

# 講 演 メ モ

スウェーデン核燃料・廃棄物管理会社

( S K B )

テニス・パップ研究開発局長

The SKB logo is a small black square with the white letters "SKB" inside, positioned at the top center of the presentation slide.

***High-Level Radioactive Waste Disposal  
in Sweden***

**by**

**Tonis Papp**

**Research Director, SKB, Sweden**

Ladies and Gentlemen, I am honored to be here today and to give an overview of the situation in Sweden to this distinguished audience.

## ***Highlights***

- The Swedish System
- Financing
- Siting Programme
- The Äspö Laboratory
- Concluding remarks

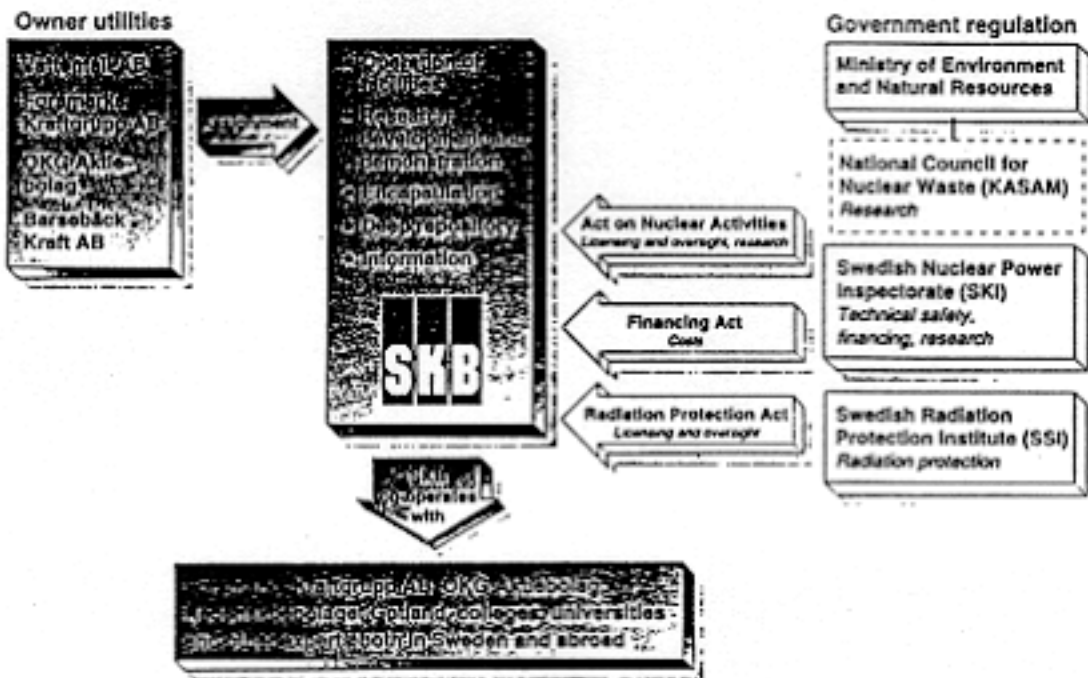
I will quickly show you the Swedish organisation, existing and planned system, and how the financing is arranged.

And then focus on the siting issue, the progress we have made and the problems we have encountered, especially with regard to public acceptance.

A short overview of the activities within the Äspö will be given.

And I will end with som concluding remarks

# SKB, laws and authorities



Swedish law states that whoever operates a nuclear facility is also responsible for the safe management of the waste produced.

The four Swedish utilities have formed a jointly owned company, SKB to carry out the task to manage the waste outside the nuclear sites.

That is,

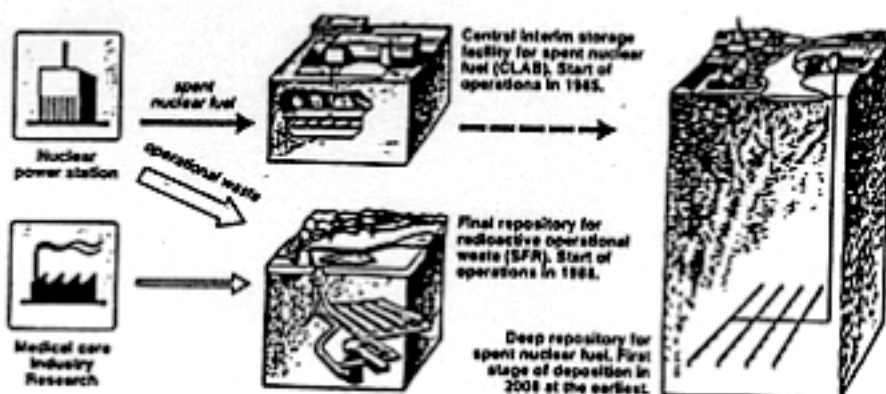
to build and operate the facilities needed for transport, storage, conditioning and disposal,

to do the necessary research to develop a final repository, to site it, to build it and to licence it for permanent disposal,

and to carry out the necessary information and other activities to get it accepted by the public.

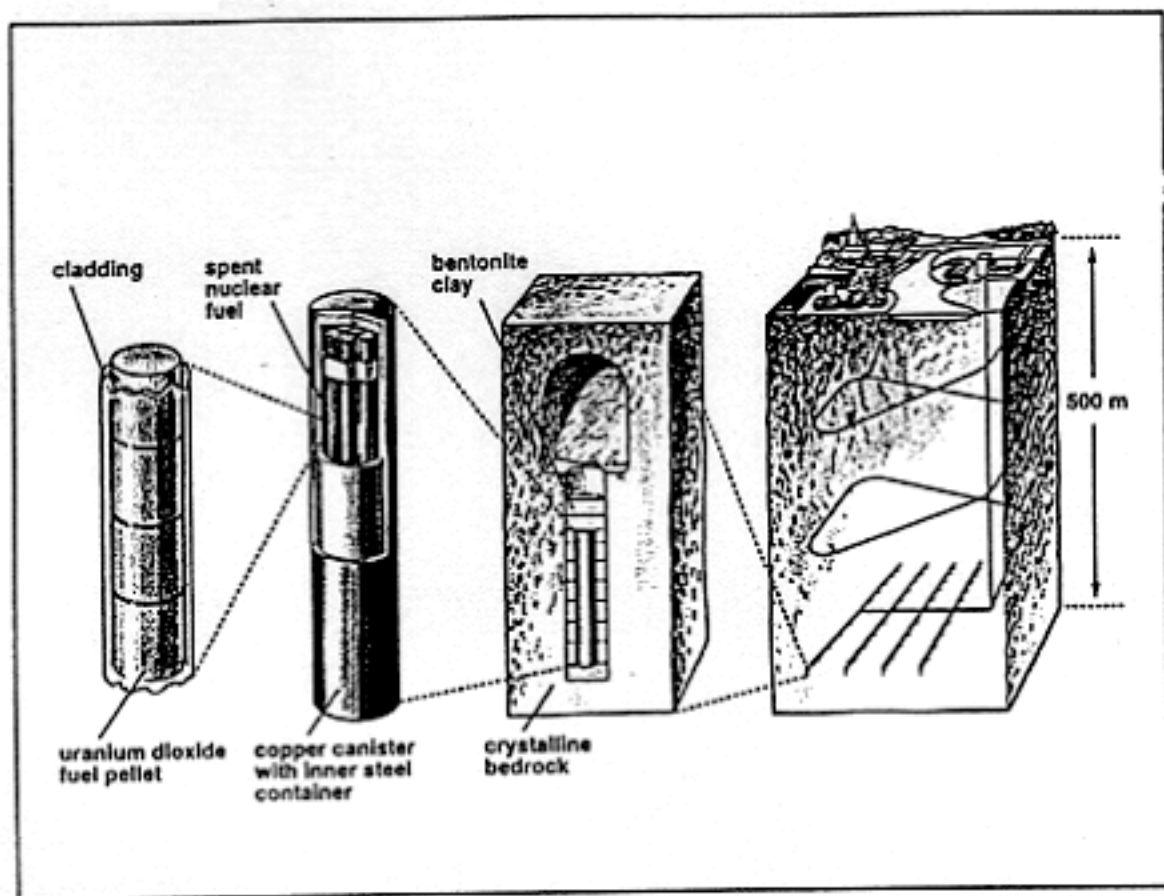
Authorities are appointed to controll that this work is done according to laws and regulations.

## The Swedish system



Sweden has a system in operation today that will manage all of our radioactive waste for a long time to come. There is a transportation system, a final repository for the operational waste and an interim storage facility for spent nuclear fuel. The operations are running smoothly and the relationship with the lokal population is good.

The final repository for the spent fuel is planned to be in operation about a decade into the next century, at the earliest. The system is under development and the siting process has started.



Sweden has decided not to reprocess the spent nuclear fuel. After 30 to 40 years of interim storage, it will be deposited in a deep geologic repository.

The deep repository, as planned today, is an excavated tunnel system at about 500 m depth in Swedish crystalline rock.

Before disposal the fuel will be encapsulated in a steel/copper canister. Each canister will be deposited in a separate drilled hole in the tunnel floor, and be surrounded by a plastic clay to protect it from external effects.



### **Nuclear Waste Fund**

**Deposited in interest-bearing accounts  
with the National Dept Office.**

**The charge is fixed annually by the  
Government and is based on cost  
calculations submitted by SKB to SKI.**

**Charge: 1996 - 0,019 1997 - 0,011 (SEK/kWh)**

The management of long lived radioactive waste in Sweden is financed by a charge on every kWh of nuclear electricity produced in Sweden.

This fund is to cover all cost for handling transport and conditioning of the waste, and all the cost for finally dispose it into a deep repository and to decommission all the nuclear facilities.

The fund is administered nationally, and every year SKB has to revise its cost calculations and submit them to the government. After a review by the Swedish Nuclear Power Inspectorate the government will decide the level of the charge for the next year.

## Reserve fund contents and withdrawals



The estimated total cost of taking care of all the radioactive waste produced and dismantling the facilities is 53 GSEK, expressed in 1996 years money.

About 11 GSEK has been withdrawn from the funds up till today, and the present reserves in the fund are about 20 GSEK. Today more than 1 GSEK is paid into the fund from the electricity charge. An equal amount is coming from the interest on existing reserves.



**SKB programme, RD&D 95**

- Generic countrywide investigations
- Siting
  - Safety - Interest - Industrial
- 5-10 feasibility studies
- 2 sites      drillhole investigations
- 1 site      underground investigations

After having made basic geological investigations in more than 10 places in Sweden, the siting program started in the early 1990:ies.

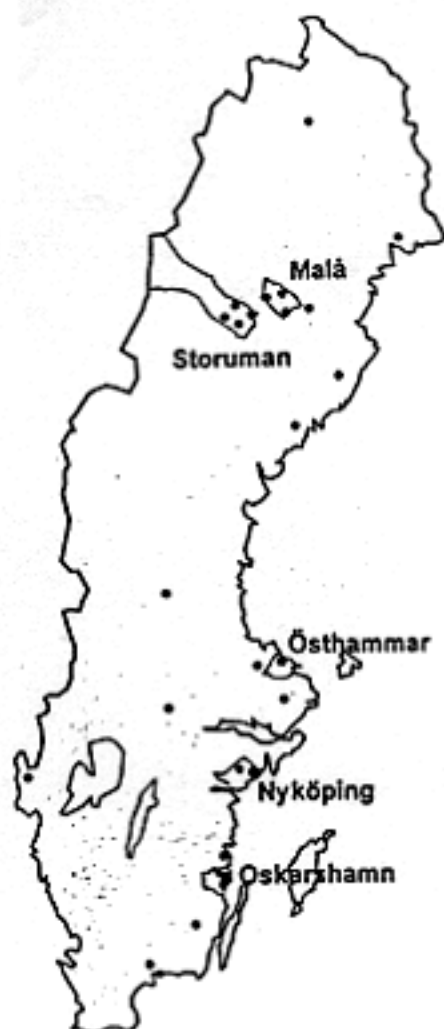
Three basic qualities where sought for in the municipalities:

it should have a geology capable of giving high safety  
they should be interested in (or not opposed to) SKB making investigations  
there should be an existinh local industrial infrastructure

The planning foresees that 5-10 feasibility studies (archive material, no drillings) are made as a basis for selecting two sites for site characterisation (about 10-15 drillholes down to 1000 m). Among these sites one will be proposed as the site and a license application will be submitted.

If this siting is approved further investigations will be done from shafts or tunnels on that site.

We are today working with the feasibility studies.



Here you can see the map of Sweden and where we have made geologic investigations.

The areas marked with yellow are the municipalities where we have made, or are making, feasibility studies. The red dots outside of yellow areas are earlier study sites. Those inside the two northern yellow areas mark areas of interest found in the two feasibility studies that are completed.

Today feasibility studies are going on in the three municipalities on the east coast of Sweden. They all have all previous experience from nuclear activities.

The Forsmark nuclear plant is located in Östhammar. The Nuclear research laboratories in Studsvik are in Nyköping, and the Oskarshamn nuclear plant is situated in The Oskarshamn municipality.

In the northwestern area, Storuman, a referendum was held on whether we should be allowed to continue our investigations there. By 70% against 30% the population said they didn't want us to continue. No activities are going on there today.

We hope to be able to add some more municipalities to this list. Recently another municipality in northern Sweden indicated their interest.

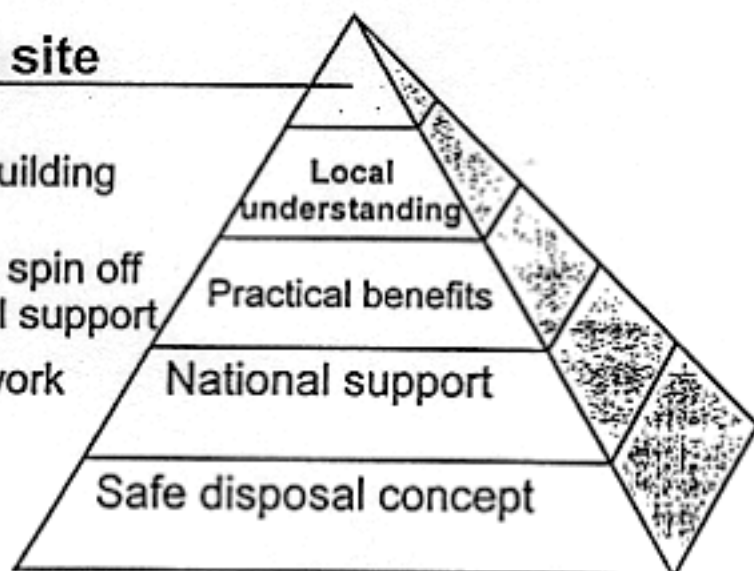
## Accepted site

Confidence building

Employment, spin off  
Infrastructural support

Legal framework  
Coordinator

Assessments



1997-03-04, TP

As I said, we try to establish a local acceptance for our siting work - or at least tolerance. --- This is not an easy task.

Even if there is a strong majority saying that "of course Sweden must take care of its own waste" the willingness to accept it in your own neighbourhood is low.

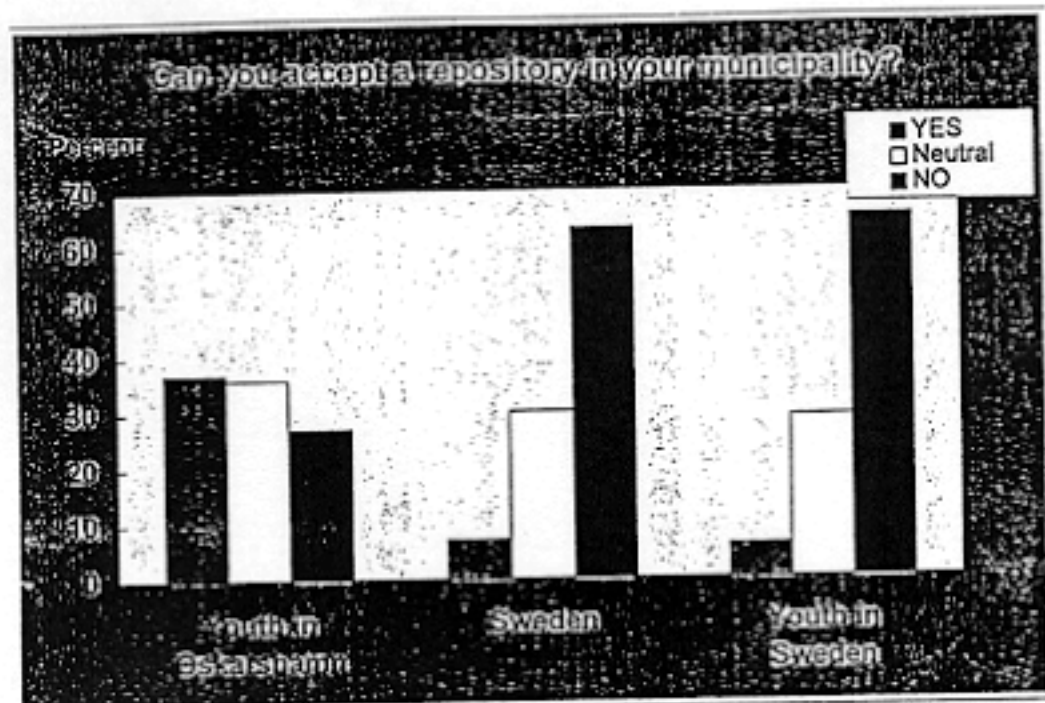
To illustrate the building of tolerance we can compare it to building a pyramid.

The most basic requirement for getting a stable acceptance for site work is the understanding that it is possible to build safe repositories, and that there are good sites available in the community we work.

But even then it is very clear that there is a need for national support, through legislation, governmental support etc. In Sweden a national coordinator has recently been appointed to support the establishment of a fair and accepted siting procedure for siting.

All this is a necessary basis for tolerance, but we will never have an acceptance if the local people do not see any practical benefits in us being there. Jobs etc are of course central, but also indirect benefits must be made visible. Compensation for damages or value loss is normal, but there is no tradition in Sweden to pay someone for accepting an unwanted facility.

The final basis for the acceptance is the confidence. A local confidence that the siting is done for the common good, that both field workers and experts are trustworthy, that all the information gained is available for scrutiny. In short that we are doing a fair and transparent job.



The building of the pyramids of confidence and acceptance will be a hard job, and the opinion polls are not very encouraging.

In this picture you clearly see the very negative attitude shown in Sweden. Still there are sometimes also good signs, like the recent investigation made among youth in Oskarshamn at the left.

Due to the reactors there the Oskarshamn people have probably a better than average knowledge of what a repository is about, they have also a clearer perception of what job opportunities the repository might involve.

And finally, since the interim storage is also sited at Oskarshamn, they might better appreciate the fact that a final repository is built in order to enhance the long-term safety.

Another recent good sign is the fact I mentioned earlier that another municipality in northern Sweden have recently indicated their interest in a feasibility study, to find out what siting of a repository would mean in practice to their community.

## Internationellt samarbete i Äspölaboratoriet



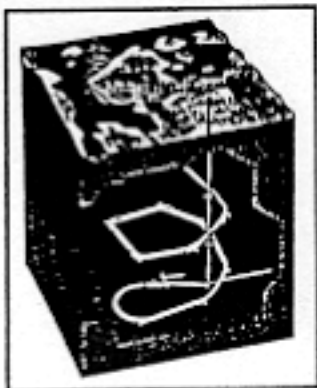
ÄSPÖLABORATORIET • ÄSPÖ HKL

The building of this confidence in the public is seen today as the most important task for SKB. Work is done in many areas, and I can only address some of it here.

The Äspö Hard Rock Laboratory is one of the most important activities, both when seen from a technical point of view or when looking at its effect on understanding and acceptance.

The Äspö laboratory is an underground research facility for studying the situation at large depth in crystalline rock - and thereby to create a better understanding of how a deep repository will perform in the long term.

There has been a large international interest for these investigations, and we are proud that we have now a very successful cooperation at Äspö between groups from 9 countries. Japan participating with both CRIEPI and PNC, Finland, Germany, Switzerland, Spain, France, United Kingdom, Canada and Sweden.



### ÄSPÖ HRL:

- depth 450 m
- tunnel length 3600 m
- 1986-90 site investigations
- 1990-95 construction
- 1995 operation
- total cost ~500 MSEK  
(1986-1995)

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Here you can see some basic data on the Äspö laboratory

I would like to mention that the work at Äspö has been followed with interest by the local press and relationship with the local population in the Oskarshamn municipality is good.



### ÄSPÖ HRL:

- Increase scientific understanding of safety margins
- Develop disposal technology
- Demonstrate disposal technology (inactive)

### Projects:

TRUE Experiments  
 Prototype Repository  
 Demonstration Repository

Most of the Äspö work has up to now focused on scientific experiments and on testing of instruments and site characterisation.

As the practical application in a repository comes closer, however, we are now looking more at integrated testing and demonstration of the technology we will be using.

The three large projects now starting are

The Tracer Retention Understanding Experiment to further test our models for how radionuclides move in the fracture systems.

The Prototype Repository will involve a number of full scale canisters that will be deposited and monitored over 10-20 years.

The Demonstration Repository will be a part of the tunnel system that will be used for performing full scale testing and demonstration of the machinery needed for the deposition operations.



### ***Concluding remarks***

- ***Efficient waste handling system exists***
- ***Good operational experience***
- ***Extensive R&D since 20 years***
- ***Time has come to implement***
- ***Stepwise implementation process***
- ***Focus on local understanding and acceptance***

In conclusion I would like to sum up the situation in Sweden today with the following words



スウェーデン核燃料・廃棄物管理会社（SKB）

テニス・パップ研究開発局長

Mr. Tonis Papp

の略歴

1. 生年月日

1938年3月17日、エストニア生まれ

2. 略歴

1966年                      ストックホルム大学物理・化学部門卒業

1967年～76年              スウェーデン電力庁（原子力発電の環境評価）

1976年～                      SKB

1991年～                      SKB研究開発局長

国際的な活動：

・ 北欧放射線防護協会委員

・ EU原子力安全・保障措置調整委員会委員

・ OECD/NEA放射性廃棄物管理委員会委員（1981～89）