Long-Term Safety of Deep Borehole Disposal in Comparison with Disposal in a Mined Facility

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Based on work performed under contract from the Swedish Nuclear Fuel and Waste Management Co., SKB

Outline

- Why has SKB done work on DBD?
- Concepts compared
- Important safety functions
- Pertinent questions about DBD … and answers?
- Conclusions for the Swedish situation

Why is SKB involved in DBD

- Diverse research programme on the management of nuclear waste and the decommissioning of nuclear facilities required since 1984 by the Act on Nuclear Activities

- Projects on assessing and ranking several repository concepts including DBD launched in the second half of the 1980s

- An EIA must describe “alternative embodiments” - NGOs pushed the DBD issue in the public consultation process – work has been going on since 2005

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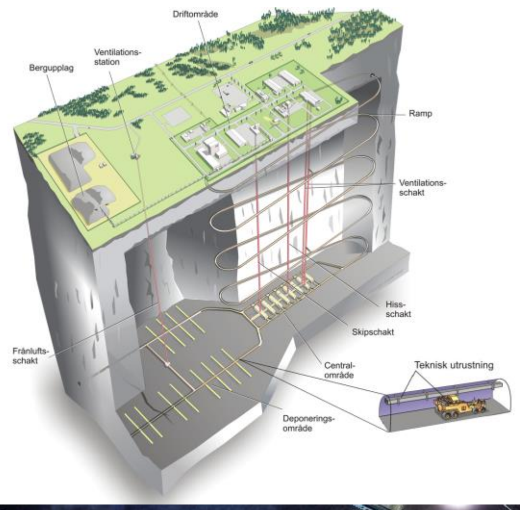
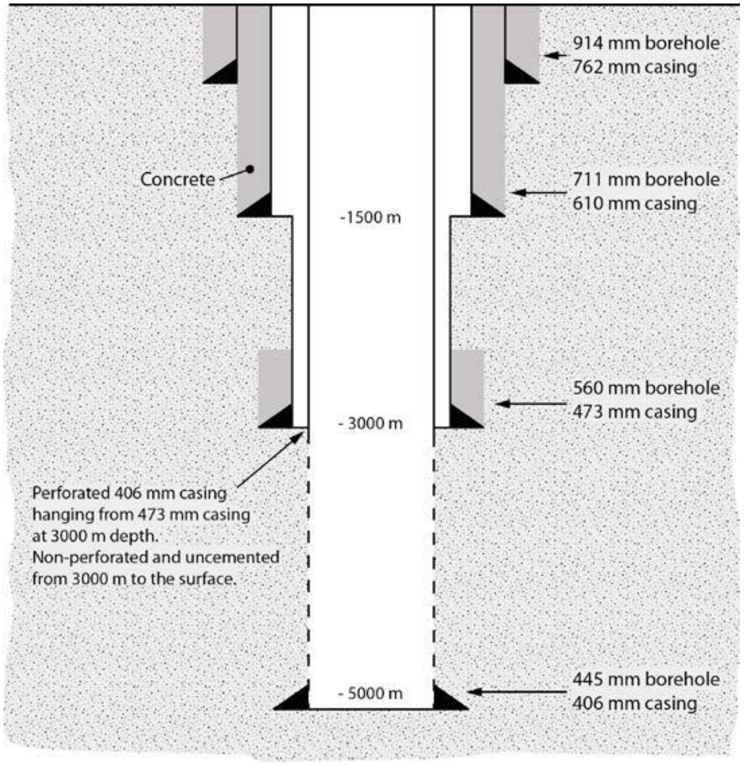
Concepts compared

KBS-3



DBD



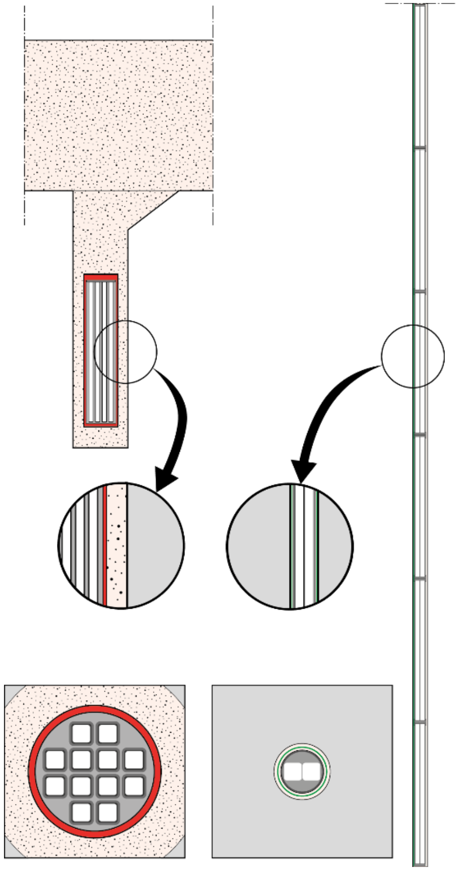
Important safety functions

KBS-3

- Long-term containment in corrosion resistant canister
- Canister protected by a compacted bentonite buffer
- Reducing conditions
- Low flow rates and retardation
- **Many safety assessments**

DBD

- Hard to obtain a long-term containment EBS
- Stagnant, density-stratified groundwater
- Reducing conditions
- Low groundwater turnover
- Long migration path
- **No comprehensive safety assessments**



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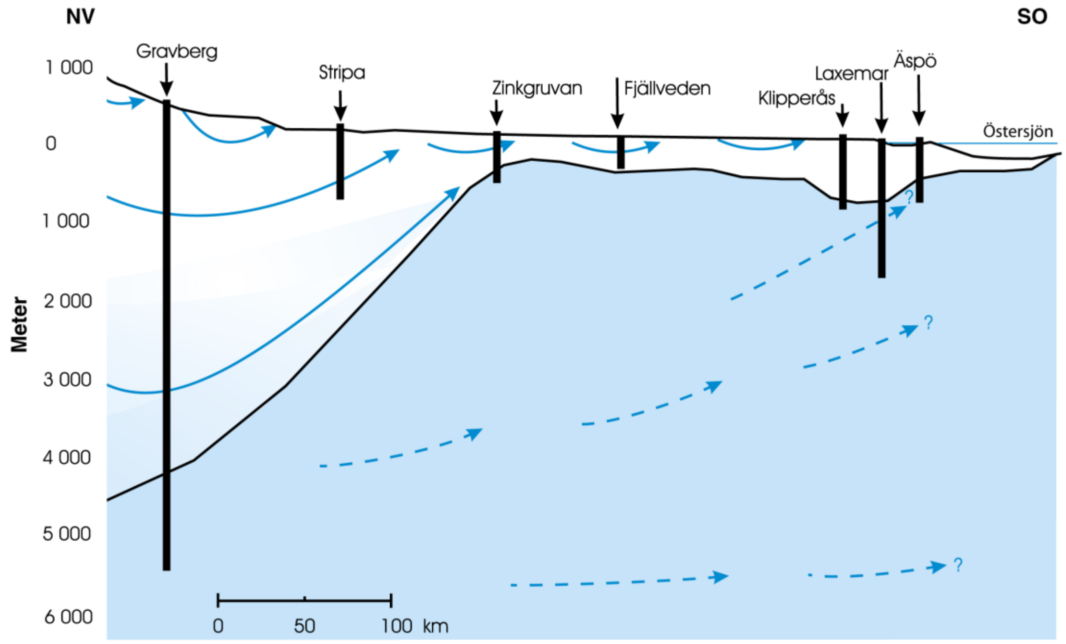
Pertinent questions for long-term safety of DBD

- Availability of sites with suitable density stratification of the groundwater and long-term stability of the stratification under natural conditions?
- Influence of the repository on the groundwater stagnancy?
- Sealing needs and challenges?

Availability favourable site conditions and their stability?



Model formulated 1998 based on <u>four</u> boreholes:

- Gravberg 1, KLX02, Böttstein, RH-12
- Not contradicted by newer observations

Long-term stability affected by:

- Washing out
- Land uplift due to post-glacial rebound

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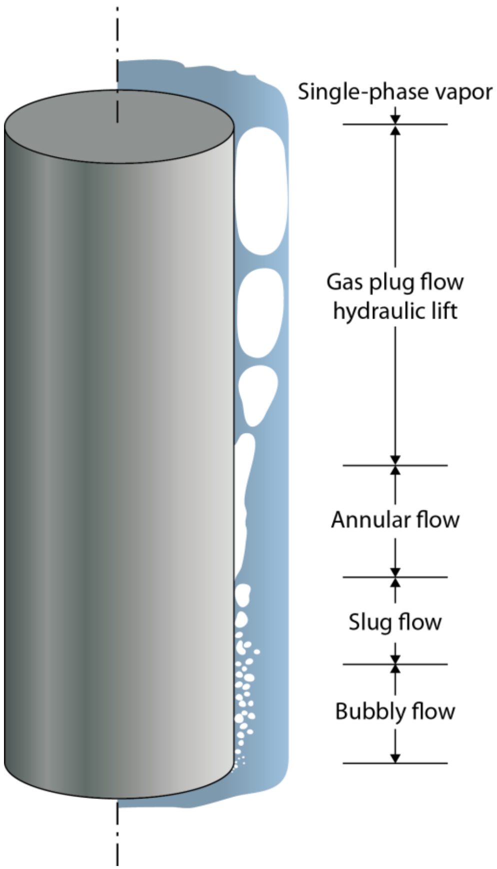
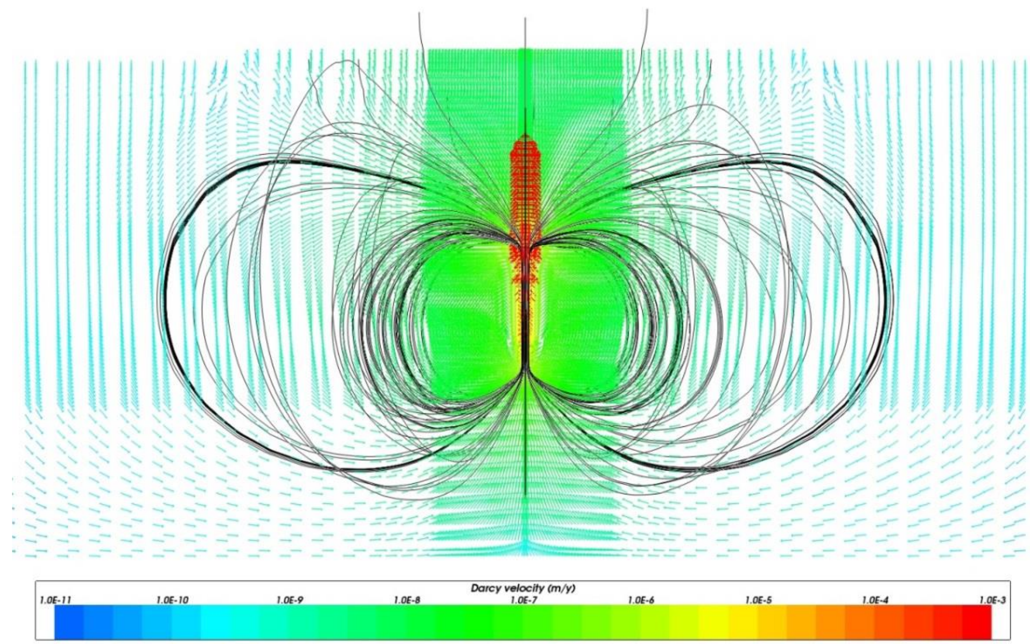
Influence of a DBD repository

Gas due to corrosion



Thermal buoyancy



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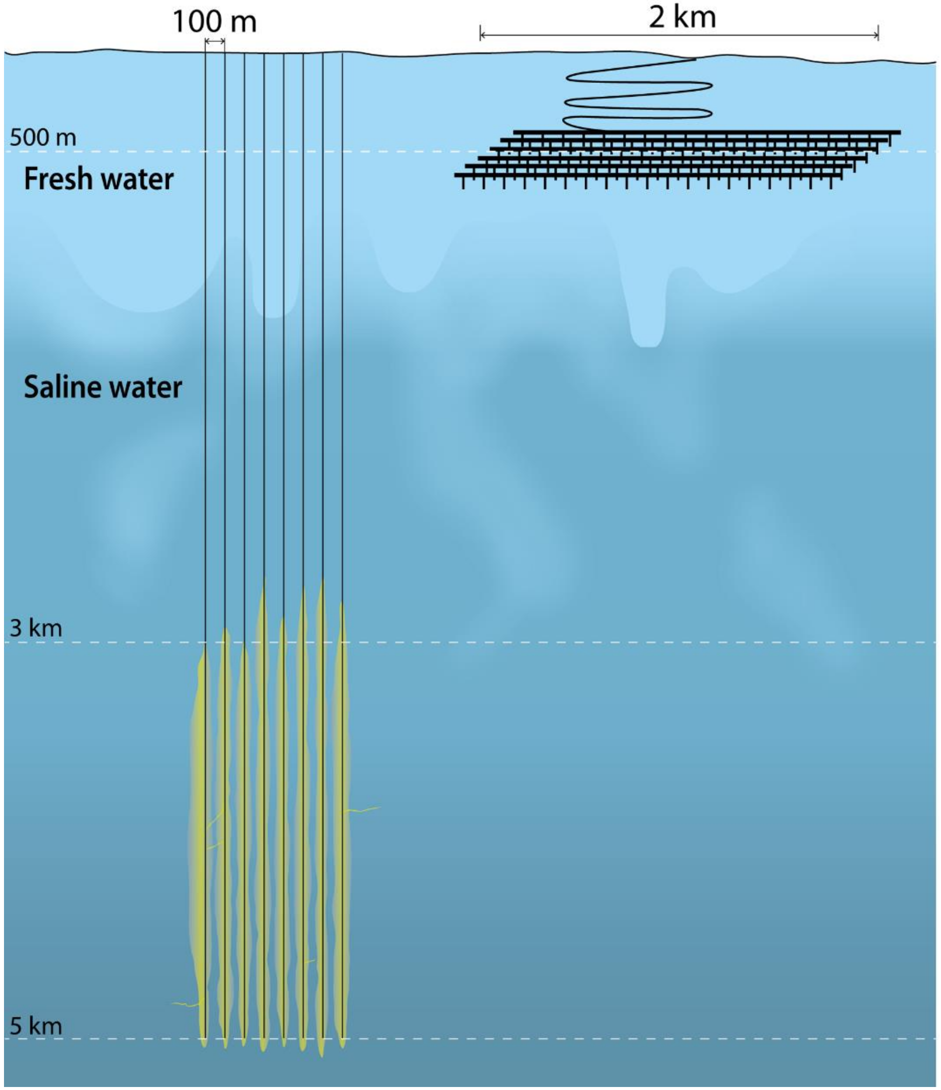
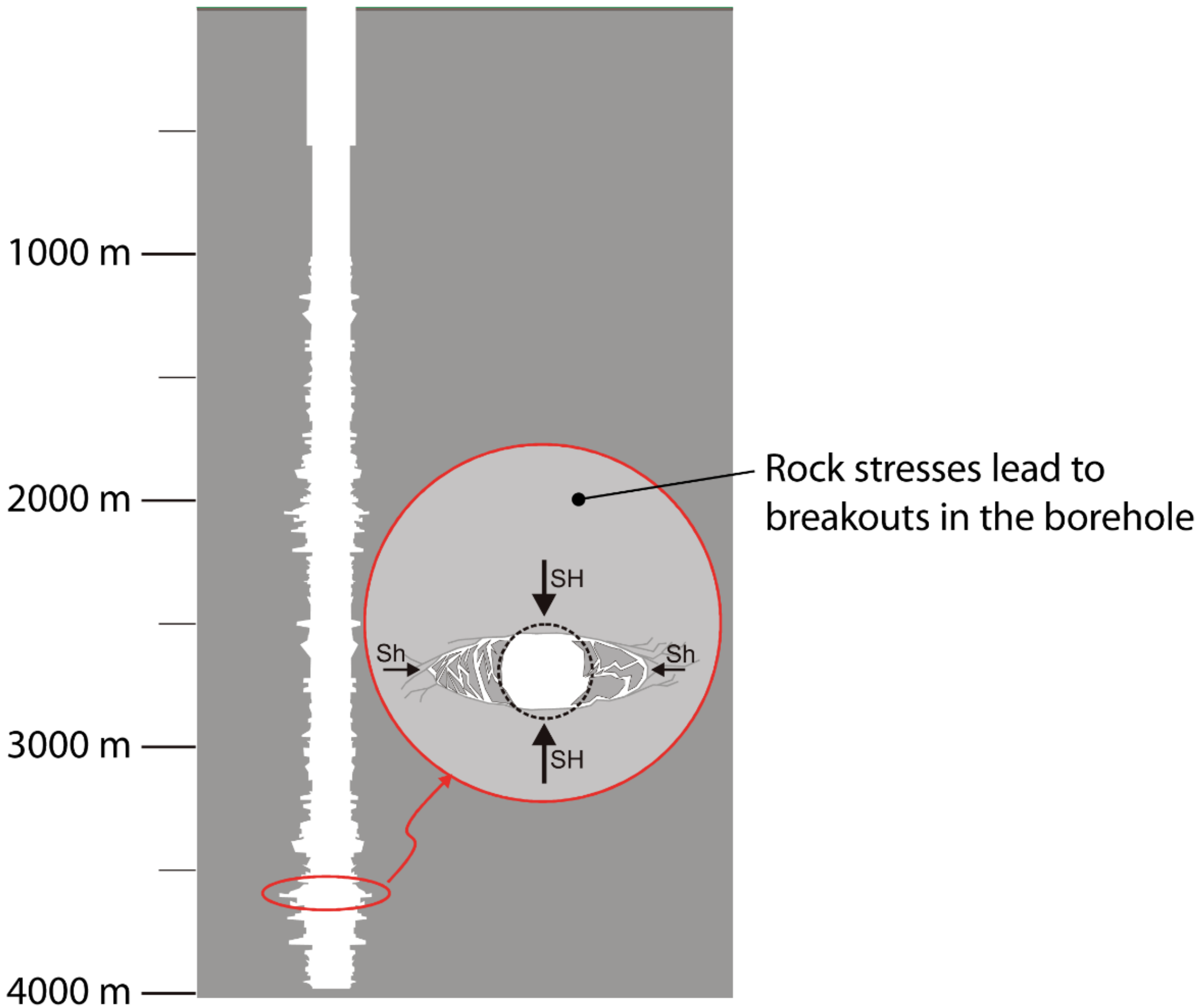
Sealing needs and challenges



Sealing needs and challenges



DBD Conclusions

- Difficult to design and implement an EBS providing long-term containment
- Risk of contamination of the groundwater around the deposition zone within the first 1000 years
- The repository introduces buoyancy forces resulting in risk of vertical transport of contaminated groundwater
- Rock stresses will likely deform the hole making efficient sealing difficult
- The depth complicates both site investigations and the disposal process
- Dose assessments are premature
- **Too many question marks to make the concept attractive for Swedish conditions**

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