The Swedish NGO Office for Nuclear Waste Review, MKG, presents its view on

alternative methods and sites

for the final disposal of Swedish high-level nuclear waste

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mkg
Miljöorganisationernas kärnavfallsgranskning

A method that is better for the environment?

Public health and the environment must be the prime concern when planning for a final repository for high-level nuclear waste. The goal must be that no radioactivity will leak from the repository and reach the biosphere for at least hundreds of thousands of years. It is unacceptable to risk that future generations might be exposed to radioactive materials because we did not chose to use the method for final disposal of spent fuel from nuclear reactors that is best for the environment in the long term.

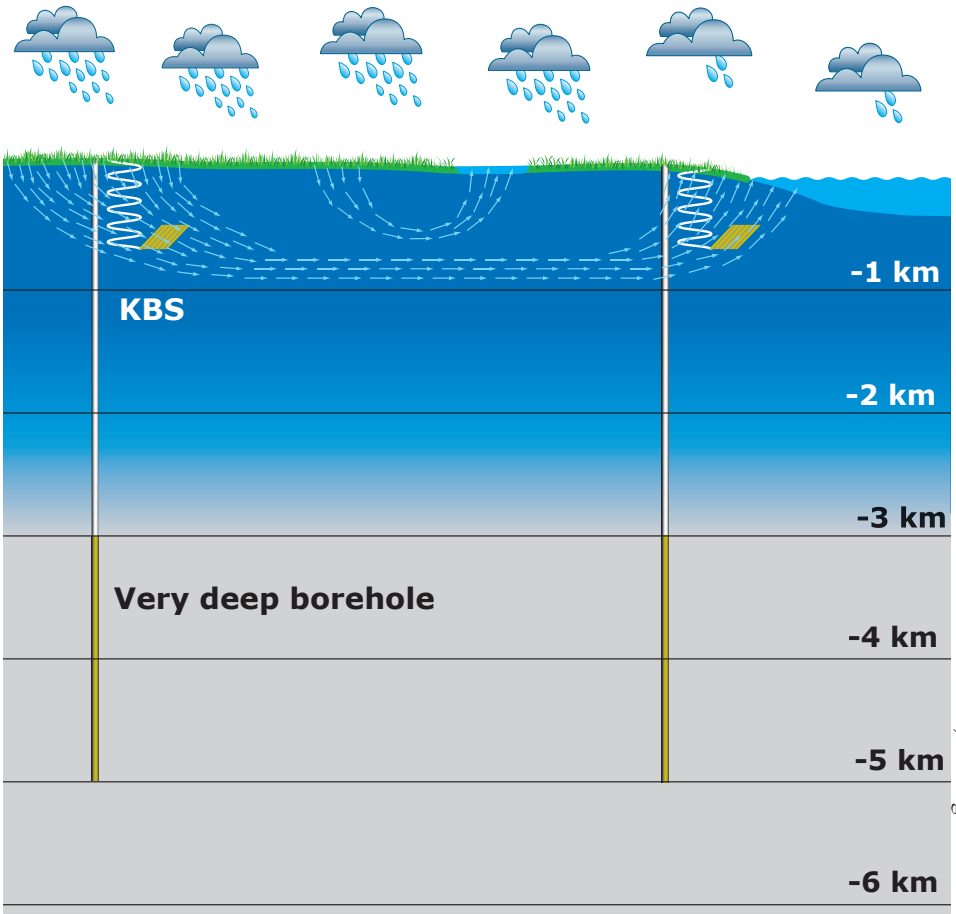
The nuclear power industry, acting through a jointly owned nuclear waste management company, SKB, has been working for some thirty years on the KBS method, an option for final disposal that they now are eager to put into practice. The method involves placing the waste in mined tunnels 500 meters underground in bedrock that contains mobile groundwater that is continuously in contact with the biosphere The waste is to be isolated by man-made barriers of copper and clay. Despite three decades of work, the long-term safety of the system has yet to be demonstrated.

An alternative to the KBS method is disposal of high-level nuclear waste in very deep boreholes, whereby the waste will be deposited at a depth of 3 to 5 kilometres (see figure). Groundwater at these depths may have been immobile for millions of years. Modelling has shown that the groundwater would remain stable even after a repository has been constructed. Totally isolated from the biosphere, the repository can therefore be expected to afford a considerably more robust system than the method the industry arrived at thirty years ago, KBS-3.

Another advantage of very deep boreholes is that once sealed, it would be more difficult to retrieve the spent nuclear fuel from the repository. Spent fuel rods contain plutonium, which can be used as raw material for the manufacture of nuclear weapons. The KBS method thus has a serious drawback in that it requires safeguards for a period of more than one hundred thousand years to prevent intrusion into the repository in search of plutonium.

It is vital that the Swedish environmental courts and the Government have a solid scientific basis for the choice of disposal method when decisions are to be taken on industry's application for permission to commence the construction of a final repository. For this to be possible, the industry must put much more effort into the study of the very deep borehole alternative. Full-

Schematic drawing demonstrating both the method and siting issues



Ill: Mikael Kårelind, Unmagumma

Method
The KBS method, favoured by the Swedish nuclear industry, involves disposal of high-level nuclear waste in the form of high level nuclear waste in mined tunnels in bedrock at a depth of 500 m. Rock at this depth contains upwardly mobile groundwater that is in contact with the surface of the earth.

An alternative method, very deep boreholes, involves disposal of the high-level nuclear waste in boreholes at a depth of 3-5 kilometres in bedrock that has no contact with the biosphere, i.e., with human beings and the environment.

Sites
Given the coastal siting of a KBS repository, any leakage would reach the surface relatively quickly. If a KBS repository were instead sited inland in a recharge area for groundwater, radioactive substances from the repository may not reach the surface for tens of thousands of years.

Whether sited on the coast or inland, using very deep boreholes may be a better choice from the point of view of the environment. If the KBS method is chosen, an inland site appears to be preferable.

scale development of the alternative is hardly necessary, only research to answer some critical questions. It is entirely feasible to wait some years before submitting an application for a KBS repository; an acceptable delay in a project that is to endure for hundreds of thousands of years.

Authorities, the environmental court and the Government need a justifying scientific basis on the alternative methods so that a comparison is possible when reviewing the application for a nuclear waste final repository from the industry. An independent inquiry should be performed to examine the time and money needed to evaluate alternative methods and what issues that should be more investigated to make sure that the decision makers have the basis needed when a decision is to be made.

MKG does not endorse a specific method for final disposal of high-level nuclear waste, but wants the government to make it clear to the nuclear industry that their proposed method cannot be approved until they have produced a better basis for environmental comparisons with alternative methods.

A site that is better for the environment?

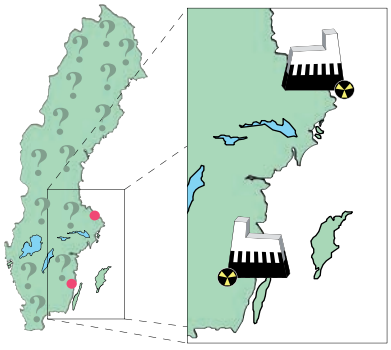
The nuclear industry has been planning for some years to locate the final repository for high-level nuclear waste at one of two sites immediately adjacent to nuclear power stations (Forsmark and Oskarshamn) on Sweden's Baltic Sea coast. Now the industry has decided to apply for a permission to build the repository at the Forsmark nuclear power plant.

The very deep borehole method may turn out to be an environmentally more robust option for disposal of spent nuclear fuel than the industry's proposed KBS method. However, if the KBS method is chosen, despite weaknesses, care in the choice of the site may substantially delay leakage of radioactivity to the environment. Generally speaking, the movement of groundwater up to a kilometre beneath the surface may be described like this: groundwater sinks down through the soil and subsurface rock in the inland and then rises again toward the coast (see figure on opposite page). If a KBS repository is properly located and an optimal depth is chosen, leakage from the repository will follow the stream of groundwater and surface again up to 50,000 years later. If, however, a KBS repository is sited on the coast, leakage may be transported to the biosphere in as little as 50-100 years time. From the point of view of long-term environmental security, an inland site

(Continued on the next page.)

THE NUCLEAR INDUSTRY'S PLANS FOR A REPOSITORY — neither the best method nor the best site?

A good method? A law passed some thirty years ago forced the Swedish nuclear power industry to start developing a method for disposal of high-level nuclear waste (or else stop producing it). The industry quickly put together a draft option for a method, KBS, which with minor modifications they have adhered to ever since. Today, much more is known about bedrock, groundwater mobility, copper corrosion and clay erosion than was known back then. The knowledge is also advancing when it comes to alternative methods. The view of the Swedish NGO Office for Nuclear Waste Review, MKG, is that the choice of method should foremost be based on an evaluation of the long-term environmental security of different alternatives. The method that is best for the environment in the long term should be chosen, in agreement with, the Swedish environmental law. The picture shows old reports from the KBS project from the late 1970s and early 1980s.



A good site? The Swedish nuclear industry has been looking for a site for disposal of high-level nuclear waste for thirty years. The result was two alternative sites that both were adjacent to a nuclear power plant (Forsmark and Oskarshamn) on the Baltic Sea coast. Did geology or local attitudes to nuclear power industry determine these choices? The industry claimed that the fact that those chosen sites were next door to the nuclear power plants was a mere coincidence. Now the industry has chosen to apply for a permission to build a final disposal of nuclear waste at Forsmark. The Swedish NGO Office for Nuclear Waste Review, MKG, wants the repository to be sited where geological and hydrogeological conditions are the environmentally best the country has to offer, not just "good enough".

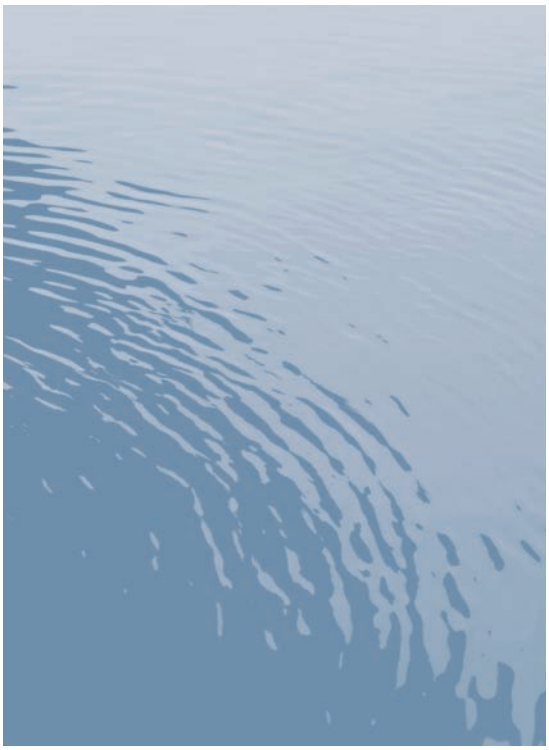
Ill: Mikael Kårelind, Ummagumma

in rock having downwardly mobile groundwater could be a better choice for a final repository of the KBS type.

Groundwater at the depth currently envisaged in the KBS method is more saline close to the Baltic coast than groundwater at similar depths in the inland. The salinity in the groundwater can adversely affect the clay that forms a buffer around the canisters containing high-level nuclear waste, this too speaks for an inland siting of a KBS repository inland.

The nuclear industry maintains that some coastal bedrock, too, exhibits downward groundwater drainage patterns. Be that as it may, the proposed site in Forsmark do not lie in such zones. The downward drainage patterns that would delay leakage the longest time are far away from the sea.

MKG does not endorse a specific site for a final repository for high-level nuclear waste, but wants the government to make it clear to the nuclear industry that their proposed site cannot be approved until they have produced a better basis for environmental comparisons with other sites.



Swedish NGO Office for Nuclear Waste Review, MKG, was established in the autumn of 2004. Its work is financed out of the Nuclear Waste Fund. The aim of MKG is that radioactive waste from nuclear activities in Sweden is managed in the best possible way with respect to long-term environmental safety and public health.

MKG has five member organizations: the Swedish Society for Nature Conservation, SSNC (Naturskyddsföreningen), the local chapter of SNF in Uppsala county administrative province and the local chapter of SNF in Kalmar county administrative province, Youth and Nature Sweden (Fältbiologerna), Oss (a local environmental group for safe final storage of radioactive waste in Östhammar community).

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