

FUTURE EXTENSION OF THE SWEDISH REPOSITORY FOR LOW AND INTERMEDIATE LEVEL WASTE (SFR)

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ABSTRACT

The existing Swedish repository for low and intermediate level waste (SFR) is licensed for disposal of short-lived waste originated from operation and maintenance of Swedish nuclear power plants.

The repository is foreseen to be extended to accommodate short-lived waste from the future decommissioning of the Nuclear Power Plants.

Long-lived waste from operation, maintenance and eventually decommissioning will be stored some years before disposal in a geological repository. This repository can be build either as a further extension of the SFR facility or as a separate repository.

This paper discusses the strategy of a step-wise extended repository where the extensions are performed during operation of the existing parts of the repository. It describes the process for licensing new parts of the repository (and re-license of the existing parts).

1. Introduction

Sweden has today (the year 2006) 10 commercial nuclear power reactors in operation (7 BWR:s and 3 PWR:s) at three sites along the seacoast. These nuclear power plants produce almost 50 percent of the electricity used in Sweden. The time schedule and conditions for shut down are still open. Based on technical, safety and economical considerations, the operation of a reactor may continue until 40 to 60 years of operation or even longer. The two reactors at the Barsebäck site (BWR) have been shut down in the year 1999 and 2005 respectively. The shut down was done before 30 years of operation for political reasons.

The 12 Swedish commercial NPP's were commissioned during a short time span, from 1972 to 1985. Consequently the operation should be terminated between the year 2012 and 2025 if an operating lifetime of 40 years is assumed. Dismantling of a reactor close to a still operating unit will not commence until the other unit has ceased operation. With this strategy the first reactors in Sweden should start dismantling around the year 2020, after removal of the spent fuel. This is also the year scheduled for opening the extended repository for disposal of decommissioning waste.

2. The existing repository

The existing repository for short-lived radioactive waste (SFR 1) has a capacity to accommodate waste from operation of the remaining reactors in Sweden up to almost 60 years of lifetime (Figure 1). There might be a need for an extension for some of the intermediate level waste produced during operation and maintenance.

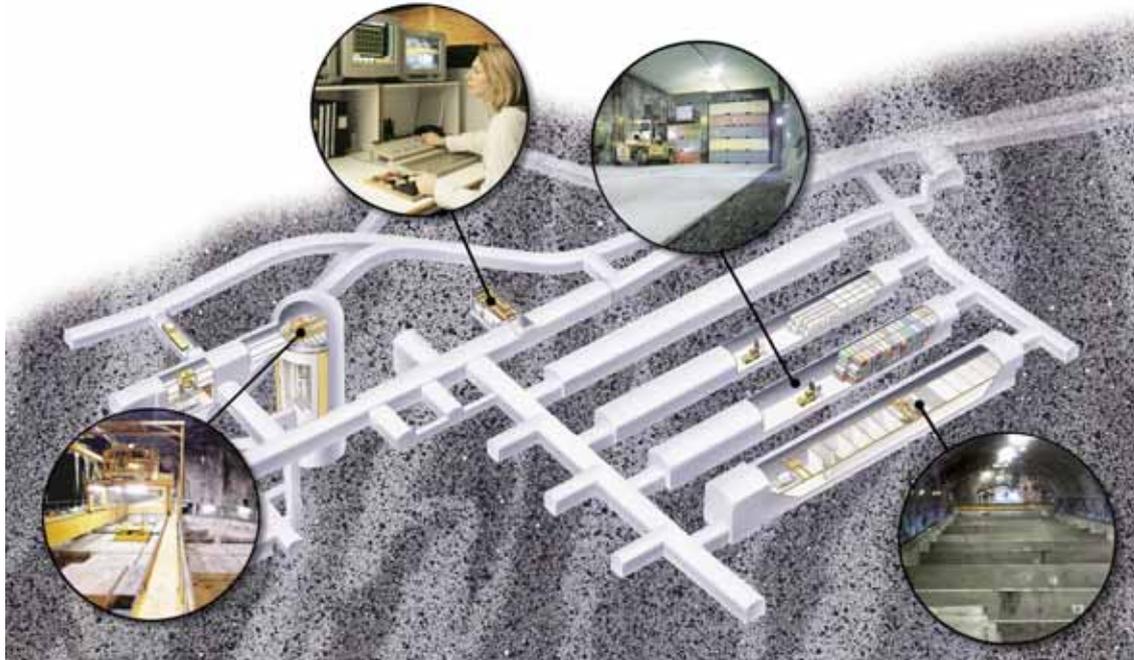


Figure 1. The existing repository, SFR, for operational low and intermediate level waste

3. The step-wise approach to extension

The situation today is that Sweden has reactors already shut down while other reactors are foreseen for a life extension to 60 years or more. The need for a repository for decommissioning waste is spread over a long time period and therefore a step-wise extension of the repository is planned. A first step would be to accommodate waste from early shut-down reactors e.g. the reactors at the Barsebäck site. This first phase of extension may also include capacity for some operational waste. The following step of extension of SFR is depending of the lifetime of the reactors and of the strategy for dismantling adopted by the different operators (Figure 2).

The total volume of short-lived low and intermediate level decommissioning waste has been estimated to approximately 150.000 m³ (processed, packaged and ready for disposal). The two reactors in Barsebäck will together give rise to about 18.000 m³ of radioactive waste for disposal in SFR. Another 200 m³ of long-lived waste is anticipated for interim storage before the eventual disposal in a separate repository for long-lived waste. The exact quantity of decommissioning waste is depending on many factors like the strategy for processing the waste, on the requirements for free release measurement and on the time schedule for dismantling.

When the existing repository was planned and constructed a step-wise extension for operational waste was foreseen. The first step (63.000 m³ of waste) which is now in operation was supposed to last 10-15 years. After that an extension to a total of 90.000 m³ was planned. To facilitate the extension the tunnel system was prepared for further

excavation in the way that niches were prepared for new disposal chambers. The idea was to excavate the new chambers during operation of the first phase. As a preparation for future decommissioning of the nuclear power plants also niches to caverns for decommissioning waste were excavated already during the first construction phase.

The originally planned second step for operational waste had a disposal capacity of 30.000 m³ of waste. This space will now be available as part of the first step for decommissioning waste. The exact volume available can not be determined until a detailed rock characterisation has been performed. After the site investigation a detailed lay-out and design study can be done. The total available volume is assumed to be in the range of 50.000 m³ in this stage. The total volume of decommissioning waste for disposal in the SFR will be determined based on experience from dismantling end demolition of the first reactors. When the second stage is needed, today estimated to 100.000 m³ depends on the lifetime of the reactors and of the strategy for dismantling taken by the individual utility owner.

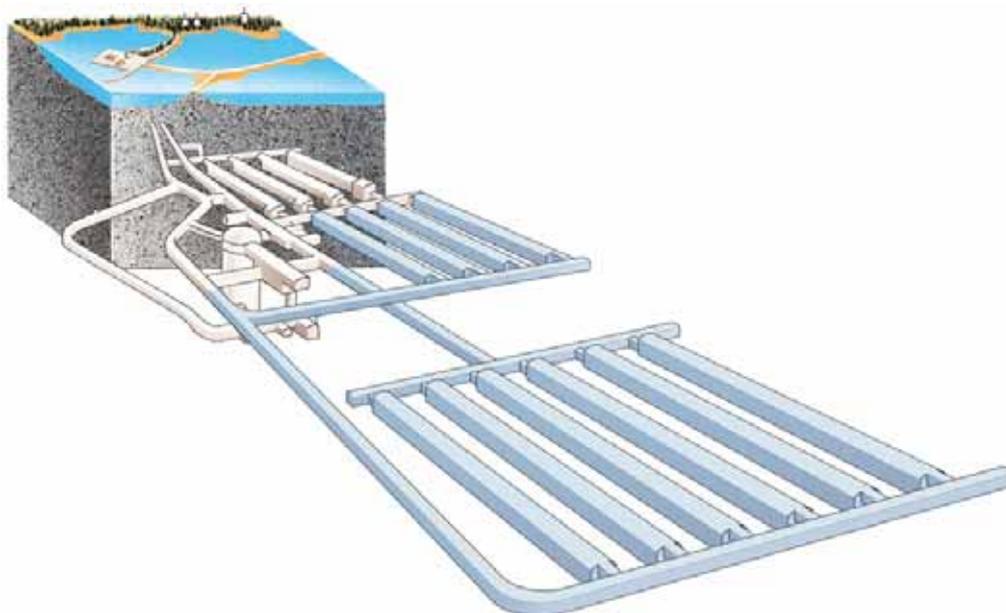


Figure 2. Extended repository for disposal of decommissioning waste. First phase close to the existing part and the second phase in the foreground.

4. Legal aspects

There is no national policy requiring a certain starting point or endpoint of decommissioning. When the dismantling will start is a decision to be taken by the owner of the power plant. Only if there is radiation protection or safety hazards the Swedish authorities may require an earlier decommissioning. Since no major decommissioning project has been performed so far the conditions to be achieved have been given by the Authorities on a case-by-case basis. It is the responsibility of the owners of the power plants to plan and to execute the decommissioning of their plants. The responsibility to take care of its own waste is stipulated in the Act on Nuclear Activities and is included in the license to operate a nuclear facility. Generic decommissioning studies are performed by the Swedish Nuclear Fuel and Waste Management Co, SKB.

Following the final shut down of a reactor and removal of spent fuel it is assumed that the dismantling will commence, preferably after a thorough decontamination of the process systems. In addition a period of 5 – 15 years might be used for decay of short-lived radionuclides. If and how long this period will be has to be decided by the utilities for each nuclear power unit from an ALARA standpoint.

5. Scheduled activities

Investigations at the SFR site are expected to start next year (2007) with the aim to license and carry out the extension so that the first decommissioning waste can be disposed of in the year 2020. The site investigation will cover the fully excavated site and the safety assessments for the long term period will include a rough estimate of the fully excavated repository and a detailed analysis of the first step.

During the extension temporary walls are put into the niches and the excavation (drill and blast technique) will be from the “back-side” of the area. The so called construction tunnel will be used for transport of personnel and blasted rock. After excavation and installation of necessary equipments the temporary walls are removed and disposal activities may commence in these new parts.

The excavation needs to be licensed both according to nuclear/radiological laws and regulations and according to the environmental law. A new environmental impact study is needed and the application will be for short-lived radioactive waste from operation, maintenance and decommissioning of nuclear power plants and similar waste from research, hospitals and industry. By re-licencing the existing repository to cover also waste from decommissioning an optimal use of the repository is possible.

6. Summary

The existing repository for short-lived radioactive waste is licensed for operational waste only. A re-licensing is needed to accept also waste from decommissioning. The waste volume from operation and decommissioning is based on annual prognosis for operational waste and on decommissioning studies performed by SKB and the utilities. As decommissioning probably will be carried out over a rather long time period excavation will be in steps. The first step is planned for operation from the year 2020. It will mainly be built to allow for disposal of waste from dismantling of the first reactors but also for some operational waste where the existing facility is not sufficient. The following extension(s) will be scheduled according to operational lifetime of the reactors and the strategy of the utility owners for decommissioning.