Aspects on the acceptance of waste for disposal in SFR

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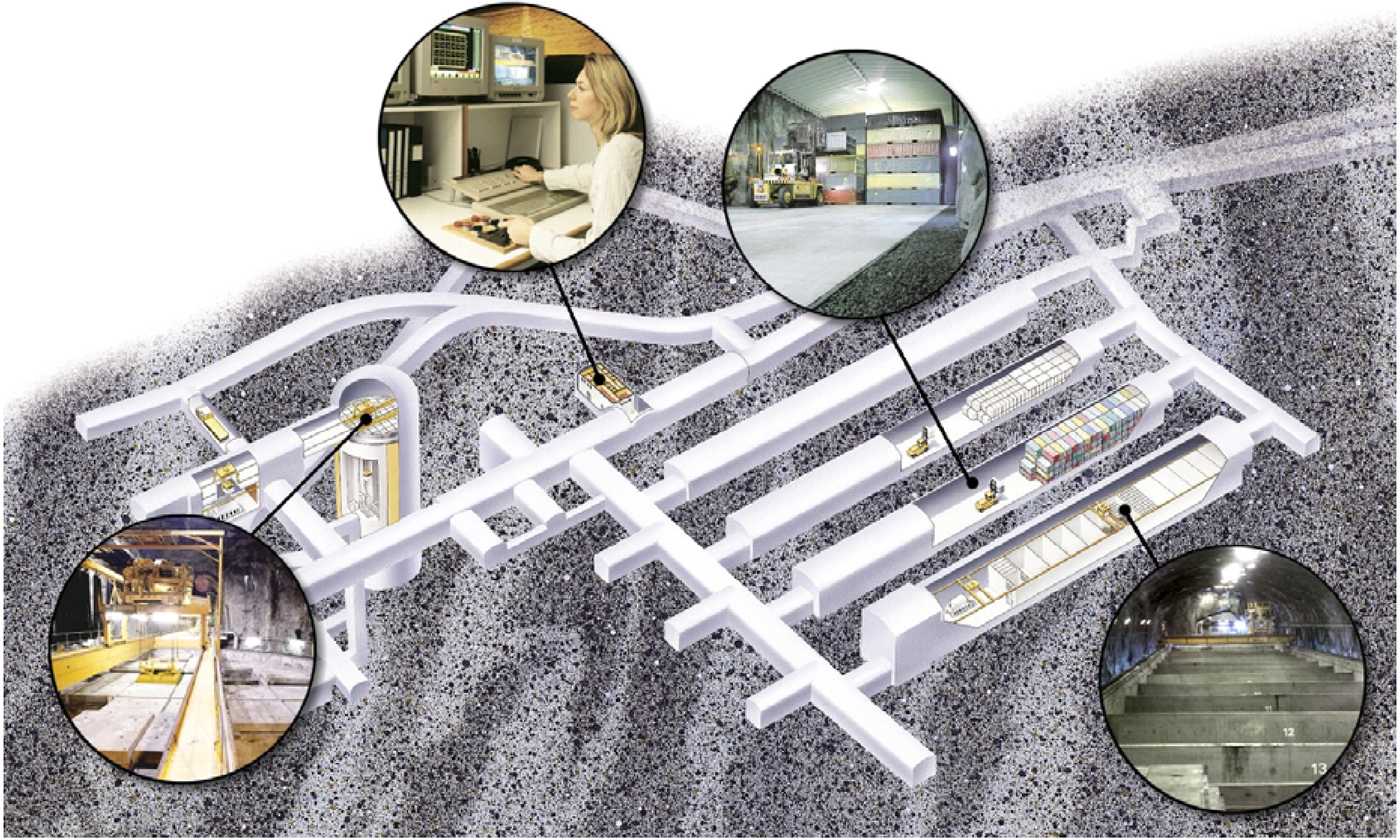


A task that produces waste will start at a nuclear site

Do not start to look at a technical solution!

Start to look at the end, i.e. the final storage of the radioactive waste!

- What type of radioactivity will be handled and how much.
- Suitable repository?
- What type of waste can/will be produced?
- Is this an acceptable type of waste?
- How to produce the acceptable type of waste?

Waste Acceptance Criteria for SFR:

- Design, geometry and dimensions
- Weight
- Marking
- Radionuclide inventory
- Surface dose rate and dose rate at a certain distance
- Surface contamination
- Internal radiation
- Homogeneity
- Composition and structure
- Liquids
- Corrosion resistance
- Gas formation
- Combustibility and fire-resistance
- Chemical reactivity
- Leaching
- Mechanical strength against external stresses
- Mechanical stability

A case study

At the Ringhals NPP a decision has been taken to reduce over-all water releases to the recipient.

- The evaporator will be used for water effluent reduction.
- Methods for reduction of complexing agents in the waste stream.
- Cement solidification formulas for handling of evaporator sludges containing boric acid.
- Theoretical modelling of the long-term properties of the waste, and tentative evaluation of the long-term influence on the SFR repository concrete structure.

A case study, cont.

Destruction of complexing agents:

- Minimise the use of complexing agents at the site.

- Methods for reduction of complexing agents in the waste water.
  - Wet oxidation
  - Miniature purifying plant

- Methods for reduction of complexing agents in the evaporator sludge.
  - Electrochemical oxidation
  - Pyrolysis
  - Plasma

A case study, cont.

Cement waste solidification formula:

- Salt solution (DS 23%), no boric acid, 2 types of cement.
- Salt solution (DS 15%), no boric acid, 2 types of cement.
- Boric acids solutions (B > 5%), 2 types of cement.
- Boric acids solutions (B < 2%), 2 types of cement.
- Salt solution (DS 15%), with boric acid, 2 types of cement.
- Dry salt, with or without boric acid, as a cement slurry or as dry salt, in a concrete cubicle.

A case study, cont.

Theoretical study:

Cement – waste – repository interactions calculated using:

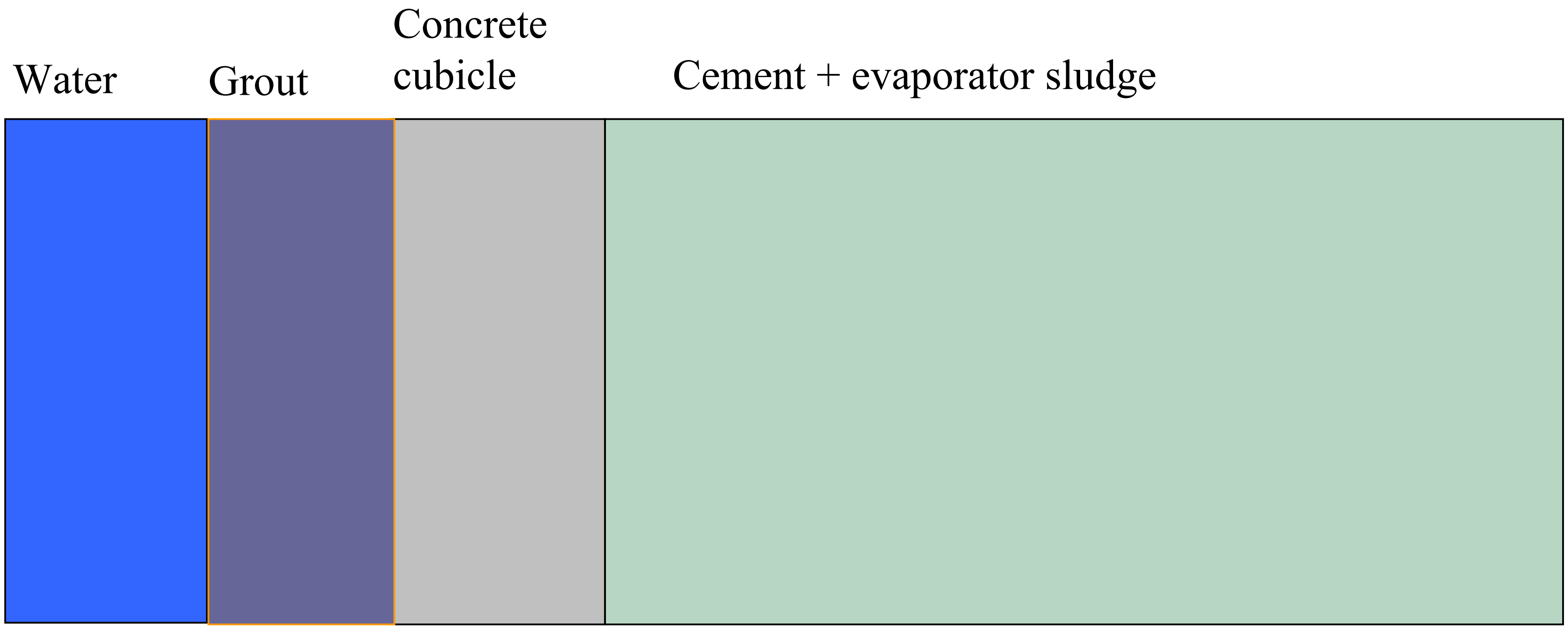
PHREEQC-2 (USGS; Parkhurst & Apello)

+ Modified using subroutines for mineral volume calculations, "dynamic" porosity with an empirical diffusivity calculation.

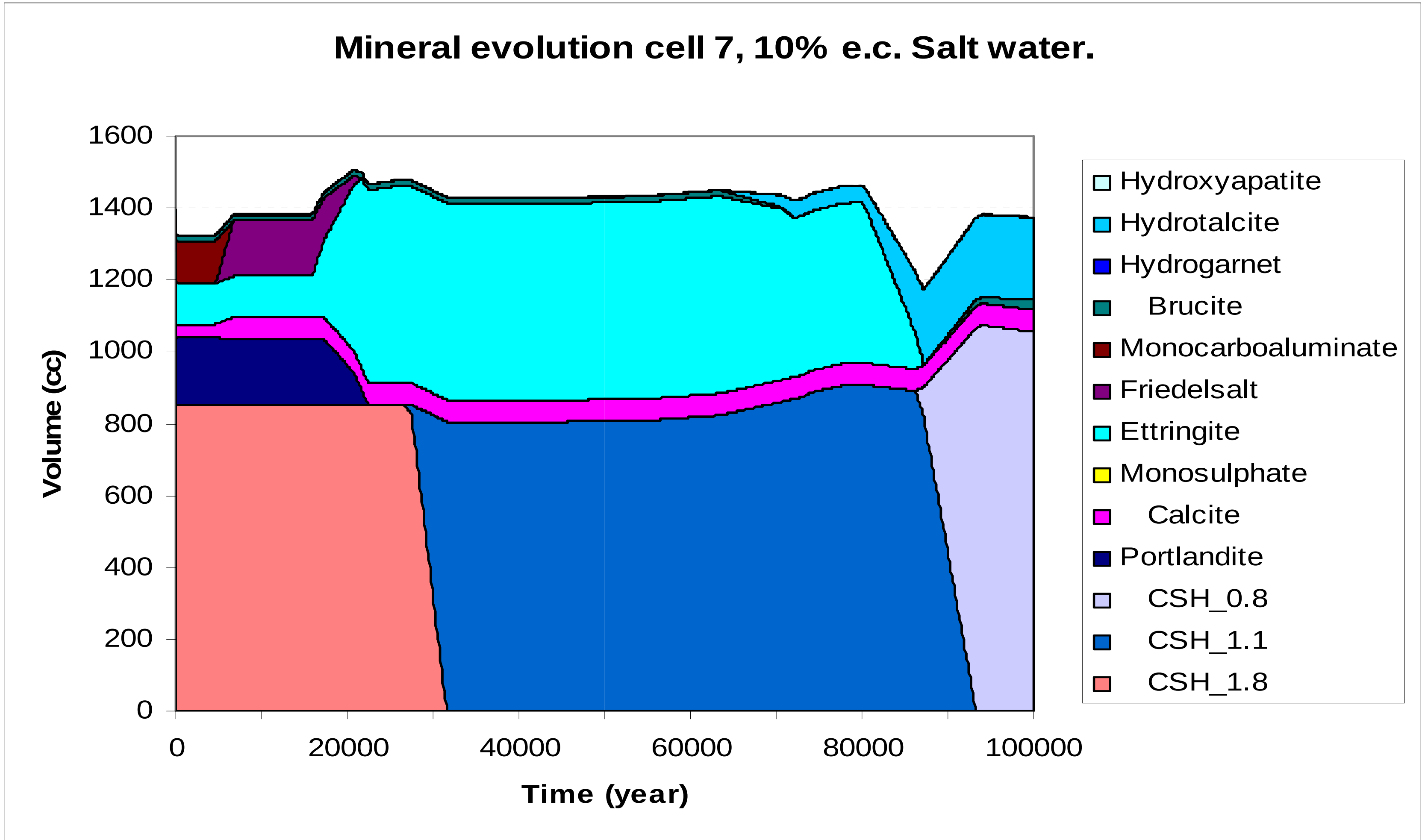
A case study, cont.

Model:

10 cm concrete cubicle + waste + grout

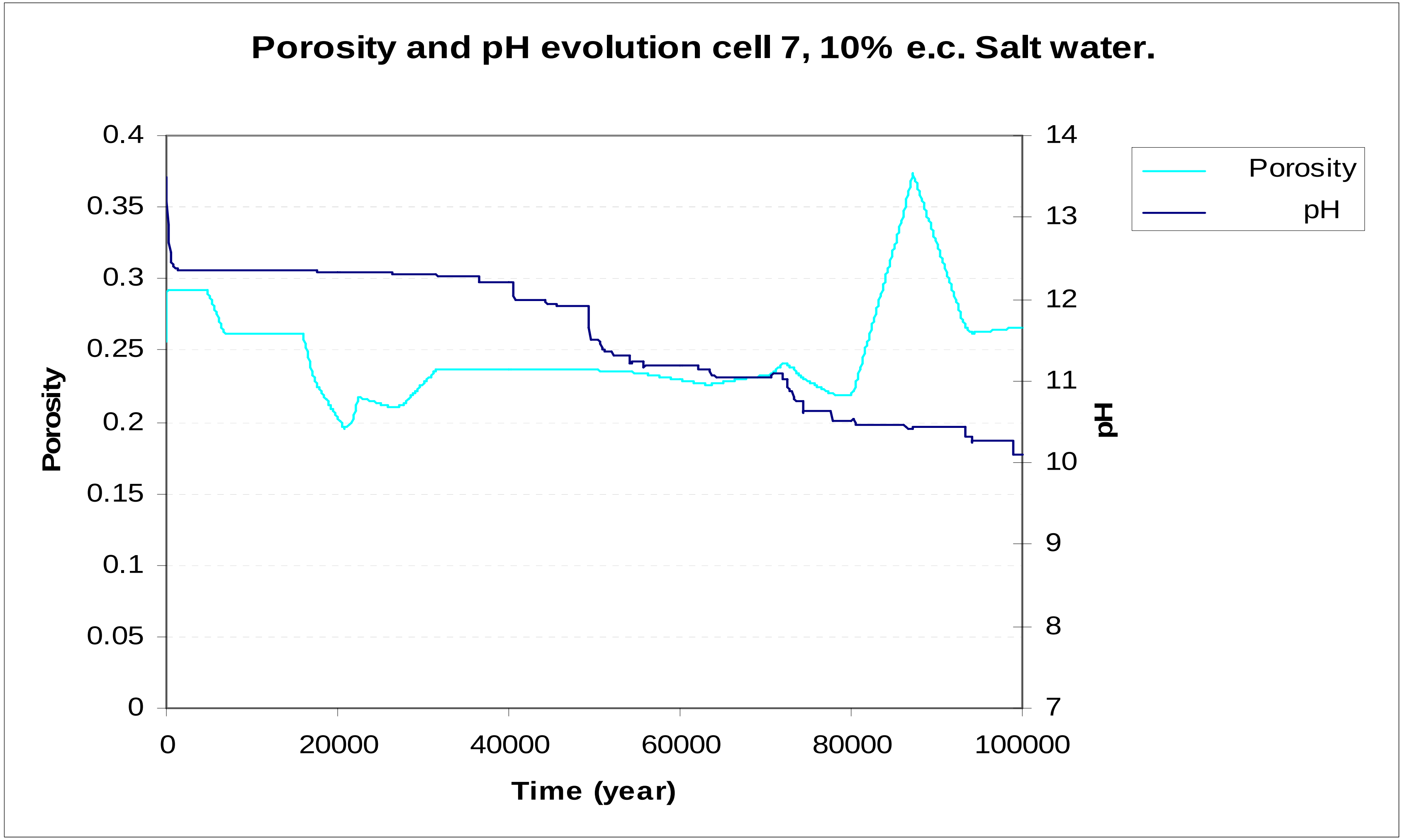


A case study, cont.



The mineral evolution in cell 7, the outer part of the cement-encapsulated evaporator concentrate.

A case study, cont.



The porosity and pH evolution in cell 7, the outer part of the cement-encapsulated evaporator concentrate.

Conclusions

- All aspects must be included in the evaluation of the best technique to use, when planning for a new or modifying an existing waste treatment facility.
- The whole chain of operation must be studied, including the final storage and the influence the new waste type may have on the long-term safety of the final repository.
- Without this complete analysis it will be difficult or impossible to issue a license for operation.