

## **Äspö International - Role of the Äspö HRL as an International URL – 14501**

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### **ABSTRACT**

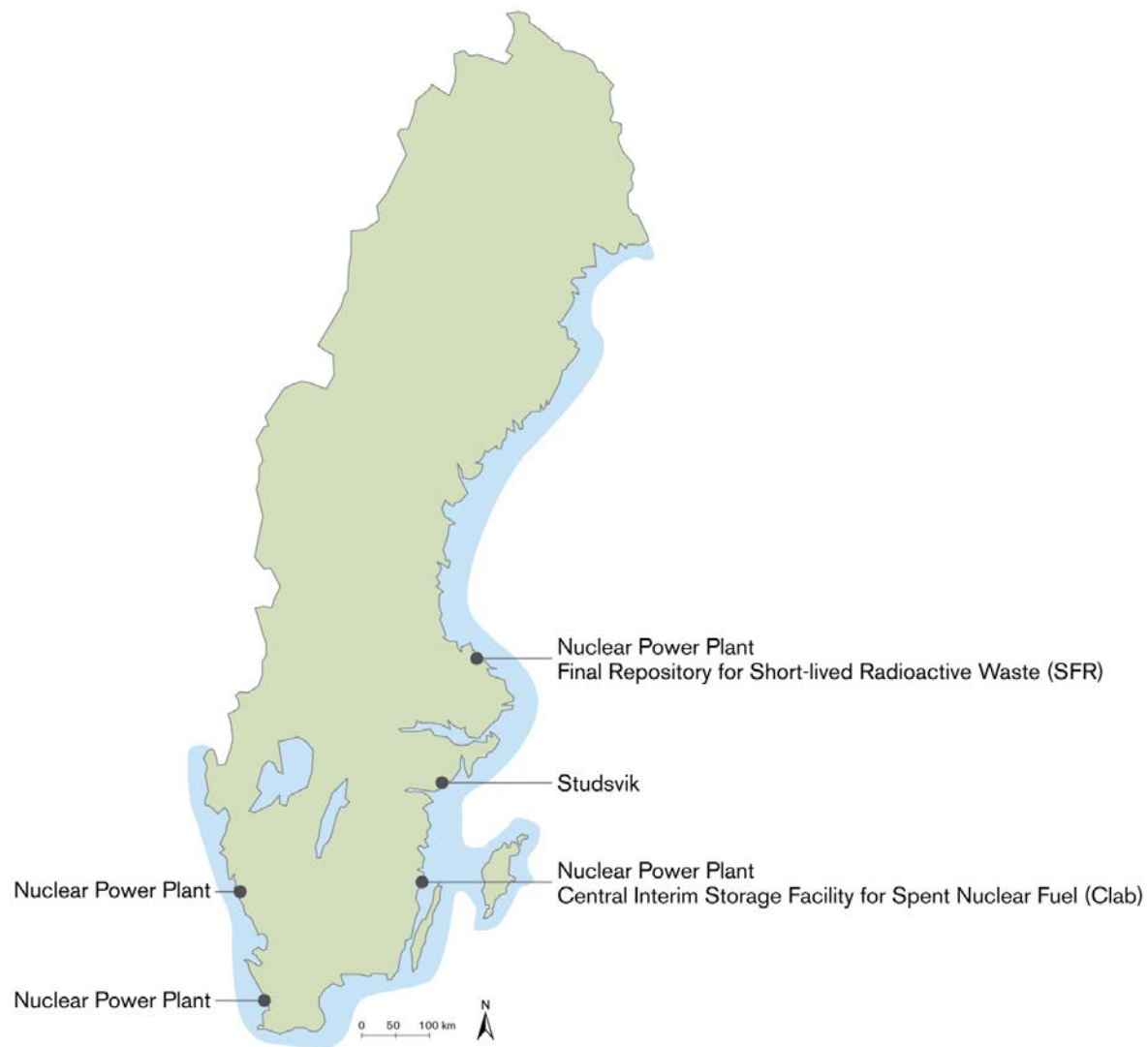
The Äspö Hard Rock Laboratory (HRL) was developed by SKB, the Swedish Waste Management and Nuclear Fuel Company (SKB) in the 1990s in order to support the research, development and demonstration (RD&D) work programme regarding geological disposal. The Äspö HRL along with the Canister laboratory and the Bentonite Laboratory are SKB facilities where much of the RD&D have been conducted as part of a 'dress rehearsal' of the technology supporting the SKB licence application which was submitted to the authorities in March 2011. The Äspö HRL is located in the community of Oskarshamn. As part of the Added Value initiative SKB is committed to the future of the Äspö HRL, along with the Canister and Bentonite laboratories, as an international research facility. This is seen as a benefit to the community and its local businesses and the ongoing development of geological disposal technology for SKB and other waste management and research organisations around the world. The facility is also available for other types of research activities such as environmental research for non nuclear projects; which is handled through Nova. Nova is a joint research and development platform at Nova Centre for University Studies, Research and Development supported by the Swedish Nuclear Fuel and Waste Management Co (SKB) and the Municipality of Oskarshamn.

### **INTRODUCTION**

The Äspö Hard Rock Laboratory (HRL) is an integral core component of the Swedish nuclear waste management programme. It was developed by SKB, the Swedish Nuclear Fuel and Waste Management Company AB, in the 1990s in order to support the research, development and demonstration (RD&D) of direct geological disposal of spent nuclear fuel (SNF) in crystalline rock. The Äspö HRL along with the Canister laboratory and the Bentonite Laboratory are SKB facilities where much of the RD&D have already been conducted as part of a 'dress rehearsal' of the technology supporting the SKB licence application for the Forsmark SNF repository and the Oskarshamn Canister Encapsulation Facility (INKA), which was submitted to the authorities in March 2011. The Äspö HRL is located in the community of Oskarshamn, which also hosts three nuclear power plants (NPPs) and Sweden's central storage facility for SNF, CLAB (see Figure 1). CLAB is the underground central storage facility holding all the spent nuclear fuel generated over the past four decades from Sweden's nuclear power programme.

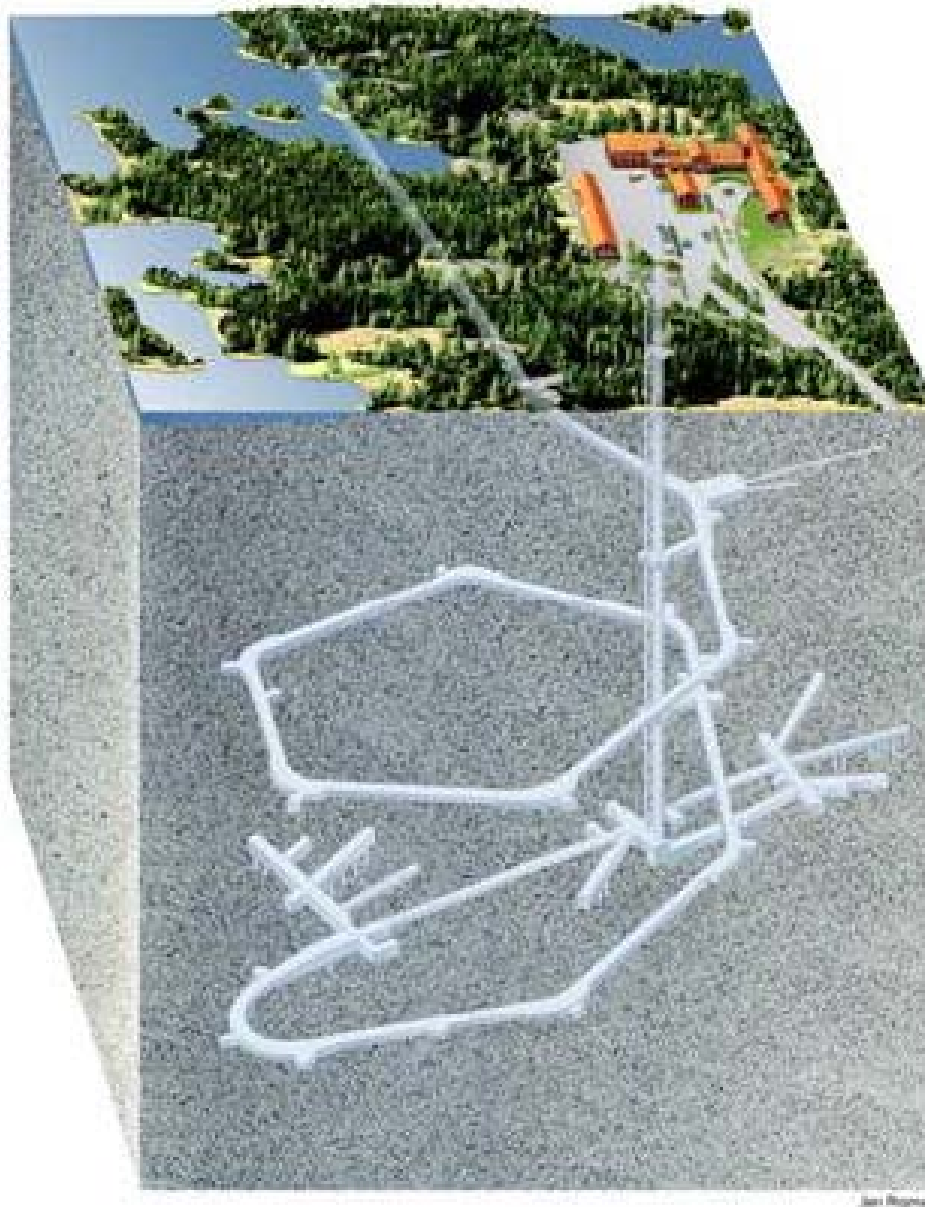
### **SKB FACILITIES**

The Äspö HRL (Hard Rock Laboratory) is an important part of SKB's work with the design and construction of a deep geological repository for the final disposal of SNF at Forsmark. It is located in the Simpevarp area in the municipality of Oskarshamn near the SKB Central Interim Storage Facility (see Figure 1). One of the fundamental reasons behind SKB's decision to construct an underground research laboratory (URL) was to create opportunities for RD&D in a realistic and undisturbed rock environment down to and below the planned repository depth.

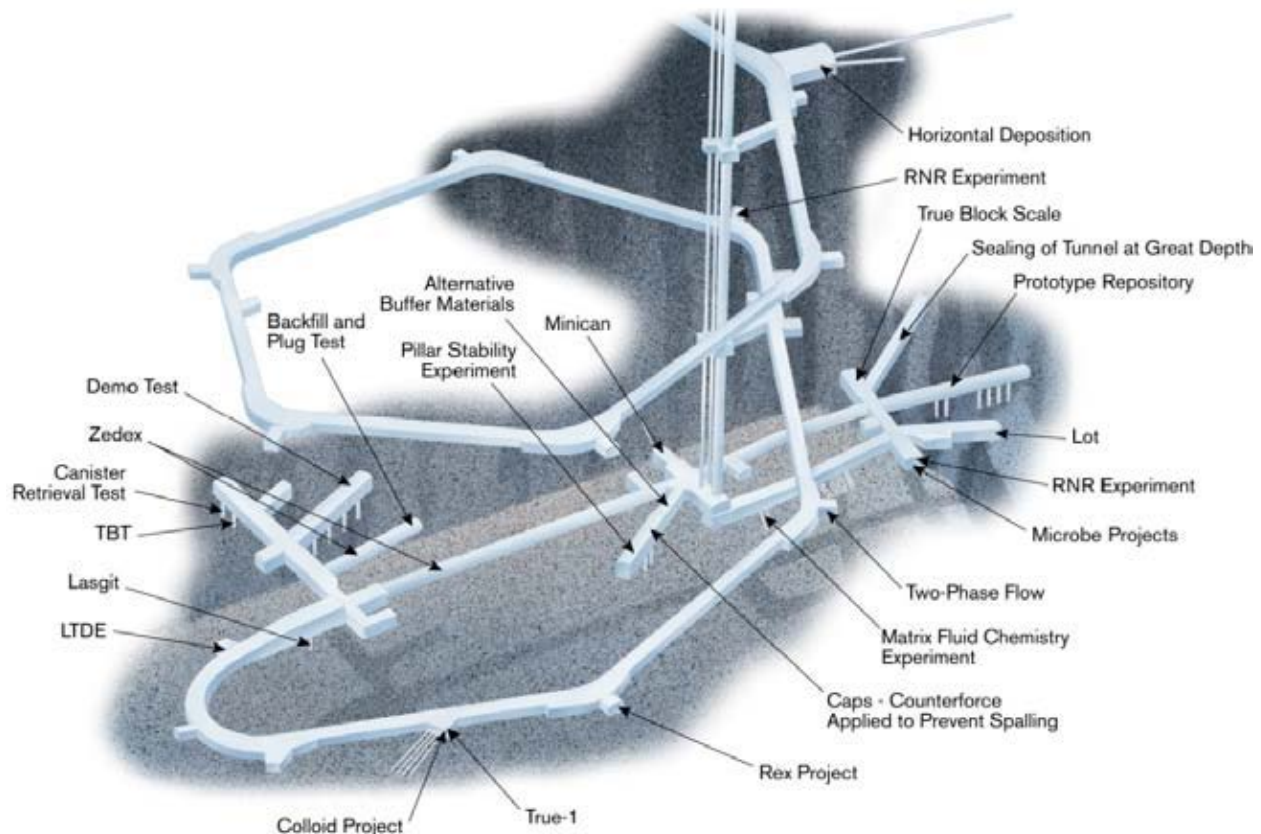


*Fig. 1. Map of Sweden showing locations of nuclear power plant sites and their related waste management and disposal facilities.*

The underground part of the laboratory consists of a tunnel from the Simpevarp peninsula to the southern part of Äspö where the tunnel continues in a spiral down to a depth of 460 m (see Figure 2). The Äspö HRL has been in operation since 1995 and considerable international interest has been shown since then in its RD&D tasks and experiments (see Figure 3).



*Figure 2 Overview of the Äspö HRL facilities*



*Figure 3 Experimental sites at depth in the Äspö HRL.*

During the 1990s SKB developed additional facilities, including the Canister Laboratory and Bentonite Laboratory, close to the Äspö HRL. These facilities also act as the 'dress rehearsal' for other key aspects and features of the repository system. They are used by scientists and engineers not only from SKB but from all over the world and organisations such as specialists working on behalf of the regulators are also invited to examine the work. It is important for the local communities and SKB to demonstrate the high quality and standards underpinning the plans for a final SNF repository.



*Figure 4. Photo of the Bentonite Laboratory.*

Before building a final SNF repository, further studies of the behaviour of the buffer and backfill under different installation conditions are required. SKB has built a Bentonite Laboratory at Äspö, designed for studies of buffer and backfill materials. The laboratory has been in operation since spring 2007. The Bentonite Laboratory (Figure 4) enables full-scale experiment under controlled conditions and makes it possible to vary the experiment conditions in a manner which is not possible in the Äspö HRL. The laboratory, a hall with the cross-sectional dimensions of 15 m by 30 m, includes two stations where the emplacement of buffer material at full scale can be tested under different conditions. The hall is used for testing of different types of backfill material and the further development of techniques for the backfilling of deposition tunnels.

## **INTERNATIONAL PROJECTS**

In addition to SKB, organisations from many countries participate in the international co-operations at Äspö HRL. International organisations participate in the experimental work at Äspö HRL as well as in the dedicated Äspö Task Forces such as: (1) The Task Force on Modelling of Groundwater Flow and Transport of Solutes; and (2) The Task Force on Engineered Barrier Systems (EBSs), which bring together experts from different national SNF- and HLW-disposal programmes.

The Äspö HRL also provides facilities for international co-operation in support of the 'Implementation of Geological Disposal of Radioactive Waste– Technology Platform' (IGD-TP)

which Secretariat is sponsored by the European Commission (EC). Through this platform nuclear waste management organisations and academic institutions can perform joint projects which partly is done in the Äspö HRL facilities. Currently 11 organisations with implementing responsibilities are involved in the IGD-TP work, see the IGD-TP web site [www.igdtp.eu](http://www.igdtp.eu). In addition to SKB working with other waste management organisations on experiments in Äspö SKB has also arranged for staff from both NUMO in Japan and NDA RWMD in the UK to work with SKB staff in the facility. The purpose of these staff placements is to provide an opportunity for observation of the planning, installation and monitoring of experiments in an URL. The longer term interest is enabling the organisation to consider a move from desk based and laboratory scale experiments to full scale demonstration.

## **VALUE ADDED PROGRAMME**

Oskarshamn and Östhammar were the two candidate communities where site investigations were carried out to determine the suitability of the bedrock to host the final repository for SNF. In 2009 the Forsmark site in the Östhammar community was selected as the site for the repository. At the end of the siting process, based on an initiative from the communities and in recognition of the effort of both communities, SKB and its owners, the Swedish utilities, reached an agreement with the communities that support would be given to projects that would create added value..

The agreement is termed the Added Value Programme with up to 2-billion SEK (~ \$300 million) being available to projects in both communities with 75% of the sum allocated in the community NOT selected as the site for the continued development of the SNF repository (Oskarshamn) and 25% allocated in the community selected to host the SNF repository (Östhammar). However, only 20% of the 2-billion SEK will be allocated for projects before the final approval of the licence application.

SKB's demonstration 'dress rehearsal' facilities are all within the Oskarshamn community, which was not selected to host the SNF repository. The related challenge is that the local research and expertise associated with SKB is being relocated from the community and it becomes a victim of its own success with the potential decline in its use as the SKB programme moves to construction at Forsmark.

As part of the Added Value Programme, SKB is committed to the future of the Äspö HRL as an international research facility. This is seen as a benefit to the Oskarshamn community and its local businesses, and to the ongoing development of geological disposal technology for SKB and other waste management and research organisations around the world.

Funds from the Added Value Programme have been made available for the construction of an additional 100m of new tunnel excavation in the Äspö HRL. These tunnels provide a unique opportunity for international organisations to establish work programmes in an underground research laboratory (URL) at marginal effort and cost. The Äspö HRL has been opened up as an international research facility and is available to the nuclear community along with knowledge and experience in the field of geological disposal. The facility is also available for other types of research activities such as environmental research for non-nuclear projects; which is handled through Nova FoU.

## **THE MISSION OF NOVA FoU**

Nova FoU (the Center for University Studies, Research and Development) in Oskarshamn gives university courses, conducts research and performs business development ( [www.novaofou.se](http://www.novaofou.se) or



[www.oskarshamn.se/nova](http://www.oskarshamn.se/nova)) in the municipality of Oskarshamn thus contributing to the long term growth in the region by creating networks between academia, business and society. Äspö Hard Rock Laboratory ([www.skb.se](http://www.skb.se)) is a world unique underground research laboratory which is now open for more general research. Nova FoU is the organisation which implements this policy and facilitates external access for research and development projects to the SKB facilities, data and competence in Oskarshamn. The aim of Nova FoU is to create local and regional spin-off effects in favour of the society and business. It is supported by SKB and the municipality of Oskarshamn. and provides access to the following facilities:

- Äspö Hard Rock Laboratory.
- Bentonite Laboratory at Äspö.
- Canister Laboratory in Oskarshamn.
- Site Investigation Oskarshamn (Laxemar).

The aim of the research and development projects at Nova FoU is to create long term spin-offs and business effects beneficial to the region. Nova FoU supports new and innovative research, for example environmental studies, where the extensive SKB datasets from geological, hydrogeological, hydrogeochemical and ecological investigations and modelling can be used.

The data can be used e.g. for assessing the consequences of natural resource management and pollution risks. The data and models can be used to estimate exposure both at individual and population levels. Development of monitoring and analytical systems can be performed relating to the management of various renewable natural resources in, for instance, agriculture, fisheries, forests and groundwater. Studies which give a better knowledge concerning pollution problems coupled to toxicological and epidemiological issues are possible. Technology, innovations and spin-off effects at pre-market stages are of special interest.

## CONCLUSION

The Äspö HRL has been a valuable core component of the Swedish nuclear waste management programme for more than 18 years. It has already been, and continues to be, used for state-of – the –art RD&D of global importance. The Äspö HRL including the facility and its infrastructure and the data gathered about the site over the past three decades are now being made available to other waste management organisations and the academic community for research purposes.

## REFERENCES

1. SKB AB, Report TR- 11-10, Äspö Hard Rock Laboratory. Annual Report 2010. February 2011
2. SKB AB, Report TR-12-03 Äspö Hard Rock Laboratory. Annual report 2011.