



**UNCERTAINTIES ABOUT THE SAFETY OF DISPOSAL LEADING TO A WISH  
TO KEEP ALTERNATIVES OPEN  
DISCUSSION ON THE CONCEPTS "STORAGE" ("WAIT AND SEE") VS.  
"DISPOSAL" AND "RETRIEVABLE DISPOSAL" VS. "DEFINITIVE DISPOSAL"**

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**Abstract**

Uncertainties about the safety of final disposal may lead to unwillingness to take decisions about waste management issues that may seem to be non-reversible. This has led to proposals that we should wait with decisions on final measures and instead store the waste for some period of time. Also the possibility of retrieval may lead to decisions not to go for permanent disposal but instead to retrievable disposal. These aspects and the pros and cons are discussed both from a more general perspective and also with some reflections from the Swedish programme for nuclear waste management and disposal.

**1. INTRODUCTION**

The long term aspects of safety of spent nuclear fuel and other types of long lived radioactive waste introduces a difficulty in the decision process. How can we, living now, take decisions now that will be of importance not only for today's generation but also for hundreds and thousands of generations to come?

First a short repetition of what we generally agree on:

- it is the responsibility of today's generation to take the necessary measures for the safe management of radioactive waste generated by nuclear power production including health and environmental protection aspects (an ethical aspect reflected in the "Joint Convention")
- this responsibility covers safety and future costs of the proposed management

The uncertainties about the safety for the very long time periods (in the order of hundred thousands of years) relevant for the management of spent fuel and other long lived radioactive waste may be considerable. The time period of concern is primarily related to the dangerous properties of the spent fuel or the waste and secondary to the management alternatives.

There are three principal solutions:

- dilute and disperse the waste
- eliminate the waste (send out in space, "complete" transmutation etc)
- final disposal of the waste (no supervision needed); between experts it is generally agreed that deep geological disposal is the preferred option

In addition to that several other aspects are often discussed:

- storage of the waste; supervision needed as long the waste is dangerous or until a final solution is found; this is just an intermediate, not a final solution
- retrievability of the waste in final disposal
- national vs. regional disposal
- recycling of spent fuel instead of disposal (only a few recyclings are in practise possible)

Note that these aspects do not offer a final solution (per se) they only give alternative ways to achieve a principal solution. If the spent fuel is regarded as a resource and not a waste this of course will affect the decision on future management. However, in the end, it is very probable that an end product will be waste. The discussion above will then again be relevant.

Dilute and disperse is not an acceptable solution for spent fuel and HLW. Also transmutation is questioned as a method to give an acceptable solution to waste management and disposal risks. It could be mentioned that SKI has stated that separation and transmutation of spent nuclear fuel is not a realistic alternative to disposal.

## 2. STORAGE VS. DISPOSAL

What we strive for is to find a management method that is robust as regards safety and also that the long term safety of that method can be convincingly demonstrated. We want a safe and robust case. This has led to the multibarrier concept for disposal of waste. The possibility to demonstrate long term safety (hundred thousands of years) in final disposal of long lived waste offers considerable difficulties. However performance assessment methodology has been developed and is recognised as a useful tool for assessing safety (NEA Collective Opinion)

This short review has presented principal options and aspects in finding a final solution to the management of spent fuel and long lived radioactive waste. But even if we agree on this we still need to take the decisions in a democratic process that involves not only decision makers (implementers and regulators) but also the concerned general public and groups that may oppose a decision. The decision will be difficult, as the issue is scientifically and technically complex and controversial in regard to democracy.

However, a decision has to be taken. It should be remembered that to abstain from taking a decision is also a decision. The very difficult situation may lead to decisions that leave options open and sometimes also to decisions that are of an intermediate character and that leaves the principal problem unsolved.

One such situation is to restrict the decision to question about storage. Storage is obviously not a final solution. Storage is a way to delay the final decision. This may be justified and correct if the uncertainties are judged to be too great for a decision to be taken. If so, it should be clearly stated that only an intermediate solution has been found and that more work has to be done to find the final solution or that supervision has to go on for a long time giving burdens to future generations.

The Swedish Act on Nuclear Activities explicitly requires final disposal of spent fuel and nuclear waste. This is one fundamental basis for SKI's position on storage and disposal:

- Deep geological disposal is the preferred option for final disposal of spent fuel (NEA Collective Opinion)
- The KBS-3 concept is supported by SKI and the Swedish government (but yet not licensed)
- Long term safety, after closure of the repository, is not dependant on supervision and control
- Storage in the central storage for spent fuel (CLAB), either as planned intermediate storage or as prolonged storage is not to be seen as a final solution

### 3. RETRIEVABLE DISPOSAL VS. DEFINITIVE DISPOSAL

Retrievability of the waste is another issue that may be introduced to make it easier to take decisions about disposal. Disposal is intended to be a final solution. Some disposal concepts may offer a possibility for retrieval of the waste without endangering the safety. If so, retrievability should be accepted. If not, it should not be accepted. However, if we require the waste to be retrievable for a closed repository we seem to confirm a need for future measures. Final disposal and a requirement on retrievability may seem contradictory and may cause serious doubts about the concept.

There may be different reasons for having retrievable disposal. One is the possibility retrievability offers in regard to safety. If, for some reason, the repository in a certain stage is regarded not to be safe, future generations should have a possibility to retrieve the waste and to take measures to improve safety. An other reason for retrieval is that future generations may see the spent fuel as a resource and want to retrieve it for that reason.

Whatever reason one must recognise that the spent fuel represents a risk and that safety must be maintained for a long time. One must also recognise the problems with long term storage putting a burden on future generations and also the uncertainties in stability of the society that can threaten the safety of long term storage. In a very simplistic manner we could ask ourselves what is more stable over very long time periods (for spent fuel, ten to hundred thousands of years) society or a deep geological environment.

SKI does not require retrievability of spent fuel after closure of the repository. The KBS-3 concept incorporates retrievability (for the operational phase of a repository but also for long term periods after closure of the repository). Retrievability can be seen as an intrinsic property of the KBS-3 concept and does not require a compromise with safety.

It is sometimes said that the possibility for retrieval is not consistent with the requirement on long term safety for the repository (required by law). SKI emphasises that SKI will not accept that the possibility for retrieval is used (explicitly or implied) as an argument for compromising with requirements on safety or on requirements on demonstration of safety (by safety assessment).

#### 4. CONCLUSIONS

The management and disposal of spent nuclear fuel and long lived nuclear waste includes very long time periods and the safety of future generations. This fact obviously has lead to discussions and doubts about taking non-reversible steps such as final disposal.

In order to come to a decision about final disposal of spent fuel and long lived nuclear waste SKI has proposed a multistage decision process building on ethical, environmental, economical and democratic aspects as well as aspects on safety and radiation protection. Such a process will hopefully help in coming to agreement and acceptance on the final disposal of spent fuel. It should be stated that the basic requirement is safety and that safety has to be convincingly demonstrated.