

ESK Committee on FINAL DISPOSAL (EL)

Retrievability: Theses for a public discussion

Under the current disposal possibilities, disposal in deep geological formations is the most reliable solution for the management of long-lived radioactive wastes, in order to demonstrate safety for future generations against radioactive wastes during the required time periods of up to one million years.

When it comes to the realisation of disposal of radioactive wastes in deep geological formations, again and again the discussion comes up whether disposal should be performed “retrievable”. The widespread argument is that the safety of disposal is definitely improved by “retrievability”.

It has to be discussed within the technical and geological context, whether this argument is sustainable. Thus, the Committee on FINAL DISPOSAL (EL) of the Nuclear Waste Management Commission (ESK) has produced this thesis paper and a detailed discussion paper where these interrelations are described.

Basic problem 1: Leaving underground access ways open provides pathways

The fundamental objective of disposal is the protection of man against radioactive waste by enclosure of the waste. Radioactive substances can only be released from a repository into the environment if water reaches the waste, solubilises it and then, loaded with radioactive substances, reaches the human living space. A sealed repository prevents any water inflow. Even if the closure is “poor”, i.e. it does not function as designed and intended, comparatively, only little water would reach the waste.

A repository kept open in the long-term goes against the primary objective of enclosure; the potential risk is that in case of flooding, the left open access ways provide pathways for the water, thus, large quantities of radioactive materials could be solubilised, and could be released into the environment. A further potential risk is that future generations have not sufficient resources available to ensure the safe closure of the repository.

Basic problem 2: Who or what to trust

It is to be noted that arguments for and against retrievability are based on different principles regarding the basis of trust: one argumentative approach relies heavily on the geological conditions, technical possibilities, and predictability and quantifiability of the processes taking place at the site and underground, whereas the other approach relies on human activity now and in the future, i.e. confidence in the society and its development. The result is that the system “repository” tends to be entrusted either to a natural-technical system, or the responsibility for this system is placed in the hands of the society.

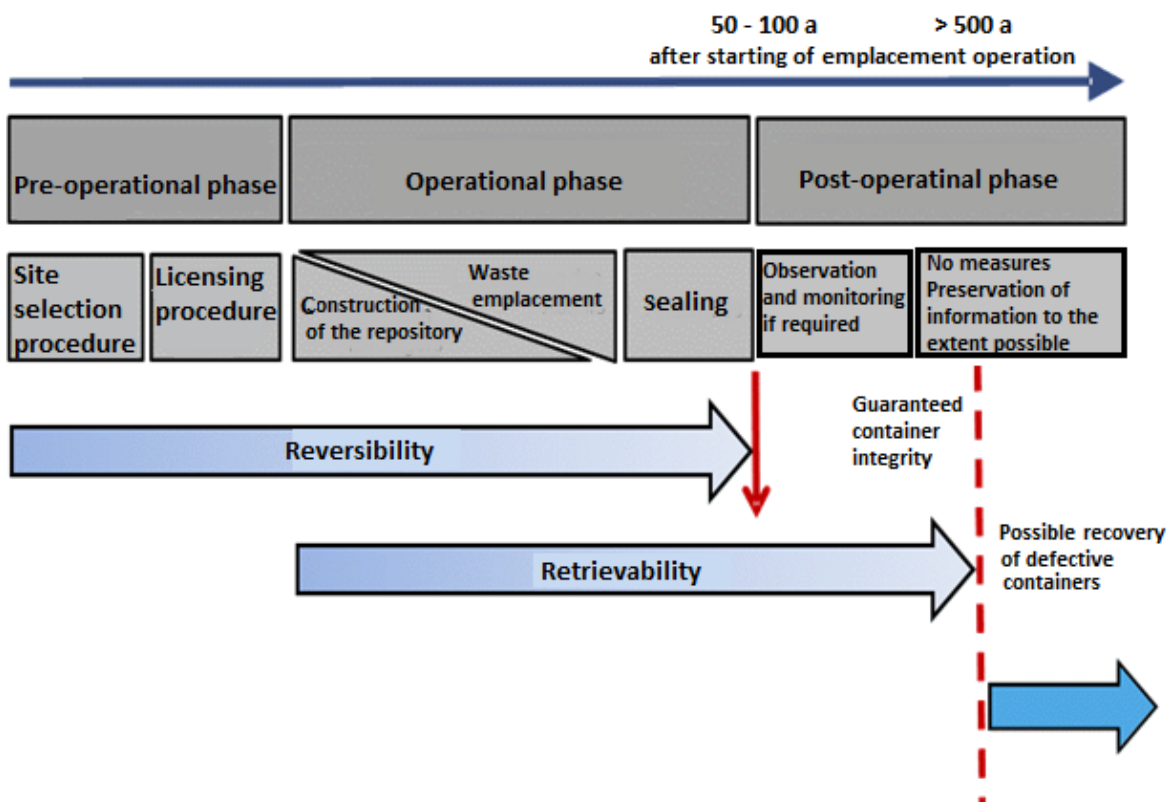
Please note: Distinction between the terms

In the discussion on the reversibility, retrievability and retrieval, it is often not precisely defined what is actually intended:

- Is it about the **reversibility of decisions**? Then, reversible decision making processes need to be developed. Important decisions are e.g. site selection and the technical conception of the repository, or the decision that the repository or certain storage areas will be closed now. This includes also the decision to undertake retrieval now.
- Is it about the **retrievability**? Then, technical feasibility of waste retrieval from the repository mine has to be ensured in each time period to be defined.
- Is it about the **retrieval or recovery**? Then this relates to the implementation of concrete measures for removal of the waste from the repository.

Please note: Distinction between the various periods of time

For this discussion, it is necessary to distinguish the periods of time discussed, since there are highly divergent technical conditions, which is illustrated by the following figure:



- **Period: pre-operational phase**

Waste is not yet emplaced in the repository; wastes at the respective sites of the interim storage facilities present potential “risks”. In this period, however, important decisions are taken: on site selection, and thus on the geological boundary conditions, on the technical concept and the organisational structure of the repository operator, highly decisive for reliability. These planning steps can relatively easily be designed to be reversible; e.g. waste conditioning is only reversible to a limited extent.

- **Period: operational phase**

The repository has been licensed, constructed and has started its operation. First, the waste has to be transported to the repository and emplaced there. This will presumably take several decades. During emplacement operation, most of the disposal cavities are accessible. In and around the repository mine it is possible to observe the behaviour of the rocks, of the internals and of the waste intensively, and to compare the results with preliminary computations. To ensure operational safety during this period, effective measures have to be taken to prevent an uncontrollable water influx, and appropriate technical equipment has to be available. As long as the repository is open, the emplaced waste can be retrieved with relatively little effort.

- **Period: “early” post-operational phase**

This phase lasts several centuries. The repository is sealed now and no human actions for maintenance of safety are required; nevertheless, there is a monitoring programme in place. The precise location of the waste in the repository is documented. This documentation will be passed on to future generations in the best possible manner. If unforeseen problems arise during this phase, retrieval would be possible, e.g. by re-opening of the closed mine, or by excavating new shafts and access ways from where the waste can be reached.

- **Period: “later” post-operational phase**

The long-lived radioactive waste has to be kept in safe enclosure for over a million years. If the knowledge of the repository would have been lost, it is crucial that the preliminary computations and technical measures have led to the maintenance of safe enclosure. But if at this time, the repository would not have been closed long ago, penetrating water could cause massive release from the repository.

Conclusion

The ESK Committee on FINAL DISPOSAL (EL) has reached the following conclusions:

- In the discussion on the retrievability, the safety-related problems must be seen in any case; therefore, the requirements regarding the retrievability must not lead to a safety-related deterioration of disposal.
- The safety of disposal is based on the enclosure of the waste ensuring that after closure of the repository no human actions for maintenance of safety are required (no maintenance).
- For safety reasons, the disposal cavities with the waste emplaced and the repository have to be closed as soon as possible, so that water influx does not lead to uncontrolled release of radioactive substances. Leaving underground access ways open would create unnecessarily pathways for penetrating water.
- During the decades of operational period, all reasonable measures for monitoring developments have to be taken. Especially the preliminary computations have to be intensively analysed. If reasonable doubts arise about future safety, appropriate measures have to be taken, or wastes have to be retrieved.
- During the “early” post-operational phase of several centuries after repository closure, a monitoring programme (at the surface) is reasonable despite the freedom from maintenance. Of essential importance is the preservation of the documentation on the precise location and type of waste as long as possible, which enables planning of retrieval, if required.