommodate decommissioning waste (60.000 m3 → 180.000 m3)
  - SSM approval for start of construction November 2024
- Construction of KBS-3 repository for spent nuclear fuel
  - Government licensing decision January 2022
  - Final steps of environmental licensing process 2022-2024
  - PSAR submitted to SSM for review January 2025 (surface installations initiated)

IRRS & Artemis – review outcomes

- Full-scope IRRS Peer Review conducted November 2022 ”back to back” with ARTEMIS Peer Review April 2023
- Some findings with relevance to waste management
  - comprehensive regulatory structure, but lack of sufficient qualified SSM staff in some key functional areas
  - need for national strategy for competence against background of policy on nuclear power
  - establish new program to search for and manage disused and orphan sources
- SSM implementing an action plan to address all challenges identified in the IRRS review report, including
  - engagement in collaborative international research programmes to maintain technical competences relating to spent fuel and radioactive waste management

Overarching Issue 7th RM

IRRS & Artemis – review outcomes

- ARTEMIS outcomes
  - Good Practice relating to how the national framework has facilitated progress in achieving wide acceptance for siting and licensing of spent fuel disposal
  - Several review findings concern gaps in the provision of safe and sustainable management routes for non-nuclear radioactive waste
  - One finding related to national competence provision (overlap with IRRS actions)
- ARTEMIS action plan
  - Investigation by Government aimed at identifying sustainable solutions for all non-nuclear wastes, reporting before this summer. Supported by updated SSM survey of the extent of the challenge, published autumn 2024.
- Follow-up
  - Both review reports have been made publicly available - published on SSM's website
  - Combined IAEA/ARTEMIS follow-up mission during 2027 being planned with IAEA

Overarching Issue 7th RM

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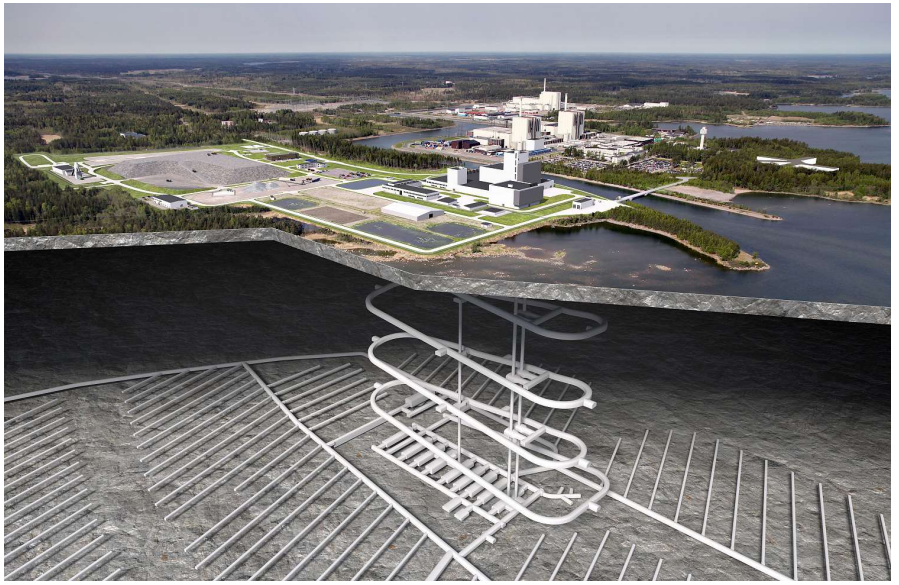
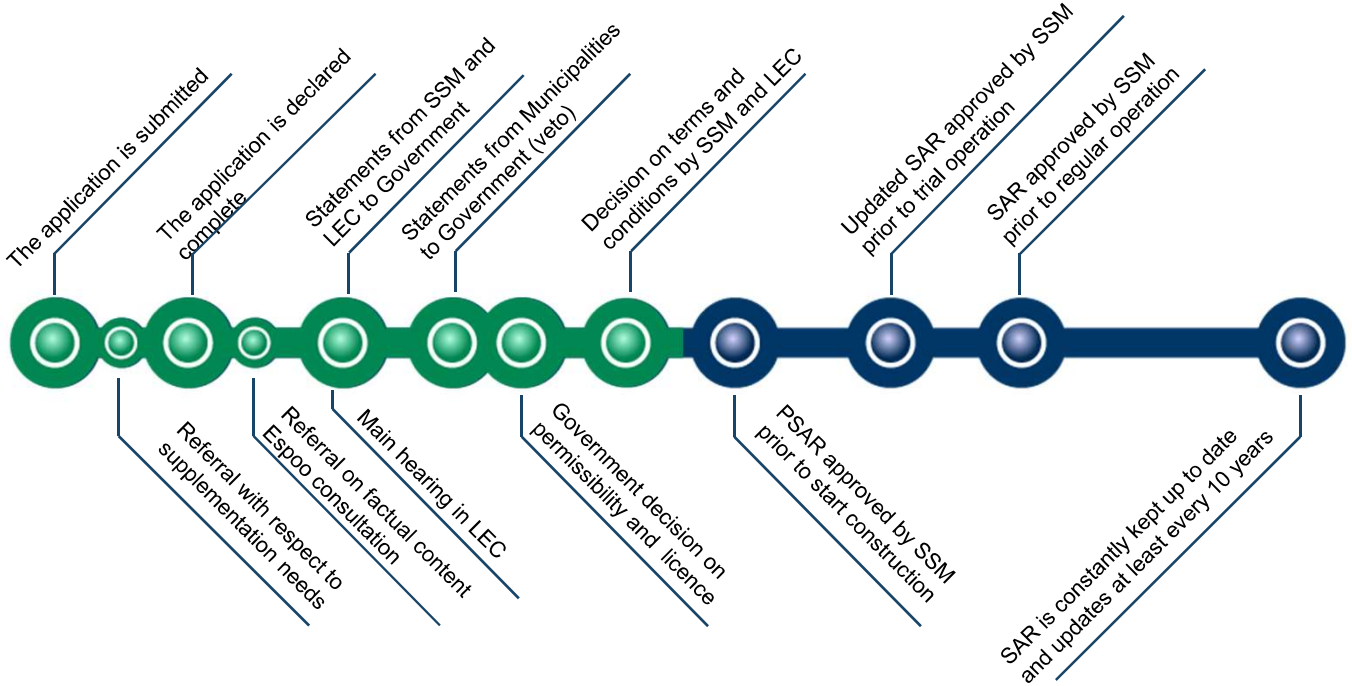
Disposal System for Spent Fuel (KBS-3-system)

- In 2011, SKB applied for a disposal system for spent fuel (KBS-3-system)
  - Based on 40 years of R&D.
  - Extensive site investigations, including the involvement of municipalities and the public.
  - Consisting of:
    - Extended capacity of interim storage (Clab), increasing from 8,000 to 11,000 tonnes. No physical extension needed.
    - Construction of an encapsulation facility (integrated with Clab).
    - Construction of a repository (KBS-3 method).
- Licencing according to the Act on Nuclear Activities and the Environmental Code.
- Decided by the Government after review by SSM and the Land and Environment Court.



Progress / Government Decision – KBS-3-system

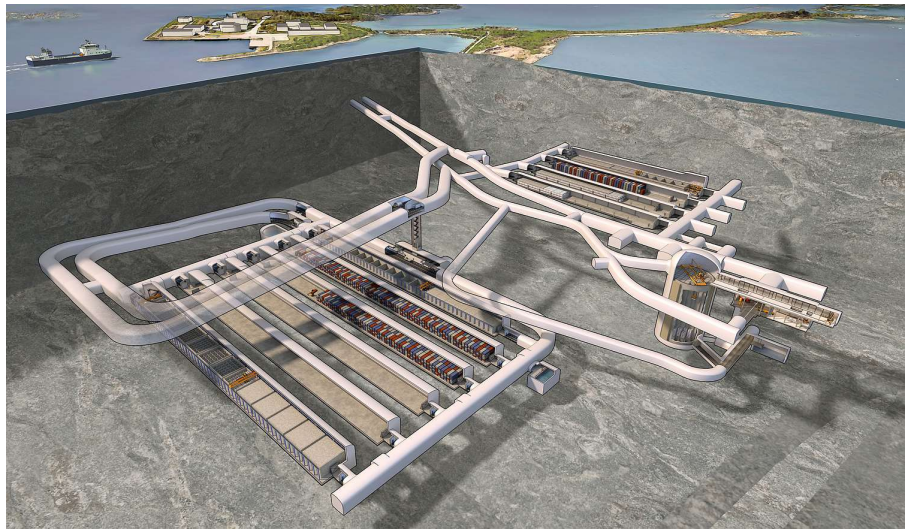


***PSAR** – Preliminary safety report, **SAR** – Safety Report*
***SSM** – Radiation Safety Authority, **LEC** – The Land and Environment Court*

- The SAR for the interim storage facility to increase capacity from 8,000 to 11,000 tons of fuel was approved in February 2024.
- The PSAR (and associated documents) for the Spent Fuel Repository was submitted in January 2025.
- Construction of the Spent Fuel Repository can commence after the approval of the PSAR.

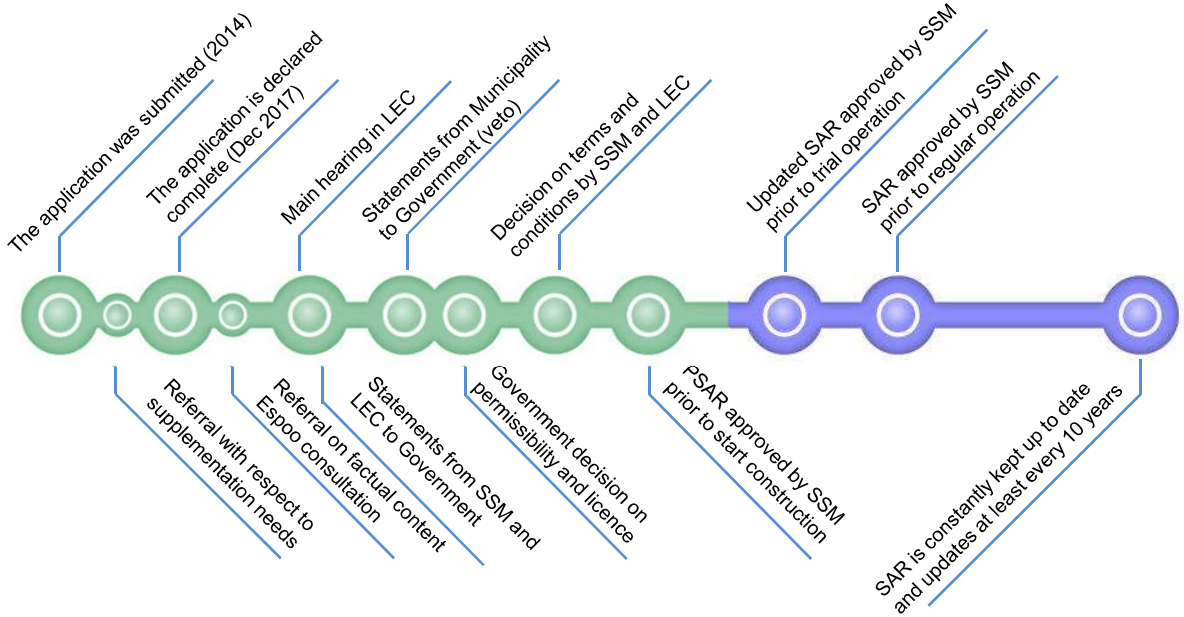
Extending the Repository for Short-lived waste (SFR)

- In 2014, SKB applied for an extension of the existing repository for short-lived LILW.
  - This was necessary for the disposal of decommissioning waste and additional operational waste.
  - The extension consists of six new waste vaults (currently five) and increases the capacity from 63,000 m^3 to 180,000 m^3.
- Licencing according the Act on Nuclear Activities and the Environmental Code.
- Decided by the Government after review by SSM and the Land and Environment Court.



Extension to the left, existing repository to the right,

Progress / Government Decision – Extension of SFR



***PSAR** – Preliminary safety report, **SAR** – Safety Report*
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- The PSAR was submitted in March 2023.
- In November 2024, SSM granted a permit to commence rock construction work.
- Rock construction work began in December 2024, with the first blasting in January 2025.
- Construction of the extension is estimated to six years.

Non-conformities of Waste Disposed of in the Repository for Short-lived Waste (K.1.3)

- Legacy waste stored at Studsvik Tech park was examined using both x-ray and destructive methods (including sampling). The study concluded that the waste documentation was inaccurate.
- Waste with a corresponding origin, but with a lower radionuclide content, has already been disposed of in the repository for short-lived waste (SFR). The waste, which consists of 2,844 drums, was placed in containers and disposed of in the waste vault for low-level radioactive waste. Currently, the waste vault is almost full, and the containers have been sitting in a corrosive environment for decades.
- Given the potential inaccuracy in documentation of the studied waste, concerns were raised about the accuracy of the documentation for the waste already disposed of, and the post-closure radiological consequences were assessed. Based on the estimated inventory, the post-closure safety requirements could not be met. However, the non-conformity is not a problem for the operational safety of the repository.
- Based on the assessment of post-closure safety, the SSM has issued an injunction requiring the non-conforming waste to be retrieved. Although logistically and technically challenging, SKB is planning to retrieve the waste for further management by its owner.

Ageing Management

Overarching Issue 7th RM

- Both SFR and Clab were commissioned in the late 1980s (Clab in 1985 and SFR in 1988), and both facilities will remain in operation until the later part of the 2000s. Managing ageing components specifically, and facilities in general, is therefore vital for ensuring radiologically safe and efficient operations.
- In the case of an underground repository like SFR, ageing management includes traditional activities such as replacing vital components according to a predefined five-year-plan or inspecting the rock to prevent fall-out. Currently, while the SFR is being extended, no waste can be received. This allows for more substantial upgrading and maintenance activities in the existing part.
- For the interim storage facility for spent fuel, Clab, ageing management involves both the ageing of components and the facility itself, traditional ageing management according to a predefined five-year-plan, as well as the ageing of the spent fuel stored in the facility. Understanding the ageing of fuel is relevant for maintaining fuel integrity and is important for both the operation of the interim storage and the encapsulation plant.

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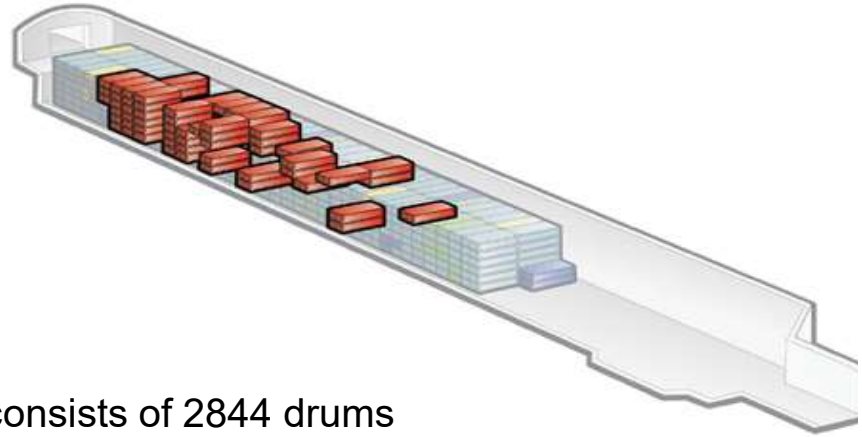
National competence supply

Overarching Issue 7th RM

- Government assignment to SSM authority's competence as well as contributing to strengthen the national competence in the field of safe nuclear power (2023-2025)
- SSM is currently working to quantify the need for national competence and educational needs on a national scale with the purpose to;
  - contribute to enhancing the attractiveness of the sector
  - contribute to strengthening the education capacity, and
  - develop collaboration platforms between e.g. authorities, universities and the industry to strengthen the overall competence system in the country
- Since the 7th RM, SSM has grown from about 290 to 345 employees, and expects to approach 400 employees by the end of 2025
- SSM has taken measures to secure SSM's competence in a competitive national context
- SSM has customized its organization to prepare for upcoming challenges

Non-conformities of waste in the SFR



- Challenge
  - The problematic waste category in the SFR consists of 2844 drums containing legacy waste (and waste produced after 1991)
  - The legacy waste in SFR has a documented inventory of long-lived alpha emitters not suitable for SFR
- Developments since 7th RM
  - In January 2024, the Government decided to provide financial support for the management of this waste
  - SSM has requested the operator of the SFR-repository to retrieve the waste
    - The decisions were appealed by SKB and the waste generators
    - The appeals are handled by the Government

The responsibilities to develop back end facilities

Overarching Issue 7th RM

- By law, the responsibility to safely manage and dispose radioactive waste rests with the waste generator
- SKB's development of a back-end program is prioritized based on the needs of the owners, i.e. the license holders of the NPP's
  - Currently, the program focuses on short-lived LILW and spent fuel
- The SFL-repository for long-lived LILW is still in early development – planned operation in the 2050'ies
- The SFL-repository will contain the following categories of long-lived LILW:
  - Metallic waste from the decommissioning of NPP:s
  - Nuclear waste from R&D at the Studsvik Tech Part, including legacy waste
  - Current and future radioactive waste from non-nuclear activities

Securing funds for future costs for Studsvik LL operational RW

- Challenge
  - A significant part of the waste currently stored at the Studsvik Tech Park is long-lived LILW, mainly from the operation of the facilities
  - The lack of waste acceptance criteria (WAC) for SFL leads to technical and financial uncertainties
  - Furthermore, the Financing Act only requires funding for waste from decommissioning and spent fuel
- Actions
  - SSM and the National Debt Office have suggested a revision of the Financial Act in order also to cover the future costs for long-lived operational LILW
  - The ordinance issued in 2025 also covers costs related to the characterization and treatment of parts of the legacy waste

Management of radioactive waste from outside the nuclear field

Overarching Issue 7th RM

- Challenge
  - The only recognised radioactive waste treatment facility in Sweden, Cyclife Sweden AB, operates on a commercial basis and has no general obligation to accept radioactive waste from all potential waste producers.
  - There is a financial risk for the company associated with assuming responsibility for radioactive waste.
- Action
  - The Government is currently conducting an inquiry to propose ways to achieve sustainable safe management of this radioactive waste. The inquiry is supported by SSM and will be reported at the end of May 2025.

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Management of SNF & RW from potential new nuclear reactors

- New energy policy with plans for new nuclear has implications for waste management
- Current system for management of SNF and RW designed for the existing fleet of reactors, existing licensees, volumes and types of waste

Actions:

- Ongoing Government inquiry on legal and regulatory structures for enabling new nuclear
  - recommendations related to the nuclear waste programme expected in August 2025
- Ongoing SSM internal study on regulatory expectations related to nuclear waste management in applications for new nuclear

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Proposals for Good Practice and Areas of Good Performance

- Sweden’s spent fuel disposal programme was acknowledged with Good Practices at the Joint Convention 5th ad 7th RMs and by Artemis in 2023
  - continued implementation since the 7th RM
- Proposal for Areas of Good Performance
  - measures to strengthening competence on a national scale and with SSM
  - ensuring transparency and stakeholder involvement in a new phase of construction of disposal facilities

Transparency and stakeholder involvement during construction of a SNF repository

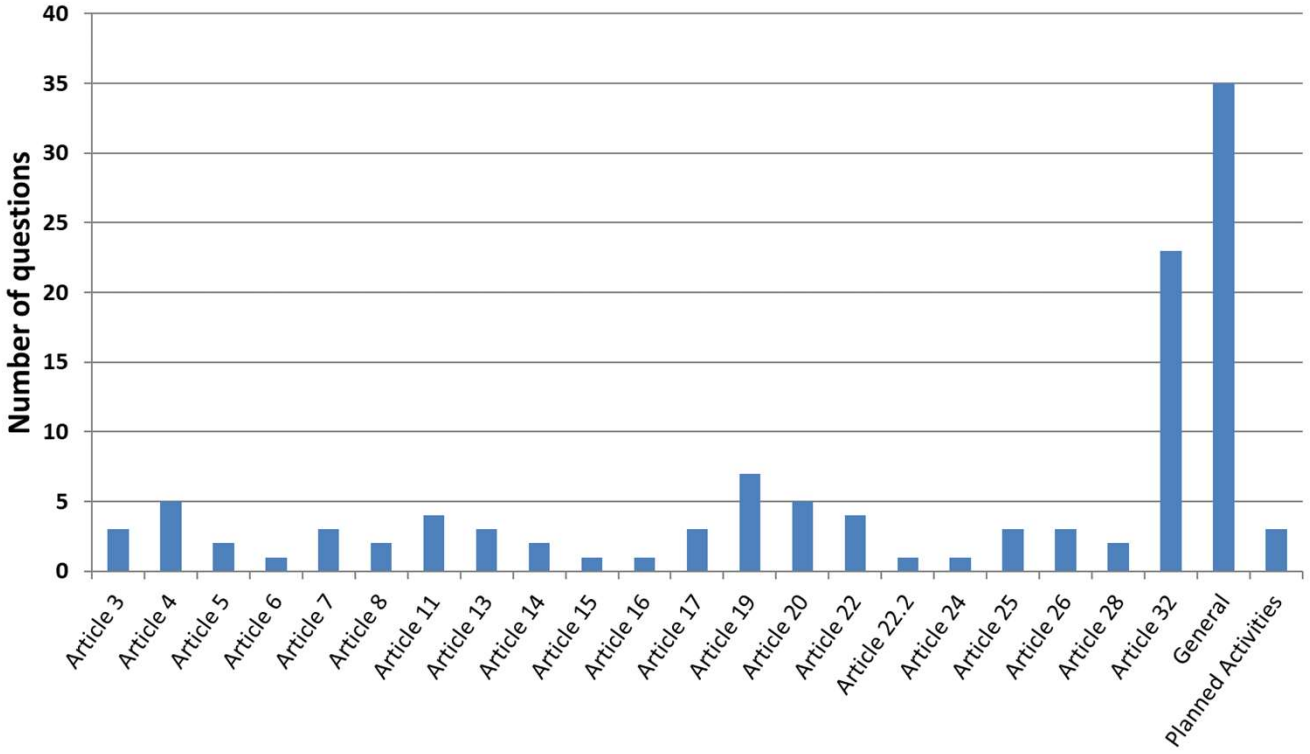
Overarching Issue 7th RM

- Sweden is moving from R&D, siting and licensing to a new phase of construction and eventually operation of waste repositories
- Actions/provisions:
  - Mandatory meetings between SKB, the municipalities and key stakeholders at least once a year
  - The Government has established Local Safety Boards in municipalities hosting nuclear facilities
  - SSM initiated research project (INCLUDE) to support development of a public outreach strategy

Rapporteur's matrix

Type of liability	Long-term management policy	Funding of liabilities	Current practice/ facilities	Planned facilities
Spent fuel	NPP licensees responsible. Shared obligations for cost calculations and development of disposal solutions. Strategy in place for disposal.	Funded by fees on nuclear energy production, accumulated in segregated funds (the Nuclear Waste Fund).	Stored on site initially, then transferred to the central interim storage facility (Clab) pending disposal. Reviews of the adequacy of funding every three years.	Government licence granted for construction of an encapsulation plant and a spent nuclear fuel repository. Pending conditions by the Land and Environment Court and approval of PSAR by SSM. All licences in place for extension of storage capacity in Clab.
Nuclear fuel cycle waste	NPP licensees responsible. Shared obligations for cost calculations and development of disposal solutions. Strategy in place for disposal.	Mainly funded by fees on nuclear energy production, accumulated in the Nuclear Waste Fund. Disposal of short-lived operational LILW (SFR) from NPPs, paid for directly by owners.	Short-lived LILW disposal at existing repository (SFR); shallow land burial for short-lived VLLW are present at NPP sites. Reviews of the adequacy of funding every three years.	Government licence granted for extension of the SFR repository for short-lived LILW. Pending approval of PSAR by SSM. Long-lived LILW to be disposed of in the planned repository for long-lived LILW (SFL).
Non-power waste	Disposal at fuel cycle waste facilities when appropriate.	Financed by producers/ owners of waste. Government funding available for legacy waste.	Disposal at fuel cycle waste repository (SFR) or interim storage pending disposal in the planned repository for long-lived LILW and nuclear fuel cycle waste (SFL).	Government licence granted for extension of the SFR repository for short-lived LILW. Pending approval of PSAR by SSM. Long-lived LILW to be disposed of in the planned repository for long-lived LILW (SFL).
Decommissioning	Licensees are responsible.	Mainly funded by fees on nuclear energy production (NPPs) or other fees, accumulated in the Nuclear Waste Fund.	Preliminary plans for decommissioning exist for all nuclear facilities, with more detailed plans for those approaching or undergoing decommissioning. Reviews of the adequacy of funding every three years.	Government licence granted for extension of the SFR repository for short-lived LILW. Pending approval of PSAR by SSM. Long-lived LILW to be disposed of in the planned repository for long-lived LILW (SFL).
Disused sealed sources	Returned to manufacturer or disposed of in SFR or in interim storage pending disposal in the planned repository for long-lived LILW (SFL).	Financed by producers/ owners of waste. Government funding available for orphan sources.	Returned to manufacturer or disposed of in SFR or in interim storage pending disposal in the planned repository for long-lived LILW (SFL).	To be disposed of in repositories for nuclear fuel cycle waste, SFR or SFL (if not returned to the manufacturer).

Questions posted to Sweden



Posted By	Number of questions
Belarus	8
Belgium	3
Canada	11
China	17
Czech Republic	3
Finland	3
France	2
Germany	4
Ghana	3
Hungary	6
Japan	2
Korea, Republic of	9
Poland	5
Russian Federation	9
Slovakia	1
Slovenia	1
Türkiye	3
Ukraine	14
United Arab Emirates	7
United Kingdom	3
United States of America	3
Total	117

Conclusions

- Sweden complies with the obligations and terms of the Joint Convention
  - National report submitted as required
  - Questions asked to other Contracting Parties
  - Answers provided on questions to Sweden
- Sweden reaffirms its commitment to the Joint Convention

Sweden’s delegation

Ministry of Climate and Enterprise:

- Ms. Eva Iveroth, Head of Section

Swedish Radiation Safety Authority (SSM):

- Mr. Michael Knochenhauer, Director General
- Mr. Björn Dverstorp, Sweden’s national point of contact to the Joint Convention
- Mr. Tomas Löfgren, Senior Advisor
- Mr. Bengt Hedberg, Senior Advisor
- Ms. Erica Brewitz, Senior Specialist
- Mr. Anders Wiebert, Senior Analyst
- Mr. Christoffer Forss Hadi, Inspector

Swedish Nuclear Fuel and Waste Management Company (SKB):

- Mr. Fredrik Vahlund, Senior Advisor

Permanent Mission of Sweden to the IAEA:

- Mr. Hilding Lundkvist, Minister Counsellor
- Ms. Anna Franzén, Scientific Counsellor
- Ms. Alva Tilling, Policy Officer
- Mr. Emrik Berggren, Intern

Officers:

- Mr. Magnus Westerlind, Senior Advisor (SKB)
- Ms. Åsa Zazzi, Senior Analyst (SSM)
- Mr. Michael Egan, Senior Advisor (SSM)