
16. Sitzung der Kommission am 2. Oktober 2015

**Anhörung „Rückholung/Rückholbarkeit hoch radioaktiver Abfälle
aus einem Endlager, Reversibilität von Entscheidungen“**

Präsentation zum Kurzvortrag
von MSc Erik Setzman, Swedish Nuclear Fuel and Waste
Management Co., Stockholm, Schweden

<p>Kommission Lagerung hoch radioaktiver Abfallstoffe K-Drs. 130 d</p>

Retrievability of spent nuclear fuel in a Swedish final repository

The Commission on the Storage of Highly
Radioactive Materials
Berlin Hearing, October 2, 2015
Erik Setzman
SKB

Final disposal of spent nuclear fuel



Legislation and requirements in Sweden

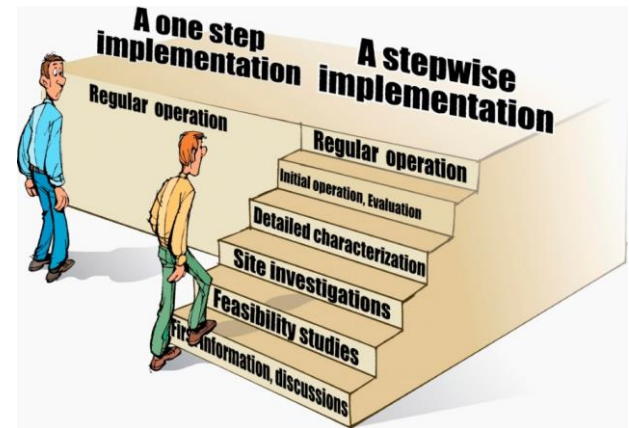
- The nuclear power industry is responsible through the license holders
- Safety the top priority: Humans and the environment must be protected from harmful radiation and other damage now and in the future
- The system has to be reliable and resistant against malfunctions
- Safety after closure to be based on a system of passive barriers without surveillance or monitoring
- No requirements for retrievability or recoverability after closure



The Swedish Radioactive Waste Management Programme



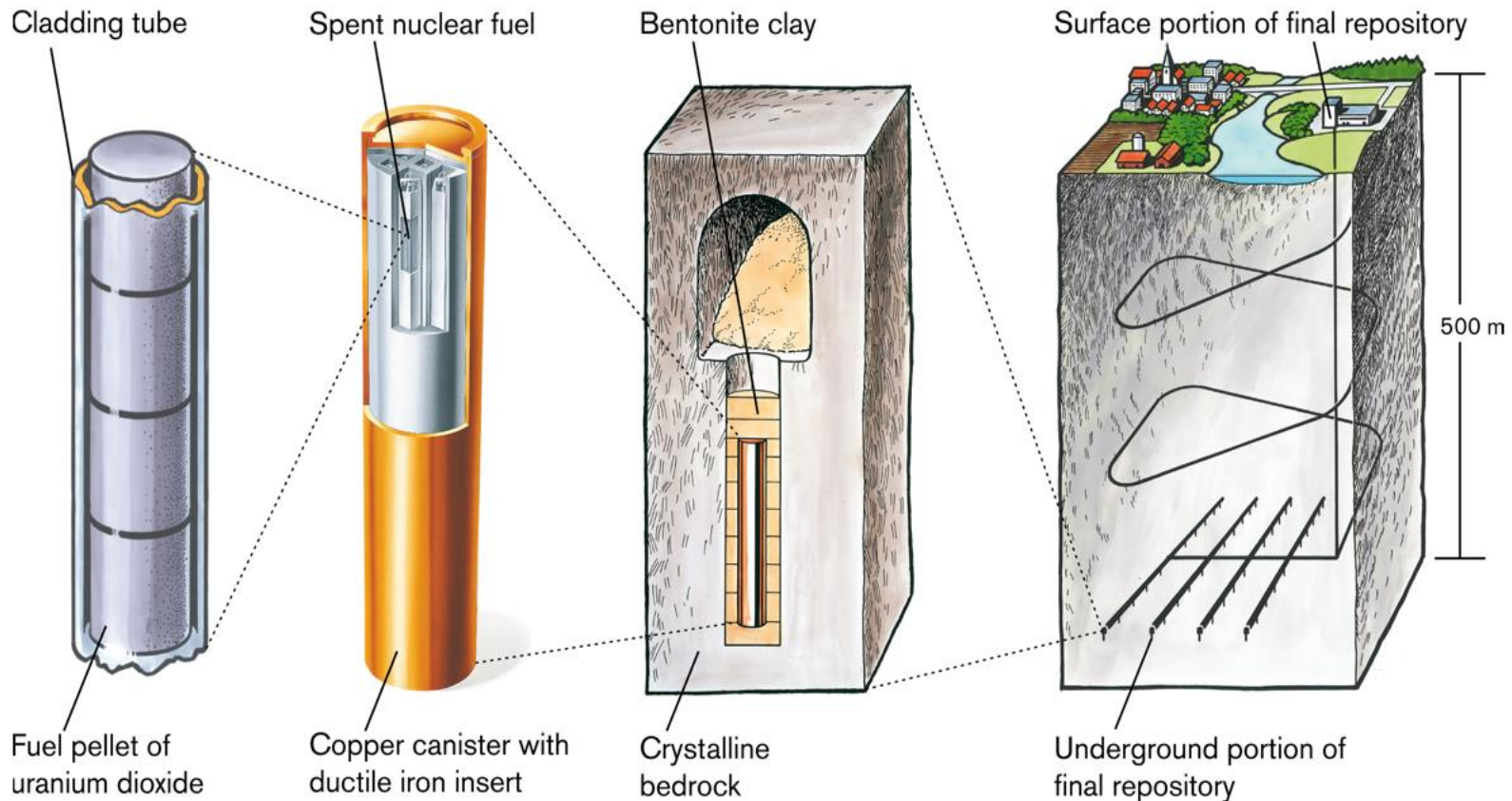
- Clear roles and responsibilities, SKB founded and owned by reactor owners to fulfil the mission
- The KBS-3 system for final disposal of spent fuel a result of more than 30 years of RD&D
- Planned final repository in the stable crystalline bedrock, not a facility for long-term storage
- Transparent and patient stepwise process involving other stakeholders in early studies, consultations, EIA, site investigation and site selection has built the essential trust and confidence
- Permit applications 2011 a milestone, licensing procedures ongoing for a repository in Forsmark
- Stepwise decisionmaking around triannual RD&D programmes and financing plan, licensing and acceptance gives reversibility of decisions if needed



SKB's spent fuel final repository



The KBS-3 system



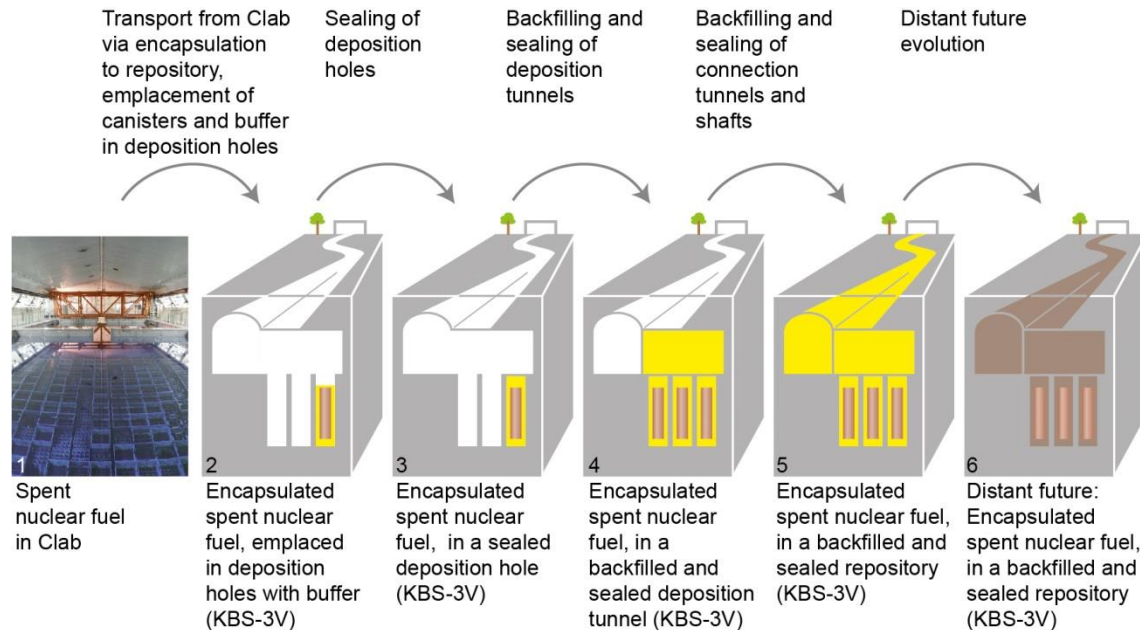
Retrievability, reversibility or recoverability



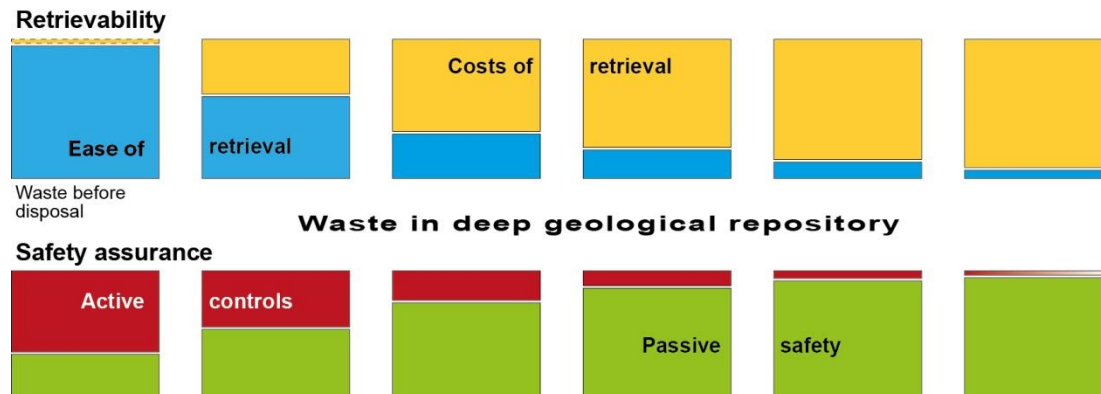
Not a prime subject in Sweden due to the KBS-3 system and the host rock, interest shown primarily from decisionmakers, the regulator, media and some stakeholders

- SKB prefers to use the term retrievability
- No requirements for retrievability after closure as there is no need for such provisions and they would risk to interfere with safety
- Controlled stepwise retrieval of spent fuel canisters for correction of mistakes should and will be fully possible during operation up until repository closure in the end of the 21st century
- No specific design or construction measures to facilitate retrieval or retrievability necessary and thus not included or planned - such measures would have to be proved not to affect safety negatively!
- If decided by future generations retrieval of canisters after closure will also be possible
- Post closure retrieval requires knowledge, technology and resources and will be more complicated which ensures security

A Swedish “Retrievability scale”



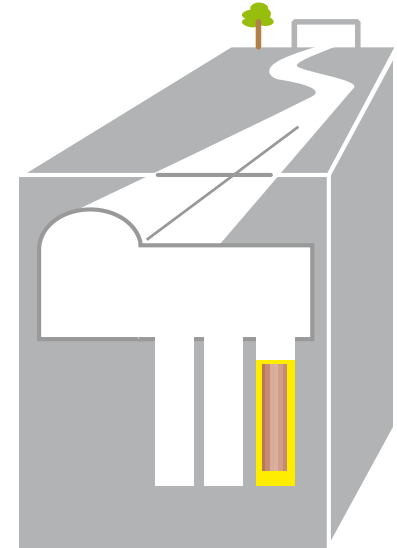
The OECD NEA “retrievability scale” adjusted to SKB’s plans for a KBS-3-repository



Retrievability before closure (1)

Scenario 1: Shortcomings/mistakes during deposition operations may have to be corrected by retrieving single canisters for inspection or other measures

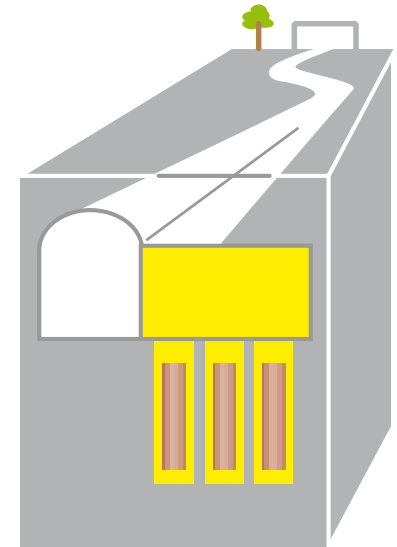
- Realistic to assume that shortcomings and mistakes will occur during deposition operations.
- We have to be prepared to handle a situation that may call for a retrieval of single canister(s) to a place where inspection or other measures can be carried out safely.
- In the Äspö Hard Rock Laboratory it has been showed how to remove a canister from a deposition hole with a bentonite buffer.
- This scenario is fully addressed in the safety case included in SKB:s permit applications from March 2011.



Retrievability before closure (2)

Scenario 2: During the operation time of the repository (until the 2070's according to current plans) the acquisition of new knowledge results in the long-term safety case being questioned

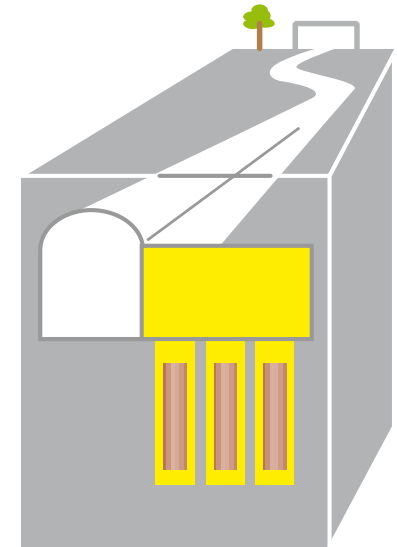
- Such a scenario highly improbable to us, however worth reflecting upon.
- Necessary measures depend on the detailed implications of such new knowledge and when the scenario occurs. Measures may vary from
 - what can be achieved within the frame of a revised KBS-3-repository to
 - a retrieval of some or all deposited canisters in order to plan for an alternative site or method for final disposal of the spent fuel.



Retrievability before closure (3)

Scenario 3: During the operation time of the repository (up to the 2070's according to current plans) it is decided that new nuclear power should be installed in Sweden, based on new reactor types making use of the remaining energy content in today's spent fuel.

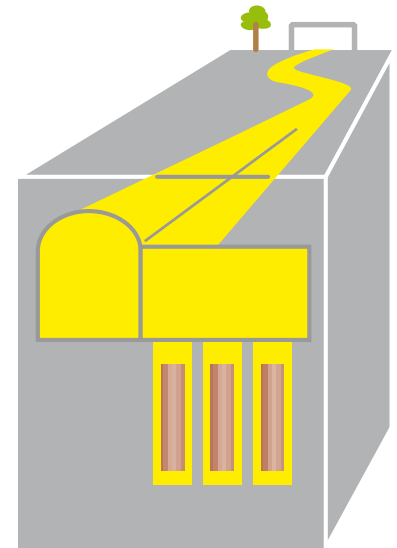
- SKB does not speculate in the probability of such a development.
- It does not seem probable that such a scenario would result in retrieval of already deposited canisters.
- A more likely development could be
 - Cancelling of further deposition operations in the repository which could then be closed and sealed with deposited canisters remaining there.
 - Use of spent fuel that remains in the central interim storage Clab.



Retrievability **after closure (1)**

Scenario 4: Some time after deposition of the last canister (in the 2070's according to current plans) the acquisition of new knowledge results in the long-term safety case being questioned.

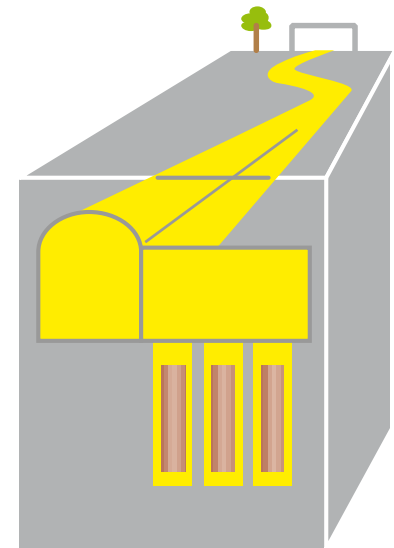
- A decision on closure of the repository can not be expected unless responsible actors (operators, regulators and policy makers) are strongly convinced of the long term safety case.
- In theory it can, however, not be excluded that the acquisition of new knowledge results in the long term safety case being questioned. Which measures have to be taken in such a scenario?
- We can not produce the answer today – only generations living at that time can address this scenario.
- Our generation must contribute to the necessary knowledge base for future generations facing this scenario.



Retrievability **after closure (2)**

Scenario 5: At some future point in time, after closure of the repository at the end of the 21st century, the repository is being regarded as an asset, containing valuable material and not waste.

- Likewise as in Scenario 4, we have to assume that a decision on closure of the repository cannot be expected unless those who will be responsible (operators, regulators and decision makers) are strongly convinced that the contents of a repository are waste and not assets. But, theoretically, it cannot be excluded that an opposite assessment will be made in the future.
- In such a scenario, only those living at that time can address the issue. They have to judge if resources needed to make use of this asset are in due proportion to what can be achieved through a retrieval operation.



Existing and planned final repositories at the Forsmark site

