Microbially induced corrosion under repository environments

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LLW/ILW

- Low and intermediate waste is produced during operation and maintenance of nuclear power plants
- Is disposed of in Olkiluoto in concrete boxes into bedrock silos (60 to 100 m depth)
- Most of metallic waste is carbon steel

Picture: Posiva
In alkaline and anaerobic environments the corrosion rate of steels is typically low.

Microbiological activity can alter conditions and enable corrosion.

Substantially high corrosion rates have been observed at repository site.

- This has lead to suspicion of microbial role in corrosion.

Microbes in corrosion pits on surface of carbon steel.
Results

- Average corrosion rates up to 29 µm a⁻¹
- Localized corrosion rates even higher
- Methanogenic archaea and sulphate reducing bacteria enriched on surfaces
HLW

- High level waste is packed in 50 mm thick copper capsule
- Repository depth 500 m

Picture: SKB
HLW

- Microbial activity may have an affect on the integrity of copper capsule
- Microbial metabolites may enable the stress corrosion cracking or cause general or localized corrosion

Microbes on surface of copper

Copper incubated with and without microbes
Results

- The result demonstrate that microbes exhilarate corrosion of copper under simulated repository conditions
Conclusions

- The microbial diversity in natural deep ground water is vast and they are able to adapt changing environmental conditions.
- Observed corrosion rates higher when microbes are present.