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Miljöorganisationernas  
kärnavfallsgranskning

The Swedish NGO Office for  
Nuclear Waste Review



# **Evaluating the Swedish KBS method for final disposal of spent fuel: Assessing the critical issues for licensing**

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# Overview of presentation

- Presentation of some fundamentals of the Swedish nuclear waste management system
- Long term environmental concerns if the KBS method is chosen for a final repository for spent nuclear fuel / high level waste
- Important issues of concern in the forthcoming licensing process of an application for a permit for a Swedish repository for spent nuclear fuel
- Implications if the Swedish KBS method has licensing problems

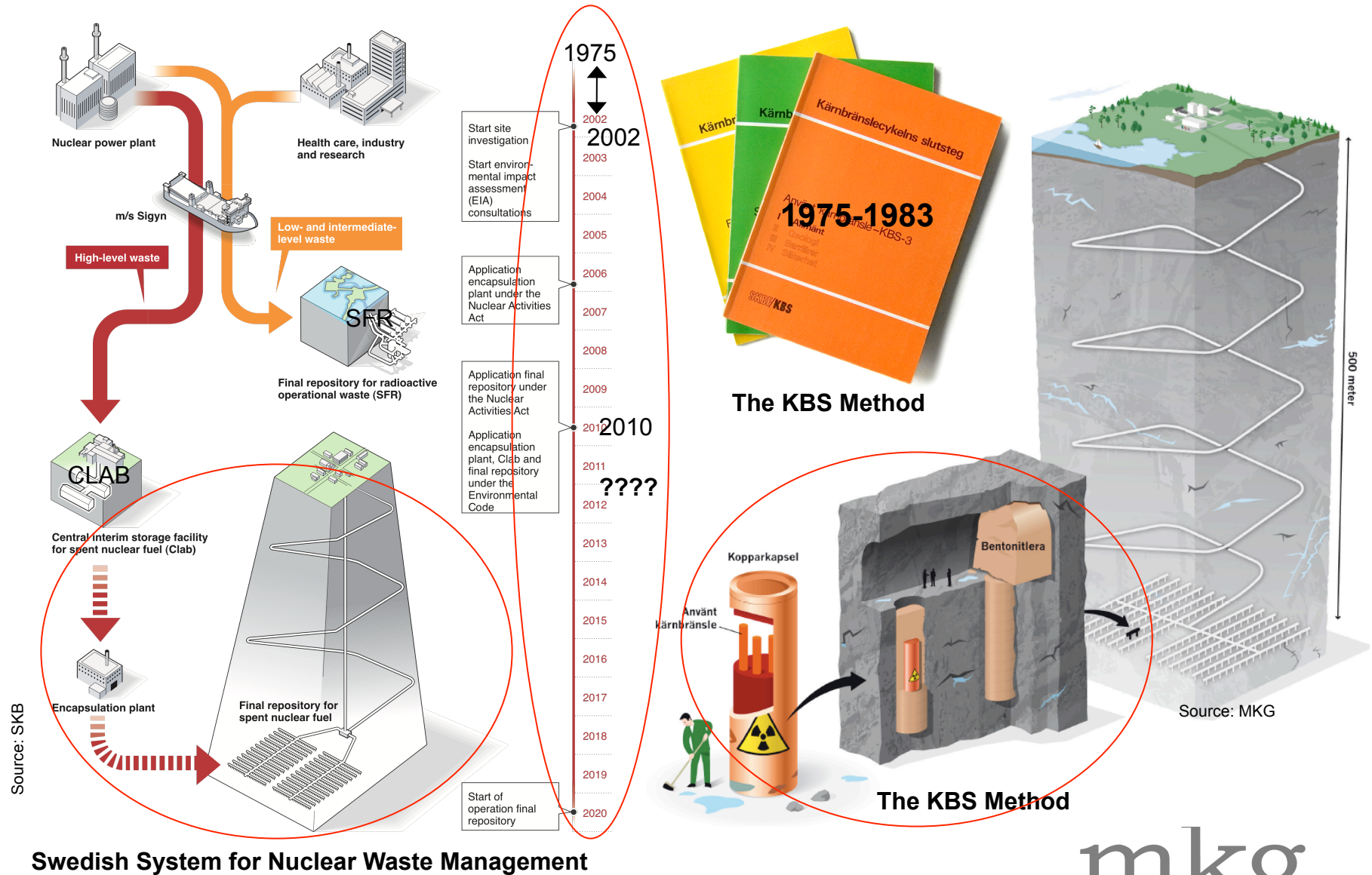
# Brief information about MKG

- The Swedish NGO Office for Nuclear Waste Review – Miljöorganisationernas kärnavfallsgranskning, MKG, is an environmental organisation working only with nuclear waste issues.
- The largest founding partner in MKG is the Swedish Society for Nature Conservation, SSNC – Naturskyddsföreningen – the largest environmental organisation in Sweden (180 000 members).
- The work of MKG is financed by the Swedish Nuclear Waste Fund.
- MKG takes an active part in the environmental consultation process for a repository for Swedish high-level nuclear waste (direct disposal of spent nuclear fuel).
- MKG is preparing for the upcoming review of an industry licensing application to the regulator (Swedish Nuclear Safety Authority) and the Environmental Court

# Management of nuclear waste in Sweden

- By law, the Swedish nuclear industry is responsible for managing and finding a sustainable method for final disposal of the nuclear waste
- An economic system with a state-controlled Nuclear Waste Fund has been set up to guarantee that the polluter-pays-principle is upheld.
- The Swedish nuclear industry, no-one else, has given the task of solving the nuclear waste problem to an industry-owned nuclear waste company – SKB.
- SKB has been working for over 30 years on developing a method (KBS) and site for disposal of Swedish high level nuclear waste, which in Sweden is in the form spent nuclear fuel (no reprocessing).
- The progress of the development of the KBS method and the repository siting work has been regularly reviewed by the regulatory bodies and the Government. But there has been problems with “capture of the regulator”.

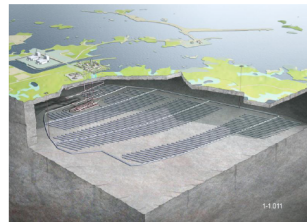
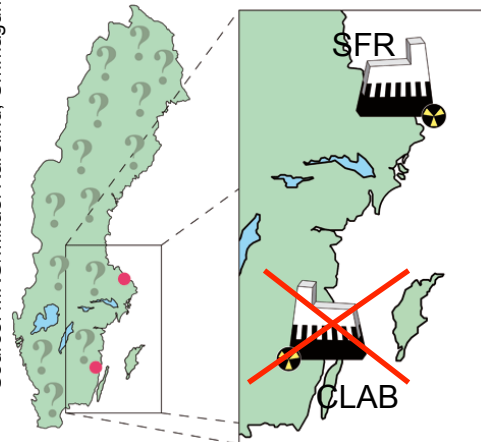
# Swedish nuclear waste system – Method



# Swedish nuclear waste system – Siting

- After a long history of siting failures the nuclear industry has since the turn of the century been carrying out site investigations at two sites, both right adjacent to a nuclear power plant.
- In June 2009 Forsmark was chosen for a repository, with an encapsulation plant to be built at Oskarshamn.

Source: MKG/Mikael Kärelind, Ummagurmma



Forsmark nuclear power plant

Oskarshamn nuclear power plant

- The nuclear industry is preparing to apply for permission to implement the KBS method at Forsmark on March 16<sup>th</sup> 2011.

# The KBS method: Long-term environmental concerns (I)

- Radiation risks för 100 000 years and longer
- Nuclear weapons proliferation risks for over 100 000 years
- Chemical risks for all future





# The KBS method: Long-term environmental concerns (II)

- A final repository for spent nuclear fuel can not be allowed to release radioactivity that harms the ecosystems for a period of over 100,000 years.
- A geologic repository in Swedish bedrock at a depth of 500 m has groundwater flowing through the repository.
- A repository using the KBS method therefore has to rely on man-made barriers (clay and copper) to isolate the nuclear waste from the environment.
- The chemical and biological environment will in the long term threaten the artificial barriers of copper and clay in ways that are difficult to foresee.
- The relatively dry rock (for the KBS method) chosen by SKB in Forsmark puts stress on the clay barrier and opens up for new questions on copper corrosion processes.

# The KBS method: Long-term environmental concerns (III)

- In Sweden there will be one or more ice-ages during the next 100 000 years.
- Glaciation will lead to variations in the chemical and biological environment that will affect the man-made barriers.
- Glaciation during ice ages will physically affect a repository (lateral movement, major earthquakes, permafrost).
- The uncertainties of long-term physical, chemical and biochemical impact on a KBS repository means that there are still a number of unanswered questions in the safety analysis.

And do not forget ...

- Spent nuclear fuel contains plutonium that poses a long-term nuclear weapons proliferation risk for over 100 000 years. This means there will be monitoring and surveillance demands for an indeterminate future.

# SKB is moving forward to licensing

- The nuclear waste company SKB has stated it plans to submit an application for licensing of a KBS repository in Forsmark on March 16<sup>th</sup>
- The application will be submitted to regulator (Swedish Nuclear Safety Authority) according to the Nuclear Act and to the Environmental Court according to the Environmental Act.
- The application means that the regulator will have legal grounds to act fully on the issues of concern that it has. A preliminary statement on the application is expected after about three months
- The whole process will likely take three years or more.
- The regulator and the court will only give recommendations to the Government. It is the Government that finally decides if a permit is to be given or not.

# Important issues in the licensing process (I)

- Basic legal issues such as if the consultation process has been properly carried out
- Will the complex model for the safety analysis hold up to scrutiny?
  - This is where SKB has their focus and strength, but
  - are ice age scenarios covered in an appropriate way (permafrost, earthquakes)
  - are scenarios for release and impact on the biosphere covered in an appropriate way
- Can the “input data” to the model be verified or at least made plausible (first 1 000 years) ?
  - This is where there may be major problems
  - Extremely weak experimental support for the fundamental idea that copper does not corrode in an environment without oxygen
  - Will the clay behave as modelled
  - Big problems with the results of research on copper and clay in the Hard Rock Laboratory (SSM Report 2010:17)

# Important issues in the licensing process (II)

- Issues related to intrusion scenarios, retrievability and need for long-term monitoring/information transfer to the future
  - Risks for unintentional and intentional intrusion to be balanced with positive aspects of retrievability
  - Nuclear weapon proliferation risks with plutonium – need for monitoring
- Siting issues
  - SKB has to show that the site has been chosen in an appropriate way
  - The Forsmark site has problems
- Alternative methods
  - SKB has to show that it has dealt with alternatives in an appropriate way
  - Deep borehole disposal may have a higher long term security and be less problematic for unintentional and intentional intrusions

# What if there are major problems ?

- Can SKB adapt the KBS method or will the concept of using man-made barriers to achieve long-term safety have to be abandoned?
- The KBS system appears to allow siting in “almost any bedrock” which allows siting in “nuclear communities”. Siting may be more difficult without the method.
- The nuclear waste management systems in Finland, Canada, the UK, and elsewhere want to use the KBS method and will be affected.

# For more information ...



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