Development of the Swedish National Database for QA of Spent Nuclear Fuel

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The owners

- SKB:s mission is to take care of all the Spent Nuclear Fuel and LILW.

Introduction

- Sweden has:
  - 12 reactors at 4 sites – 10 reactors at 3 sites in operation
  - Central Interim storage facility (Clab) – wet storage in large underground pools
  - ~ 26 000 Spent Fuel Assemblies in Clab today

- Present database
  - In operation since 2000
  - Includes among other the following data:
    - Identification
    - fuel type
    - initial and irradiated masses for heavy metals
    - assembly enrichment and burnup
    - location (i.e. at NPP or Clab)
    - date for unloading

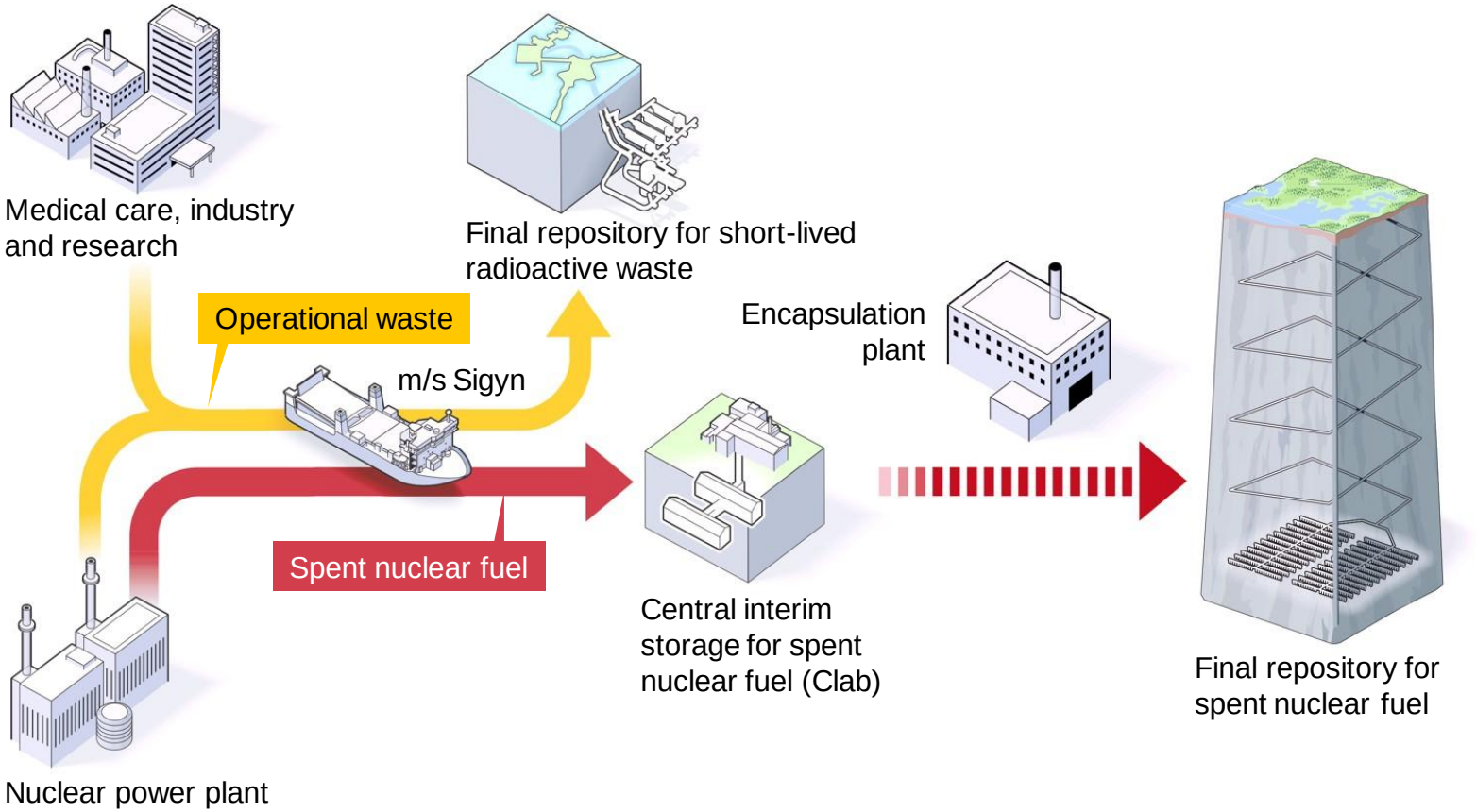
Purpose

- To present the project to replace the current national database for QA of SNF

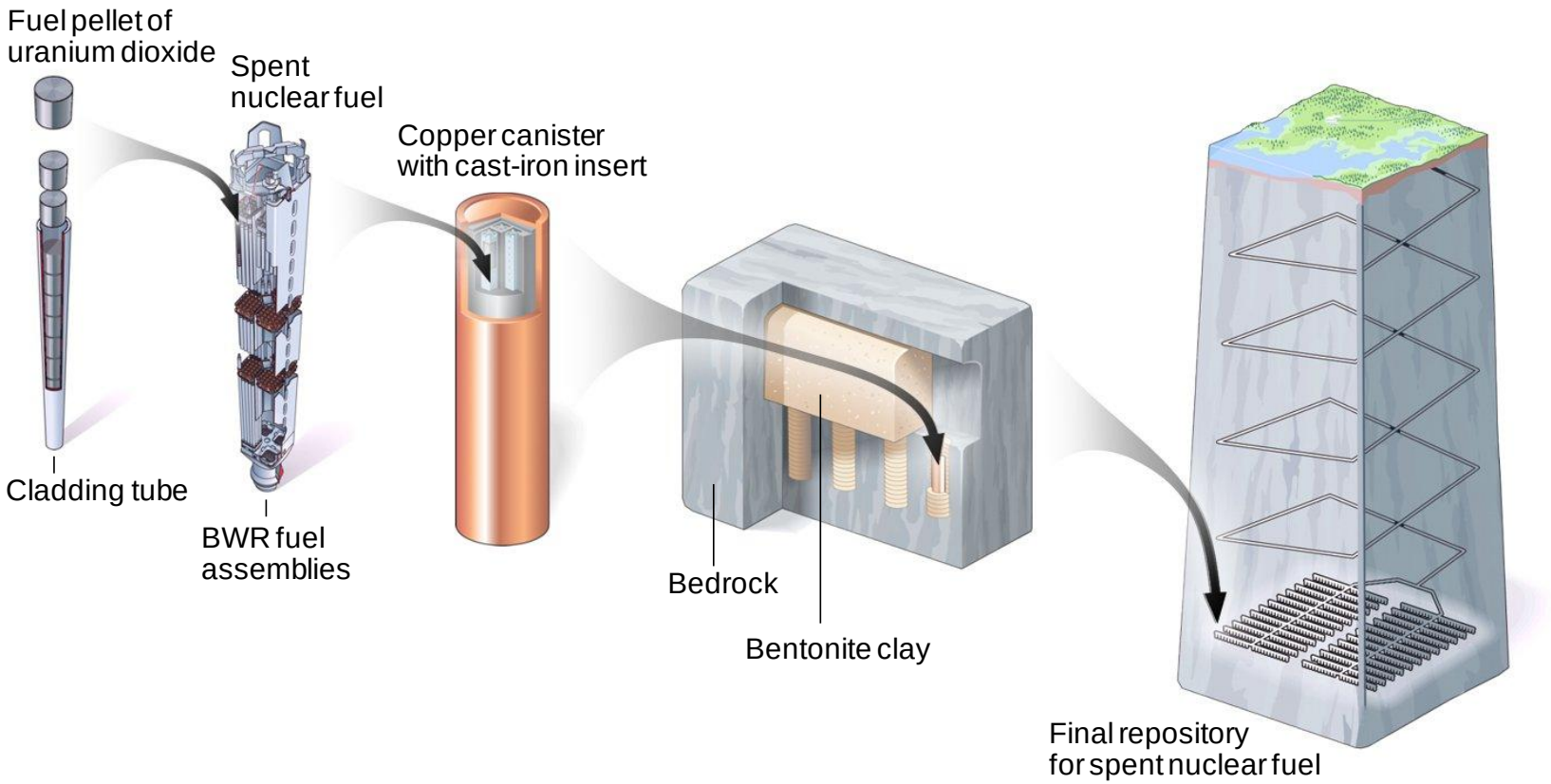
Objective

- Share experiences and ideas with other users with similar operational needs
- To increase the common knowledge about how other countries manage the same type of data
- Get international feedback to make sure that vital information will not be left out

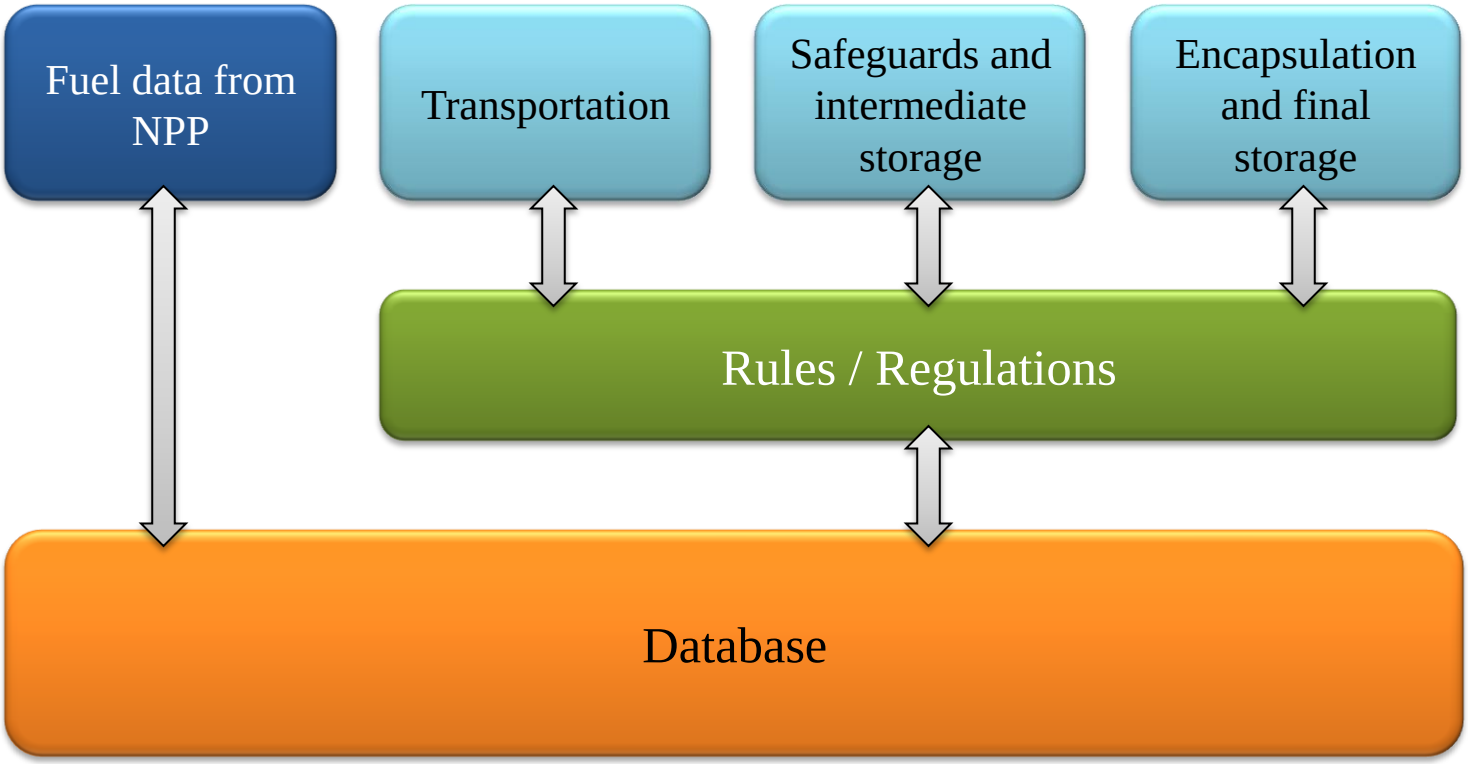
SKB's system


Medical care, industry and research
Final repository for short-lived radioactive waste
Operational waste
m/s Sigyn
Encapsulation plant
Spent nuclear fuel
Central interim storage for spent nuclear fuel (Clab)
Final repository for spent nuclear fuel
Nuclear power plant

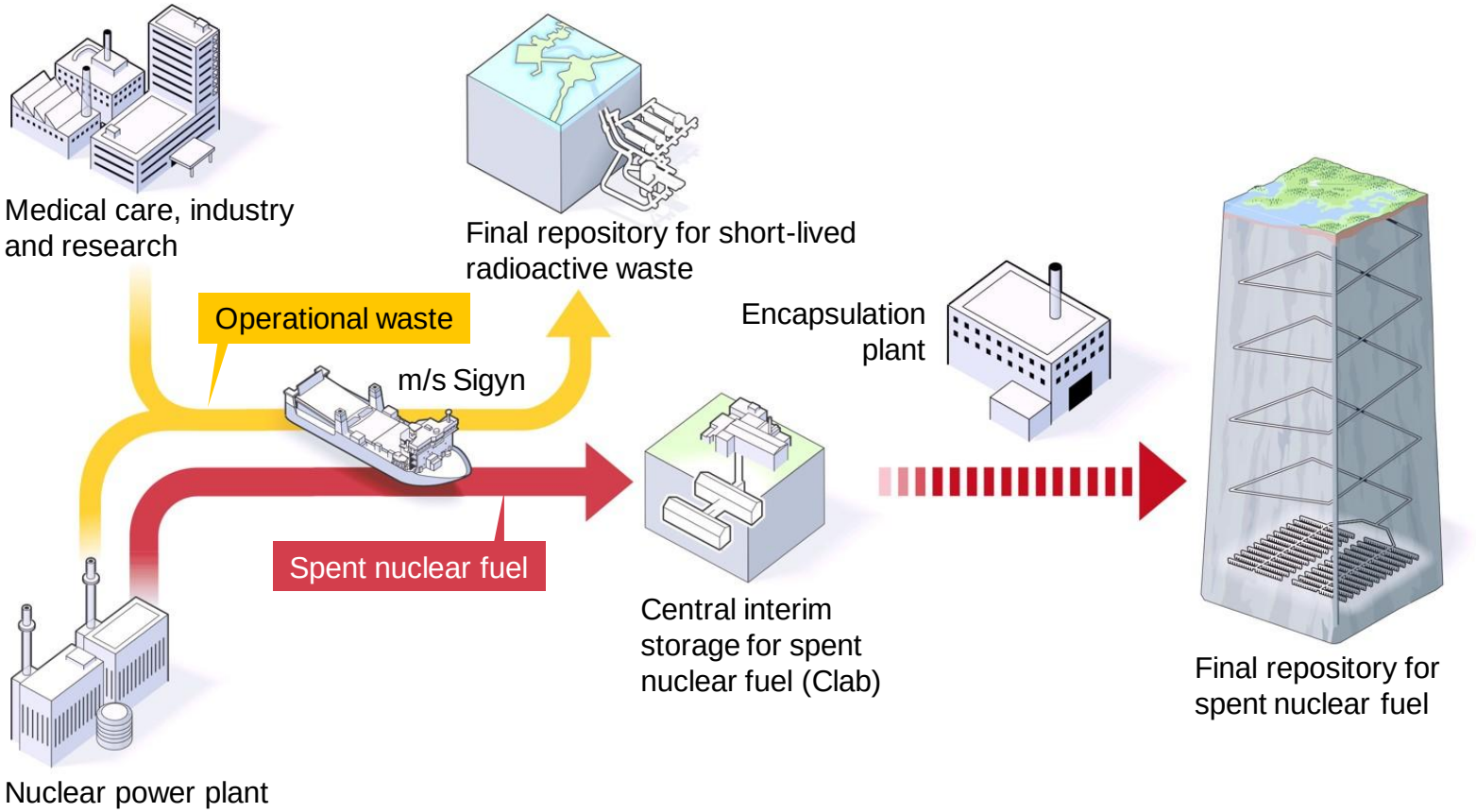
After EOL in core



Future system



SKB's system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Conclusions

- QA is essential to the SNF handling process
  – the project is of great importance to SKB.

- Sharing experience and knowledge at an early stage with other users could
  – get the system in operation quicker
  – lead to less problems in the future.

Swedish Nuclear Fuel and Waste Management Co

Area	Description	Unit
General	Fuel Type	
	Fuel Vendor	
	Reference Document	
	Reprocessing drawing	
	Overall Assembly Length, nominal	mm
	Assembly Mass, nominal	kg
	Overall Assembly Cross Section Min	mm
	Overall Assembly Cross Section Max	mm
	UO2 Mass, nominal	kg
	Uranium Mass, nominal	kg
	Initial Average Enrichment (in S ection with Highest Reactivity)	w/o U235
	Initial Uranium E nrichment (Average in Assembly)	w/o U235
	BA Type	
	Content of BA	%
	Number of BA rods/assembly	
	Active Fuel Length, nominal	mm
Assembly	Rod Array	
	Fuel Rod Pitch minimum	mm
	Fuel Rod Pitch maximum	mm
	No. of sub assemblies	
	Wight of sub assembly	kg
Rods	Number of Rods	
	Number of fuel rod types	
	Normal fuel rod length	mm
	Supporting fuel rod length	mm
	Spacer rod length	mm
	number of part length rods	
	length of part length rods	mm
	Drawing of Fuel Rod without BA	
	Drawing of Fuel Rod with BA	
	Normal Fuel Rod Length, nominal	mm
	Weight (UO2) of Fuel Rod (without BA)	kg
	Weight (UO2) BA Fuel Rod	kg
	Minimal mean cladding tube outer diameter	mm
	Maximal mean cladding tube outer diameter	mm
	Total Mass of Rod Excluding UO2 Pellets	kg
Pellet	UO2 Density Min	g/cm3
	UO2 Density Max	g/cm3
	UO2 Density BA-Pellet (nominal)	g/cm3
	UO2 Pellet Diameter Min	mm
	UO2 Pellet Diameter Max	mm
	Dishing Volume	%

Area	Description	Unit
Cladding	Clad Material / Liner	
	Minimal cladding tube thickness	mm
	Maximal mean cladding tube thickness	mm
	Total Mass of one cladding	kg
PWR Guide tubes (with end fitting)	Number of Guide Tubes	
	Material	
	Wall Thickness (Average in Active Region)	mm
	Outer Diameter Max	mm
	Outer Diameter Min	mm
	Guide tube end fitting material	
	Mass of one Guide Tube, nominal	kg
PWR Instrumentation tube	Material	
	Wall Thickness (Average in Active Region)	mm
	Outer Diameter Max	mm
	Outer Diameter Min	mm
	Mass	kg
Filling gas	Initial filling gas	
	Initial filling gas pressure	bar
	EOL gas pressure	bar
BWR water channel	water channel material	
	water channel thickness	mm
	water channel size max	mm
	water channel size min	mm
water rod	no of water rods	
	water rod wall thickness	mm
	water rod material	
	water rod outside diameter	mm
BWR water cross	water cross thickness max	mm
	water cross thickness min	mm
BWR fuel channel	channel material	
	weight of channel	kg
	Channel inner measures	mm
	channel wall thickness	mm
	channel bottom piece material	
	channel zr weight	kg
	channel stainless steel weight	kg
handle	handle material	
	handle weight	kg
top plate	top plate material	
	top plate weight	kg
spacers	number of spacers in active zone	
	axial partitions of the spacers	mm
	drawing of spacer	
	spacer height	mm
	spacer material	
lower tie plate	Lower tie plate material	
	Lower tie plate weight	kg

Individual data	Description	unit
	Fuel assembly identification	
	Box identification (BWR)	
	Project code	
Initial data	Initial weight Utot	g
	Initial weight U235	g
	Initial weight Pu 238	g
	Initial weight Pu 239	g
	Initial weight Pu 240	g
	Initial weight Pu 241	g
	Initial weight Pu 242	g
	enrichment distribution for each fuel segment	
EOL data	irradiated weight Utot	g
	irradiated weight U235	g
	irradiated weight Putot	g
	irradiated weight Pu 238	g
	irradiated weight Pu 239	g
	irradiated weight Pu 240	g
	irradiated weight Pu 241	g
	irradiated weight Pu 242	g
	Assembly average burnup	MWd/kgU
	Axial burnup distribution	
Other data	Box (BWR)	y/n
	Damaged (leaking)	y/n
	Damaged (mechanically)	y/n
	Repaired/Reconstructed	y/n
	Missing fuel rods	y/n
	contains control cluster (PWR)	y/n
	Other experiences/events	

Irradiation history	Cycle nr	Added burnup	Date BOC	Date EOC
(for each FA)	i	MWD/kgU		
	Cy i+1			
	..			
	..			
	Cy k			