Decommissioning programme at IFE

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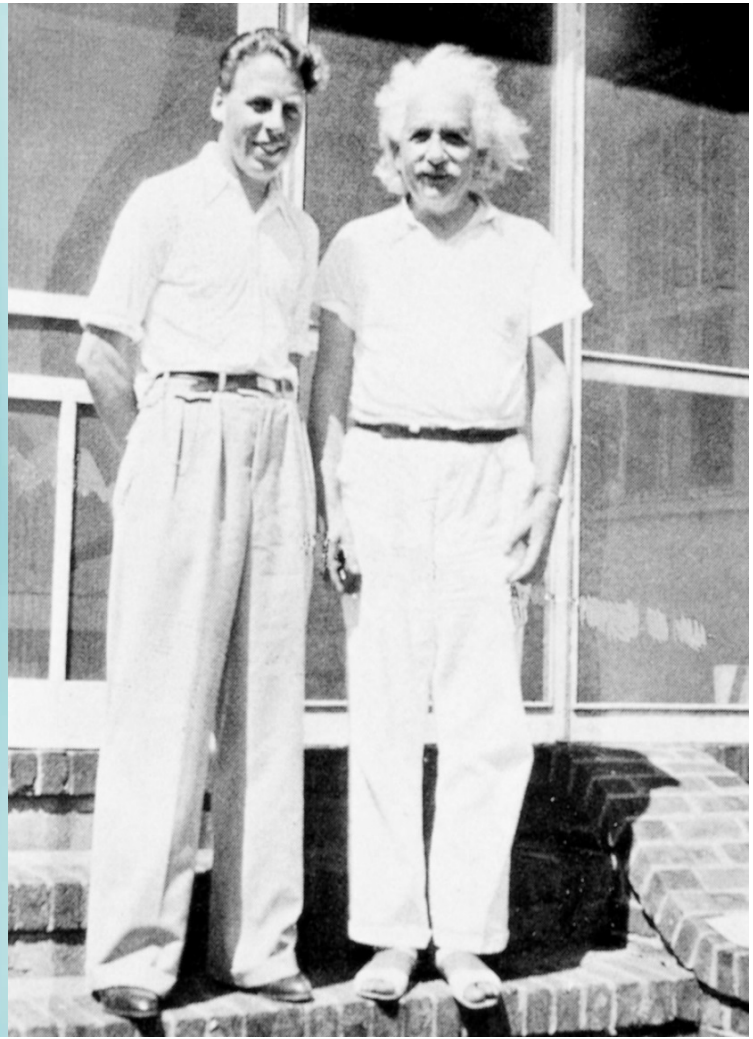
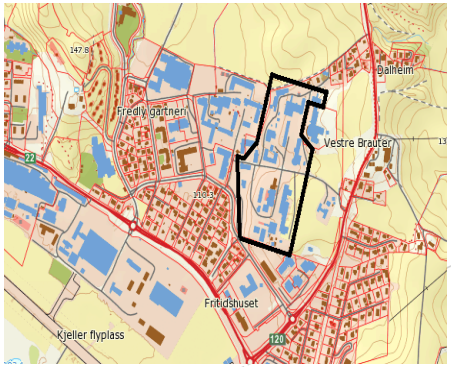
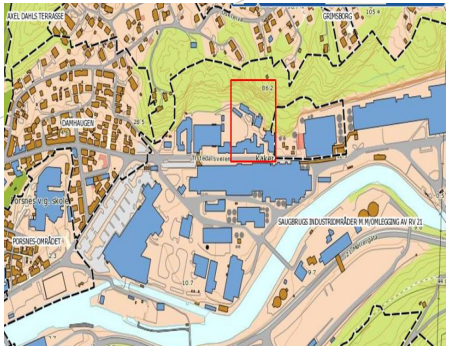
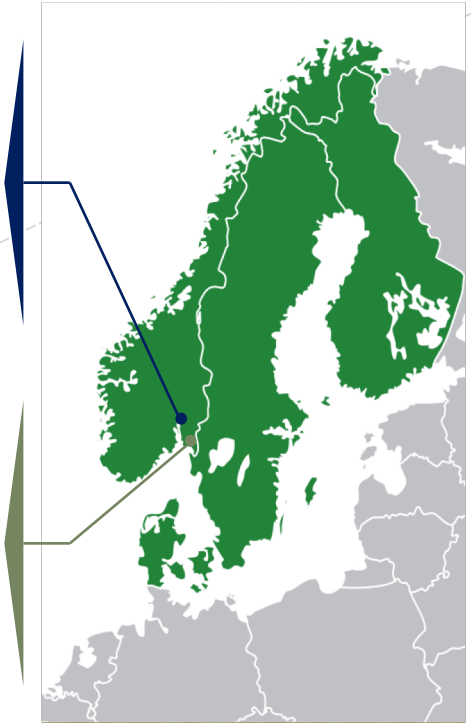


HALDEN KJELLER







Planning and implementation of decommissioning activities

Strategic
Several years ahead of time

Overall and long-term planning and decision
Adds guidelines for tactical and operational plans and activities
Starting with end state for the waste and planning backwards in time

Tactic
Quarterly and yearly

Collaboration between strategic and operational part of the organization to develop tactical plan, including measures to ensure competence, comprehensive processes and good interfaces to externals

Operational
Months, weeks and days

SAR. Detailed and technical planning, staffing, execution and documentation of work packages / subprojects
Responsibility for nuclear safety, HSE and security is in line with all internal and external guidelines

Planning tool between sector ATOM and NFS. Other sectors at IFE (DS, IED, STAN, ...) participate and support when needed at all levels

Transition from Operation to decommissioning of Nuclear Installations

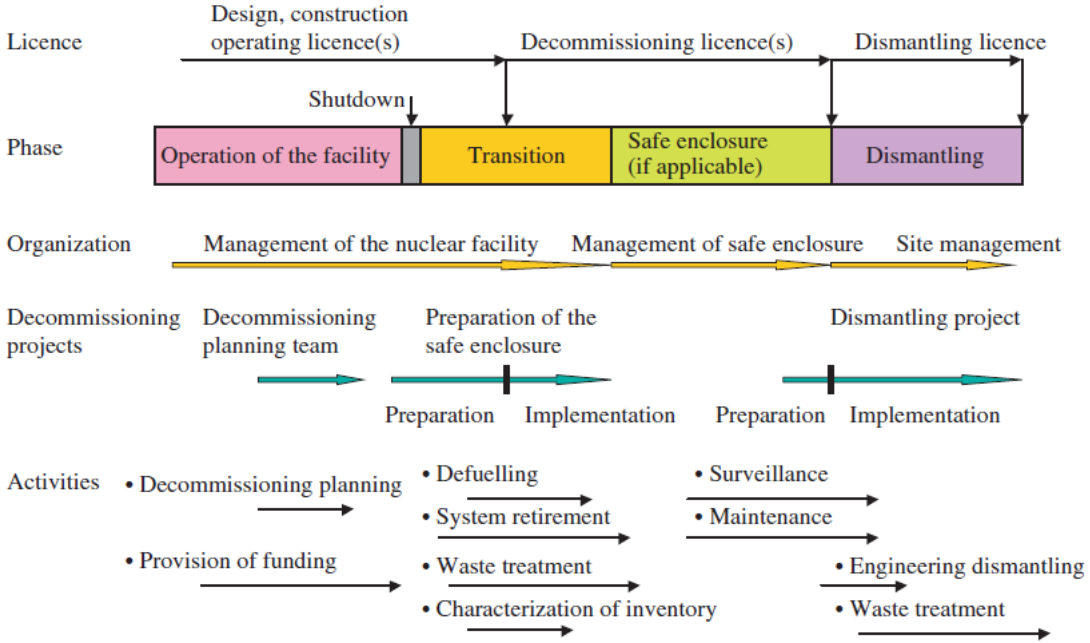


FIG. 1. Decommissioning related activities during the life cycle of an NPP.

Reference:
IAEA Technical reports series no.420
«Transition from Operation to decommissioning of Nuclear Installations»
2004

Ongoing decommissioning activities – Kjeller

- **Pilot projects Decommissioning URA**
  - Gamma scanner – Dissolver cell
  - Robotics – Dissolver cell
  - Information management system

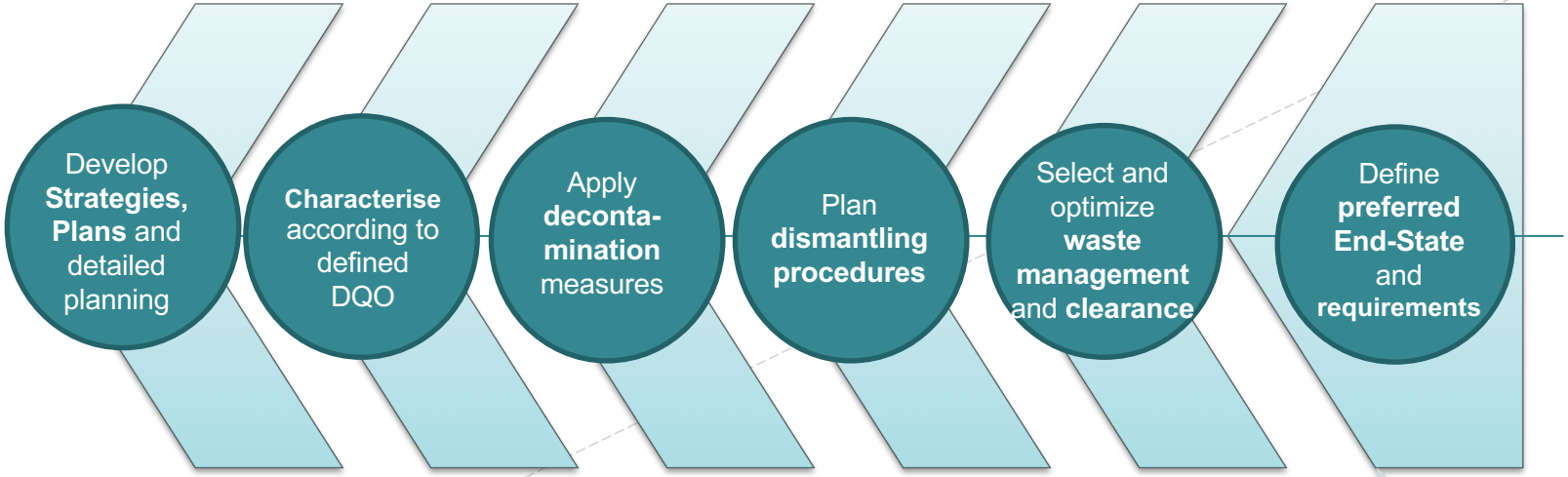
- **Decommissioning of URA (expected to be completed in 2022)**
  - Room 102A ongoing

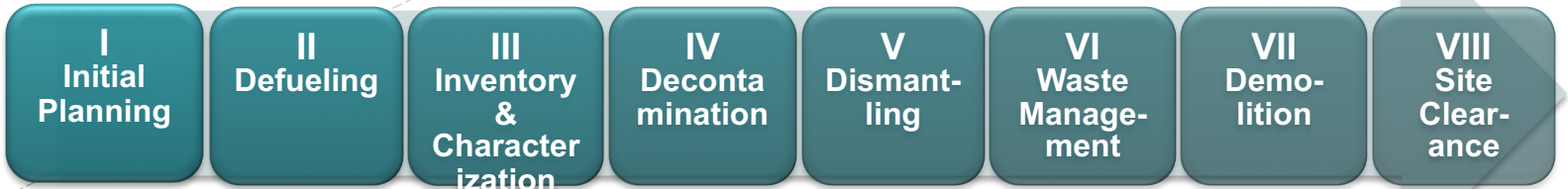
- **JEEP I and NORA, Kjeller**
  - Estimation of waste volumes that will go to KLDRA
  - JEEP I and NORA were both decommissioned under previous regulations
  - Must be re-entered, decommissioned to "out of regulatory control"

Decommissioning activities, Halden and Kjeller

- Competence mapping
- Retrieving historical data from the HBWR (log books)
- 3D scanning of the reactor hall - Building 3D model of HBWR
- Engage in Norwegian regulations and guidelines from the IAEA
- Setup of Schedule and WBS in accordance with ISDC / IAEA
- Cost estimation of decommissioning activities - use of the CERREX
- Start-up characterisation of components HBWR
- Harmonisation of decommission plans – Ongoing and Final
- Prepare a Nuclear Dictionary, Norwegian – English

Decommissioning planning – reverse from execution





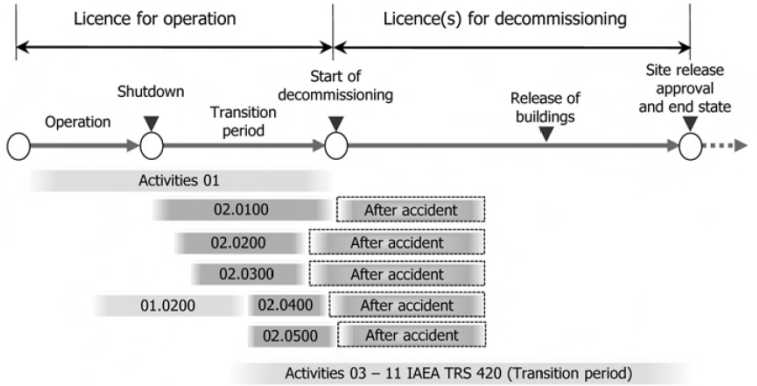
Fra Studsvik Nuclear AB

International Structure for Decommissioning Costing (ISDC) of Nuclear Installations, NEA No. 7088

Cost structure hierarchy

01 – Pre-decommissioning actions.
02 – Facility shutdown activities.
03 – Additional activities for safe enclosure and entombment.
04 – Dismantling activities within the controlled area.
05 – Waste processing, storage and disposal.
06 – Site infrastructure and operation.
07 – Conventional dismantling, demolition and site restoration.
08 – Project management, engineering and support.
09 – Research and development.
10 – Fuel and nuclear material.
11 – Miscellaneous expenditures.

Typical schedule for decommissioning activities of Principal Activity 02



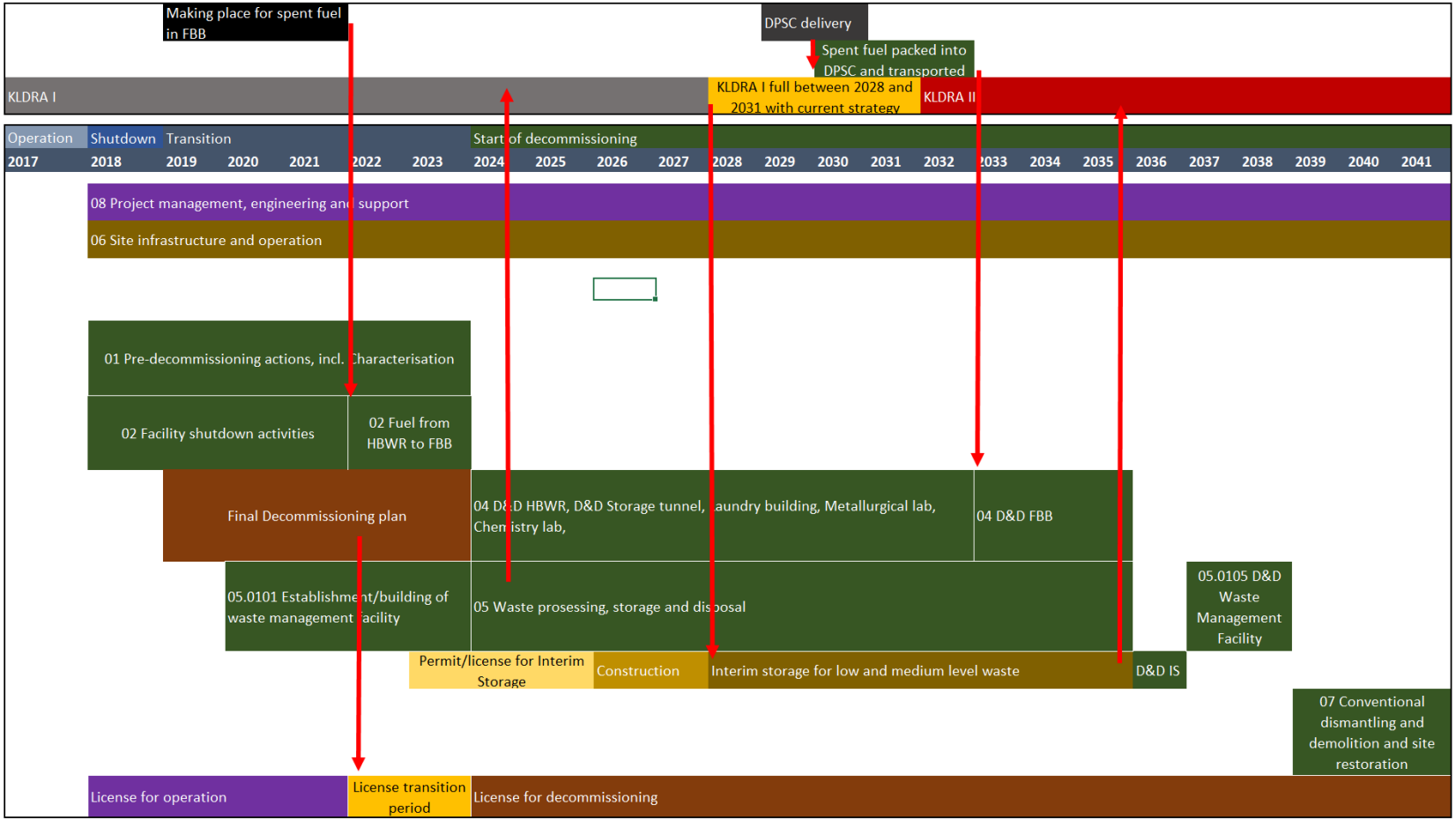
Note: The last row represents the time frame of the transition phase activities.

Overordnede faser i prosjektet

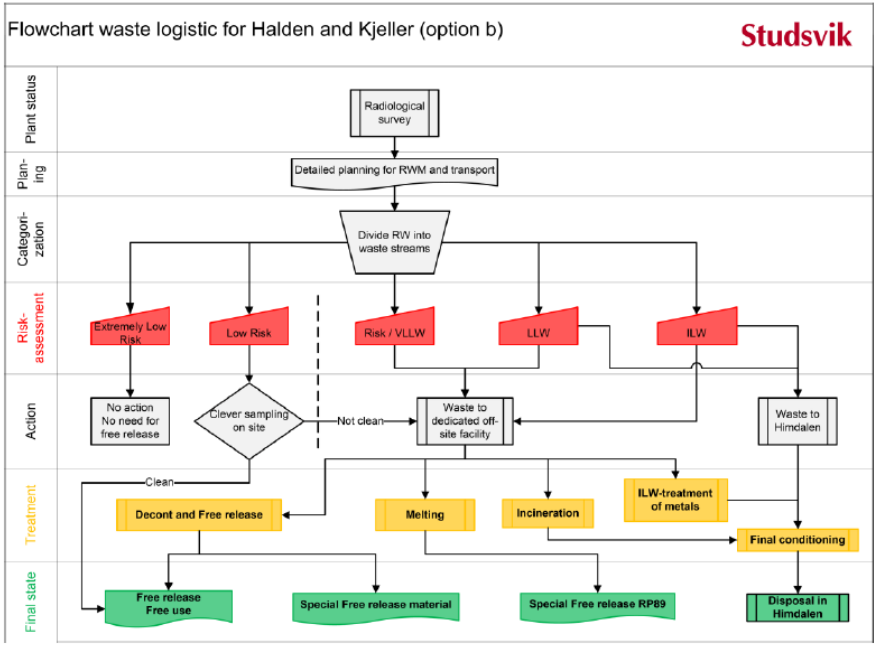
1	Overgangsfase og pre-dekom
2	Dekontaminering og demontering
3	Frigivning av regulert område

HBWR DEKOMMISJONERING

Overordnet fase i prosjektet					NND / ATOM		NFS	HUKI		
No.			ISDC Nr.	Aktiviteter	Strategisk	Taktisk	Operasjonell	Ansvarlig	Utførende	Konsultert
		3	07.0601	Routine maintenance						
		3	07.0602	Surveillance and monitoring						
1	2	3	08	**Project management, engineering and support**	S	T				
1			08.0100	**Mobilisation and preparatory work**						
1			08.0100-1	Få opp en beskrivelse av roller – og nødvendig kompetanse		T		ATOM	NFS, ATOM	
1			08.0101	Mobilisation of personnel						
1			08.0101-1	Utpeke: Prosjektleder, overgangsfasen		T		NFS	NFS	ATOM
1			08.0101-2	Ansette: Planlegger og kostnadsestimerer			O	NFS	NFS	ATOM
1			08.0101-3	Eget prosjektkontor i Halden ASAP (samlokalisering)		T		NFS	NFS	ATOM
1			08.0102	Establishment of general supporting infrastructure for ...						
1			08.0102-1	Etablering av generell støtteinfrastruktur for dekommisjoneringsprosjektet			O	NFS	NFS	ATOM, ADM "-& "
1			08.0102-2	Utarbeide føringer for design av anlegget ved dekommisjonering (inkl. intern avfallsflyt og buffer)		T	O	ATOM	ATOM	NFS
1			08.0102-3	Kartlegge behov for verksteder/Labber/ nye fasiliteter		T	O	NFS	NFS	ATOM, "-& "
1			08.0102-4	Kartlegge behov for spesielt utstyr (Hot celle)	S	T	O	ATOM	ATOM	NFS, "-& "
1			08.0102-5	Kartlegge behov for annet utstyr (kraner, sager etc)		T	O	NFS	NFS	ATOM, "-& "
1			08.0102-6	Utarbeide overordnet design av anlegget ved dekommisjonering (inkl. intern avfallsflyt og buffer), logistikkflyt og areal				NFS	NFS	ATOM
1			08.0102-7	Etablering av database arkitektur		T		ATOM	NFS, ATOM	DS, "-& "
1	2	3	08.0200	**Project management**						


Making place for spent fuel in FBB
DPSC delivery
Spent fuel packed into DPSC and transported
KLDRA I
KLDRA I full between 2028 and 2031 with current strategy
KLDRA II
Operation
Shutdown
Transition
Start of decommissioning
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
2041
08 Project management, engineering and support
06 Site infrastructure and operation
01 Pre-decommissioning actions, incl. Characterisation
02 Facility shutdown activities
02 Fuel from HBWR to FBB
Final Decommissioning plan
04 D&D HBWR, D&D Storage tunnel, Laundry building, Metallurgical lab, Chemistry lab,
04 D&D FBB
05.0101 Establishment/building of waste management facility
05 Waste prosessing, storage and disposal
05.0105 D&D Waste Management Facility
Permit/license for Interim Storage
Construction
Interim storage for low and medium level waste
D&D IS
07 Conventional dismantling and demolition and site restoration
License for operation
License transition period
License for decommissioning

Ongoing discussion – waste management strategy



Utdrag fra et av bakgrunnsdokumentene til KVU rapporten "Study on future decommissioning of nuclear facilities in Norway – Task 3 Waste management - :**4.9.7 Melting of metals for recycling or volume reduction. Background.**

Possible measures on how to reduce waste volumes to Himdalen / KLDRA

- Characterisation of the plants to be decommissioned
- Consider on-site waste treatment

versus

- Export of radioactive waste for off-site recycling
  - Combustion
  - Melting
  - Chemical decontamination

- Acquisition of equipment at each plant that enables better characterisation and sorting of today's waste
- National strategy for the management of radioactive waste
- Establishment of reception for "non-deposit" radioactive waste

Decommissioning strategy - preparation for decommissioning

- Templates and recommendations (IAEA) in the work
- Established a core team (NFS-ATOM-DS)
- Involve other sectors in IFE
- Use of external consultants to learn and to establish a solid foundation
- Financing - IFE is working actively with NND and NFD

Environmental mapping and end state

Original state

Background values

No restrictions on use of the areas

Environmental mapping at Kjeller in progress

Free release

Restricted / Unrestricted

Outside regulatory control


Thank you for your attention