



Naturskyddsföreningen



Jordens
Vänner

Friends of the Earth Sweden

The status of and problems with the planned Swedish repository for spent nuclear fuel

Joint Project, May 6, 2022

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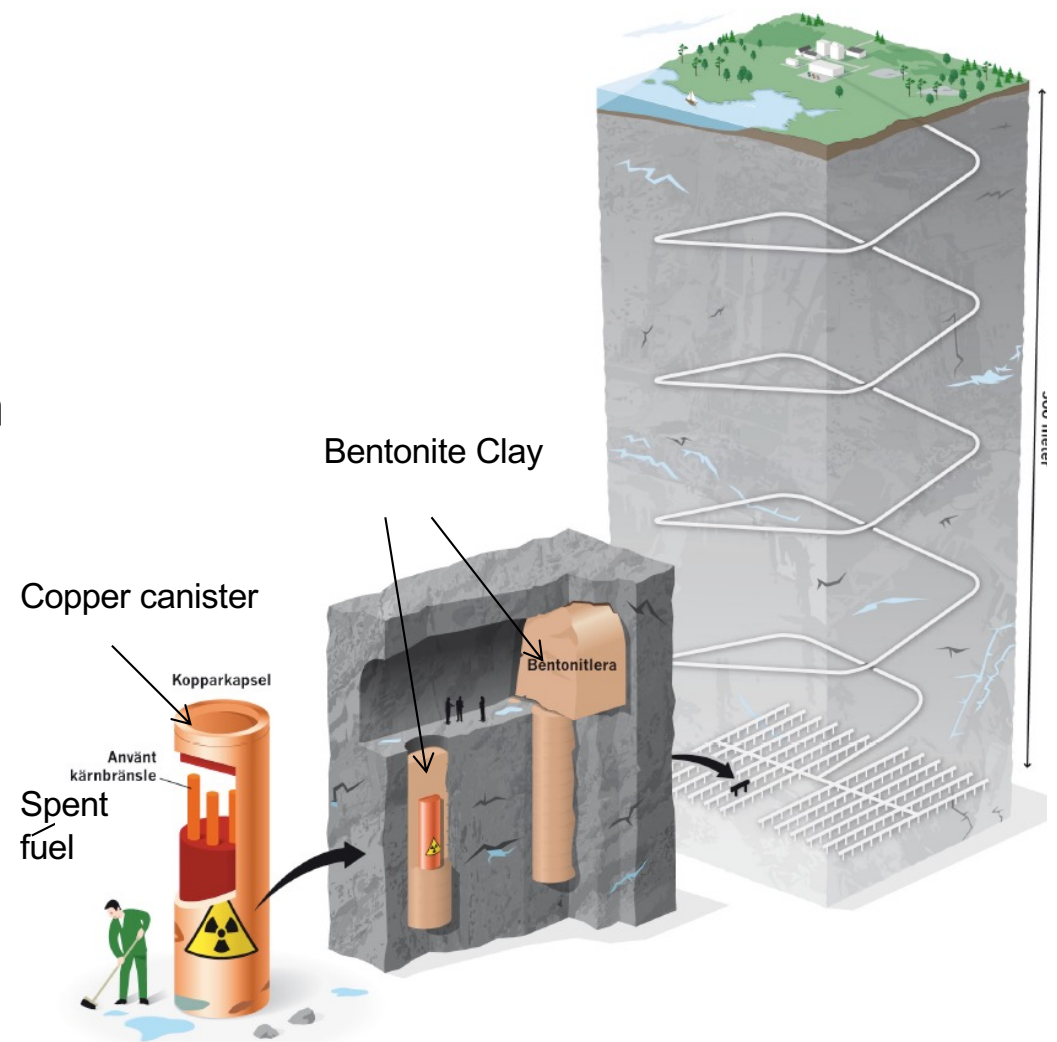
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The KBS method for disposal of spent fuel

- In the KBS(-3) method from 1983 the spent nuclear fuel canisters (5 m high) are to be deposited in holes in the floor of tunnels about 500 m underground in granite bedrock.
- The long-term safety case relies on two artificial engineered barriers – a copper canister and a bentonite clay buffer to protect the copper – to isolate the spent fuel for hundreds of thousands of years. There is clay also in the tunnels.
- Whether copper is a good choice for a canister material was debated in the 1980s and the issue surfaced again in 2007 and until today.



The KBS(-3) method

Developed
1975-1983







Further
development of
KBS method
1983-2011
(and onwards...)

MKG has
existed since
2005

License application and review (1)

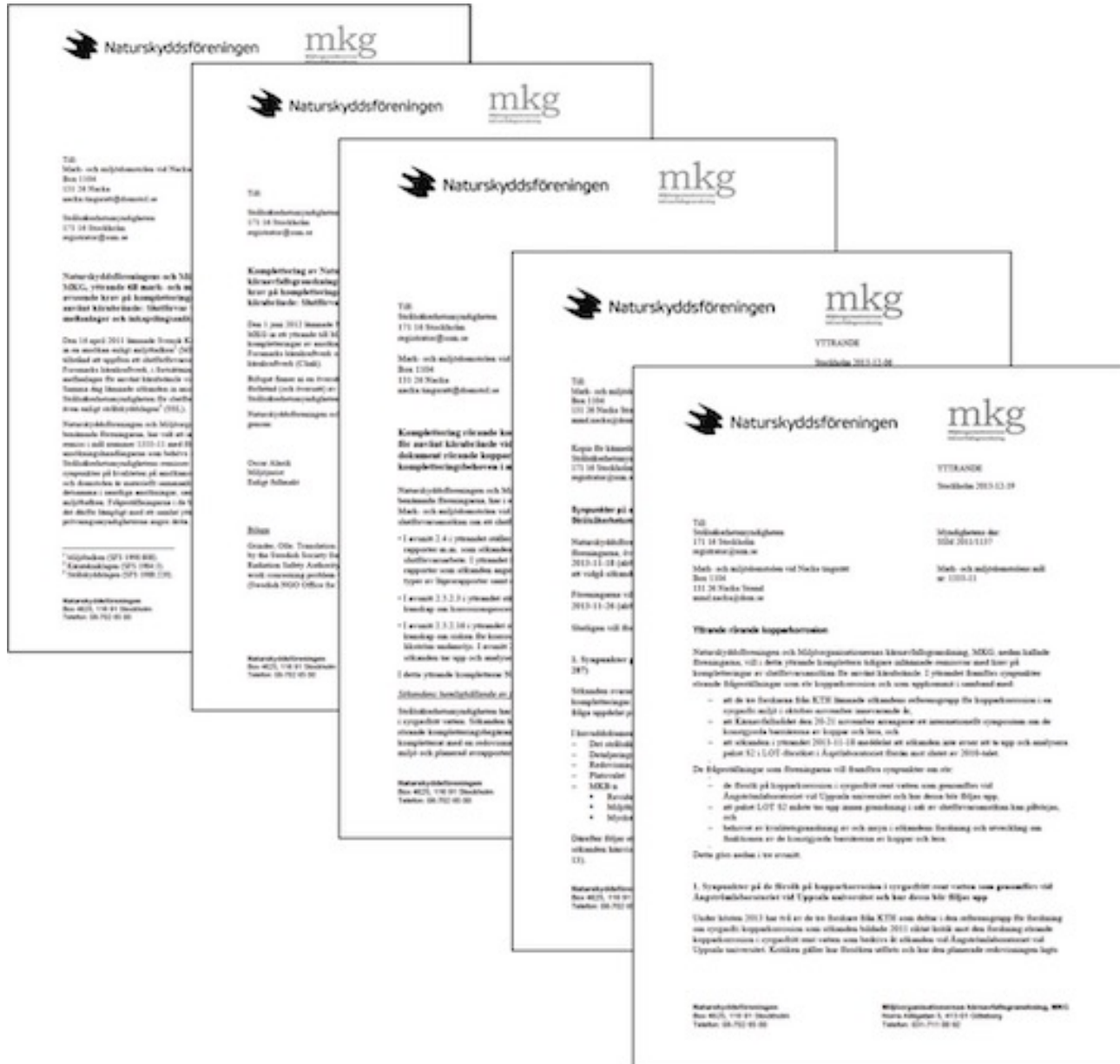
- An extended consultation process during 2002-2010 with MKG joining in 2005.
- The nuclear waste company SKB submitted a license application for a spent fuel repository system using the KBS method at the Forsmark NPP on March 16, 2011.
- The application was reviewed by the regulator, the Swedish Radiation Safety Authority (SSM) according to the Nuclear Activities Act and the Environmental Court according to the Environmental Code. The final decision on a license has to finally be taken by the government.
- Initial review for completeness of the application was completed in 2015. During 2016 and 2017 the application was reviewed on issues. Many issues were covered.
- During the review the issue of problems with the copper canister were raised by some actors including researchers at the Royal Institute of Technology (KTH) in Stockholm and MKG. The copper corrosion controversy goes back to 1980s and became very lively from 2007 with the publication of new studies.

License application 2011



2012-2017

+ another
5-6 briefs



License application and review (2)

- In the autumn of 2017, the main meeting of the Environmental Court was held. The regulator SSM told the court that some issues, i.e., the copper corrosion issue, could be dealt with after a government decision. The court questioned this in the meeting. According to both the Environmental Act and the Nuclear Activities Act the repository had to be shown safe before a government decision.
- At the court were also eminent scientists from the Royal Institute of Technology (KTH) in Stockholm that strongly questioned the SKB position on copper corrosion.
- During the court proceedings leaks to media showed that the regulator SSM had big internal problems (an SSM corrosion expert was against a yes decision and SSM scenarios showed regulatory limits would be exceeded).

Main meeting of the Environmental Court Sept-Oct 2017



MKG och Naturskyddsföreningen vid huvudförhandlingen. Från vänster: Magdalena Romanov, Christine Anvegård, Rebecca Nordenstam, Johan Swahn, Josia Hort.



Dokumentet avslöjar: Så allvarliga är riskerna

Strålsäkerhetsmyndigheten påstår att de risker med slutförvaret som avslöjats är irrelevanta. Men ett nytt dokument visar att så inte är fallet. I det skriver myndighetsspecialisten med ansvar för granskningen av slutförvarets långsiktiga säkerhet om "kritiska osäkerheter och kunskapsluckor kring kapselns grundläggande funktion".

SVERIGES NATUR GRANSKAR SLUTFÖRVARET.

De osäkerheter vad gäller slutförvaret av kärnbränsle som Sveriges Natur tidigare har rapporterat om nämns nu i ytterligare ett dokument från Strålsäkerhetsmyndigheten, SSM, som tidningen har tagit del av. Risker för kapselbrott som beskrivs i en artikel från 13 oktober är inte alls ryckt ur sitt sammanhang eller irrelevant såsom myndigheten försökt få allmänheten att tro via medier, bland annat i en intervju i Sveriges Natur 18 oktober: "Det du tar upp i artiklarna är inte relevant för bedömningen vi gjort", säger då granskningsgruppens chef Ansi Gerhardsson.

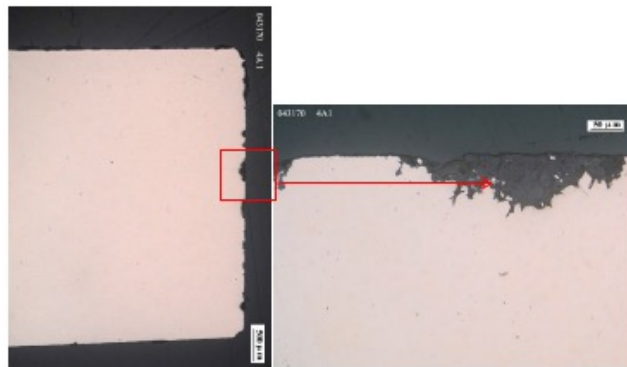
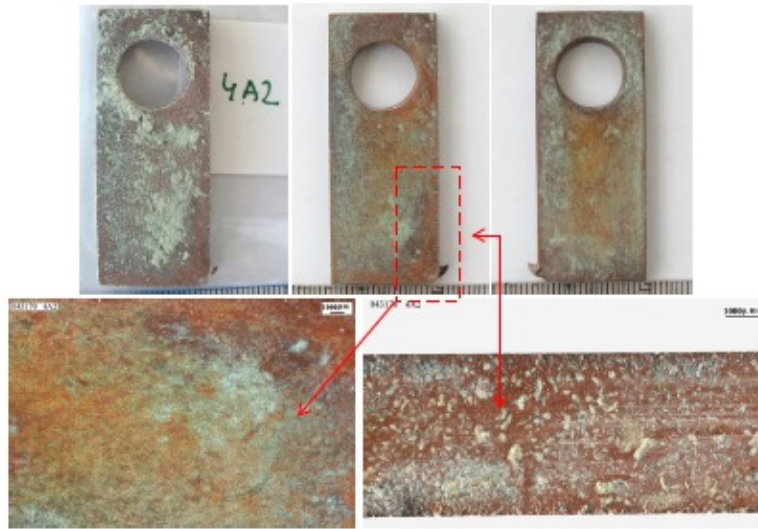
Dokumentet som tidningen nu fått tillgång till visar att risken för kapselbrott inom något hundratal år är så avgörande att det borde ha hindrat ett godkännande utan ytterligare utredning. Det skriver myndighetens specialist med ansvar för granskningen av slutförvarets långsiktiga säkerhet Björn Dverstorp i en inlägga daterad 13 juni 2016. Skrivelsen är en del av det samråd med olika experter som gjordes en innan det slutgiltiga yttrandet lämnades in till Mark- och miljödomstolen.

"Bör begära kompletterande underlag"

License application and review (3)

- On January 23, 2018 the Environmental Court made its recommendation to the government. The court recommended that the government say no to the application, primarily because the uncertainties regarding the long-term safety of the planned repository due to possible copper canister problems. These issues should have been resolved before a Government decision.
- On the same date the regulator SSM told the government that it could say yes, as some issues, i.e., possible problems with the long-term integrity of the copper canister be dealt with later, after a government decision. The regulator also believes that the repository has the conditions be safe even if the copper canister does not work exactly as postulated as there are other barriers (clay buffer/rock with clay in tunnels). This is important for the understanding of what happens later.
- The court decision took many Swedes by surprise and can be seen as an important victory for science and for those who have raised this issue.

The problems with copper



Source: FEBEX-DP Metal Corrosion and Iron-Bentonite Interaction Studies, P. Wersin & F. Kober (eds.), Arbeitsbericht NAB 16-16, Nagra, October 2017. Can be found on MKG's web site: <http://www.mkg.se/omfattande-syrgasfri-korrosion-i-det-schweiziska-febex-forsoket>

- The scientific hypothesis that anoxic (oxygen-free) water does not corrode copper in a repository, where there is no oxygen after closure, is very likely false.
- Researchers at the Royal Institute of Technology (KTH) published new results in 2007 and onwards
- There is an ongoing scientific paradigm shift to the fact that water can directly corrode copper even when there is no oxygen.
- Copper in a KBS-repository may corrode at much faster rates than acceptable (<1 000 years until release of radioactivity).
- Results from the Swiss FEBEX experiment shows heavy copper corrosion.

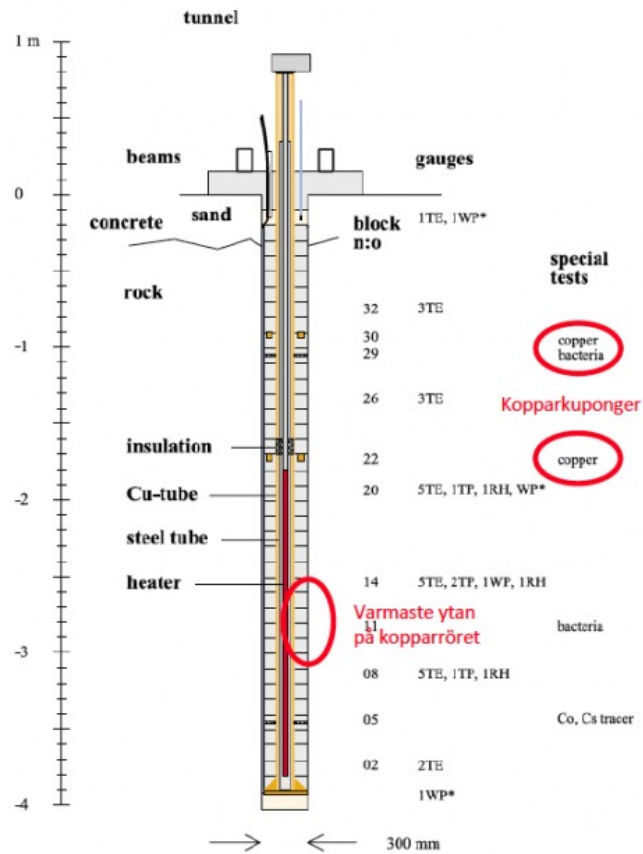
The government review of copper corrosion issues

- After the 2018 decision of the court the government review started and the nuclear waste company SKB made a submission of complementary information on copper corrosion in April 2019.
- Comments of other parties were provided to the government in the autumn of 2019.
- SSM:s conviction that the repository has the conditions to be safe was “strengthened” by the new SKB information.
- The Swedish Council for Nuclear Waste said that there may be problems with the copper, and with the cast iron insert, that may show that the concept does not work.
- MKG, the Swedish Society for Nature Conservation (and now the Swedish Friends of the Earth that have joined MKG) made a strong statement saying copper should not be used as a canister material.
- The researchers at KTH persevered in their criticism, joined by the SSM corrosion expert that was opposed to SSM saying yes.

An unexpected development in 2019: New experimental packages from the LOT project retrieved with 20 years of copper corrosion (1)

- The LOT project has been ongoing at 400 m depth at the Äspö Hard Rock Laboratory since about the year 2000.
- In total there are seven experimental packages with copper and clay in a very good simulation of real repository conditions.
- Three 1-year packages were retrieved early, but when SKB retrieved one 5-year package in 2006, an unexpected amount of copper corrosion had occurred.
- MKG has for long demanded that the next package be retrieved and analysed.

The LOT project at the Äspö hard rock laboratory



An unexpected development in 2019: New experimental packages from the LOT project retrieved with 20 years of copper corrosion (2)

- In the autumn of 2019 SKB secretly retrieved two now 20-year-old experimental packages. This was disclosed by SKB, likely as a mistake, at a meeting organized by the regulator SSM in the beginning of October.
- MKG worked to get SKB to disclose all relevant corrosion results as soon as possible, and that SSM checks the results. This has happened. SKB published copper corrosion results in October 2020 and SSM is has carried out a quality assurance project.
- MKG has stated that the results that SKB has published are not scientific.

The LOT A3 and S2 packages results (SKB TR-20-14)

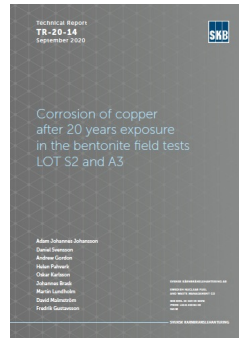


Image of corrosion on the copper bottom plate at 80° C in contact with sand (no detailed results were in the report, nor of the hottest part of the copper tube)

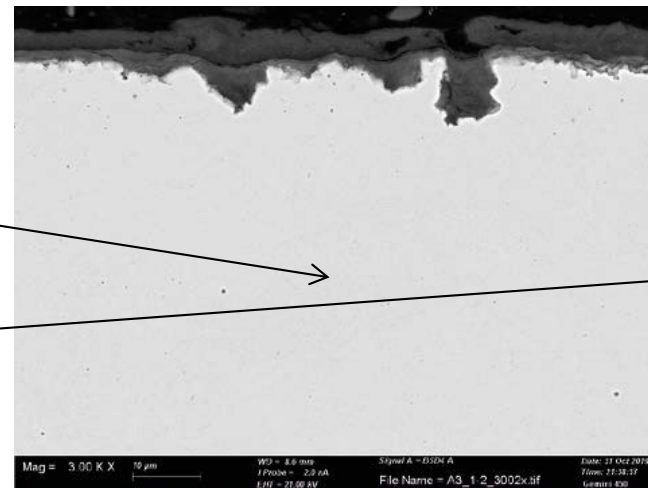
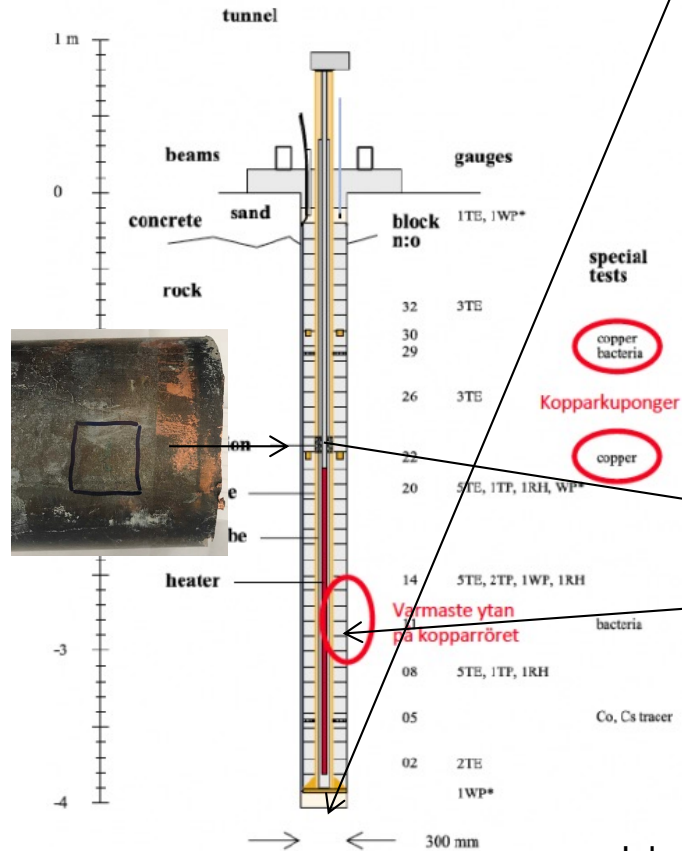
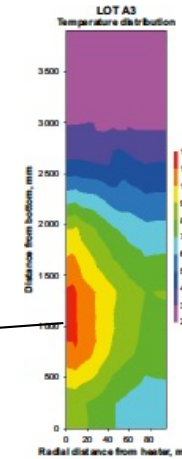


Image of pitting corrosion on the copper tube in the middle of the tube (no detailed results from hottest part of tube)



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An unexpected development in 2019: New experimental packages from the LOT project retrieved with 20 years of copper corrosion (3)

- MKG is of the understanding that if SKB had published the detailed copper corrosion of the hottest part of the central copper tubes and of the bottom plate, it would be clear that copper would not work as a canister material.
- In the end neither SSM nor the government took this into account.

Approaching a government decision (2021) (1)

- During 2021 the discussion about nuclear power and nuclear waste management has become increasingly politicized and during the autumn radioactive waste repository issues had risen to the very top of the political agenda. The government has since 2018 been a Social Democrat and Green Party minority coalition with a Green minister of the environment reluctant to approve any repository.
- In the autumn of 2021 the copper corrosion discussion became more intense. The Swedish Society for Nature Conservation, the Swedish Friends of the Earth and MKG told the government that the LOT experiment could be used to provide vital information necessary before a decision.
- The Swedish Council for Nuclear Waste stated that more research is needed to understand how the copper canister behaves in a repository environment.

Approaching a government decision (2021) (2)

- In the November-December there was political turmoil in the budget process for 2022 with the final result being that the Green Party left the government.
- The new Social Democrat minister of the environment then promised a decision on the spent fuel repository on January 27, 2022.

The government decision

- On January 27, 2022, the government took the decision to approve the repository. The decision relied almost exclusively on statements from SSM that the repository has the conditions to be safe as there are multiple barriers that assures robustness.
- On April 27 the Swedish Society for Nature Conservation, the Swedish Friends of the Earth, Nature and Youth Sweden, the Uppsala County chapter and the Östhammar local chapter of the Swedish Society for Nature Conservation and MKG jointly requested a judicial review of the Swedish government's decision to the Swedish Supreme Administrative Court (39 pages + 40 appendixes) – see the MKG web site.
- The appeal strongly questions that SSM:s evaluation that the whole system is more important than the copper canister is in accordance with the Environmental Code. The copper canister is a very weak point, but the clay buffer and the rock/clay in tunnels are not shown to be absolutely tight.
- The appeal also raises method, siting and Natura 2000 issues.

Into the future

- If the appeal to the Swedish Supreme Administrative Court is unsuccessful (likely?) the next step is the return to the land and environment court for a final license decision with conditions according to the Environmental Code. This may take several years with appeals, but the court is bound by the government decision.
- Construction start in 5 years? Operation in 15 years?
- Will the environmental NGOs have resources/interest to take part? SSM has cut MKG's funding for 2022 to a level below the funds in 2005 and given the money to a pro-nuclear group.
- SSM has a central role in the continued step-wise decision-making according to the Nuclear Activities Act, as well as in future research that will be carried out (review of SKB's R&D programme every 3 years).
- Will the copper issues prevail despite the position of SSM? A state-of-the-art steel is actually much better than copper as a canister material.
- International developments? Will deep boreholes/rolling stewardship prevail in the end?

More information, follow the developments...



The screenshot shows the Swedish version of the MKG website. At the top right, there are navigation links: "Läs alla Nyheter", "Kontakta oss", and "English". These links are circled in red. Below the navigation is a search bar with the text "SÖK" and a search icon. The main content area features a large image of a waterfall with the MKG logo and the text "Miljöorganisationernas kärnavfallsgranskning". Below the image are navigation tabs: "Hem", "Om kärnavfall", "Om slutförvarsansökan", and "Publikationer". The main text area is titled "Välkommen till MKG" and contains several paragraphs of text. On the right side, there are two promotional boxes: one for "Läs om aktuella händelser, följ myndighetens och domstolens arbete, ladda ner handlingar m.m." and another for "Miljörelsen gör slutförvaringen säkrare". Below these is a "Nyheter" section with a list of recent news items.

www.mkg.se/en

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