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DEEP BOREHOLE DISPOSAL:
AN ALTERNATIVE TO THE MINED & ENGINEERED REPOSITORY FOR HIGH-LEVEL WASTES

WHAT ***HOW*** ***WHY***

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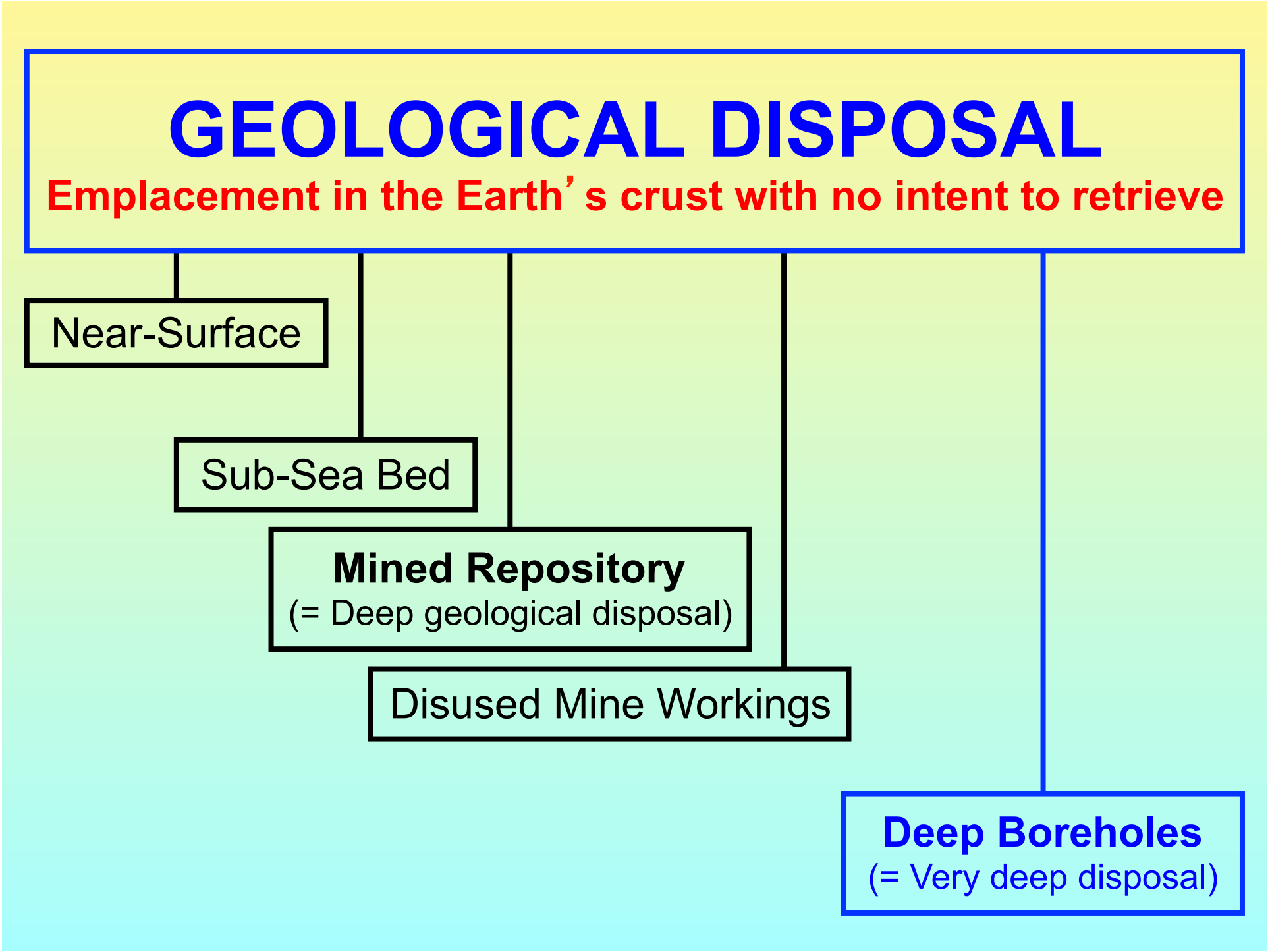
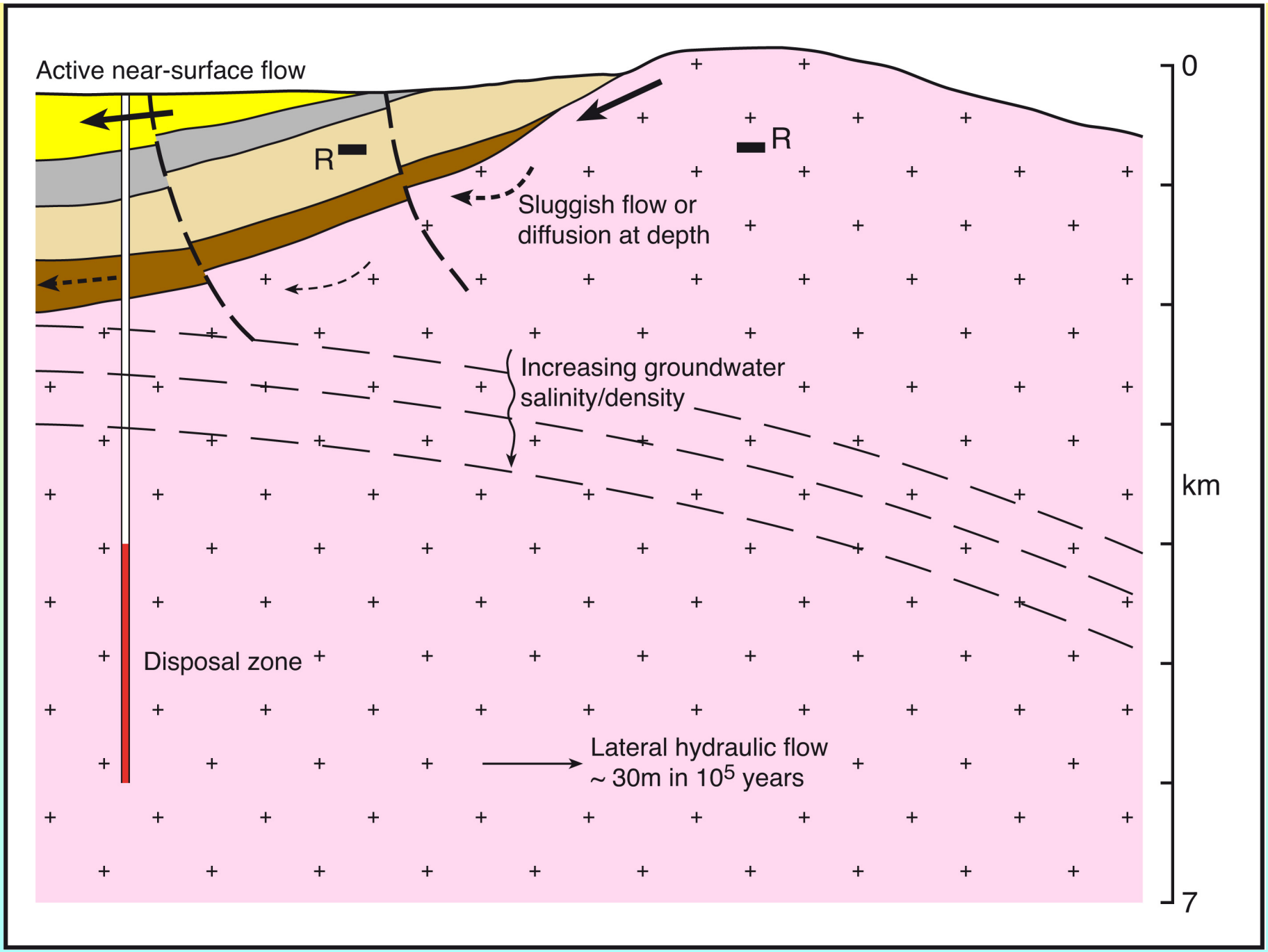
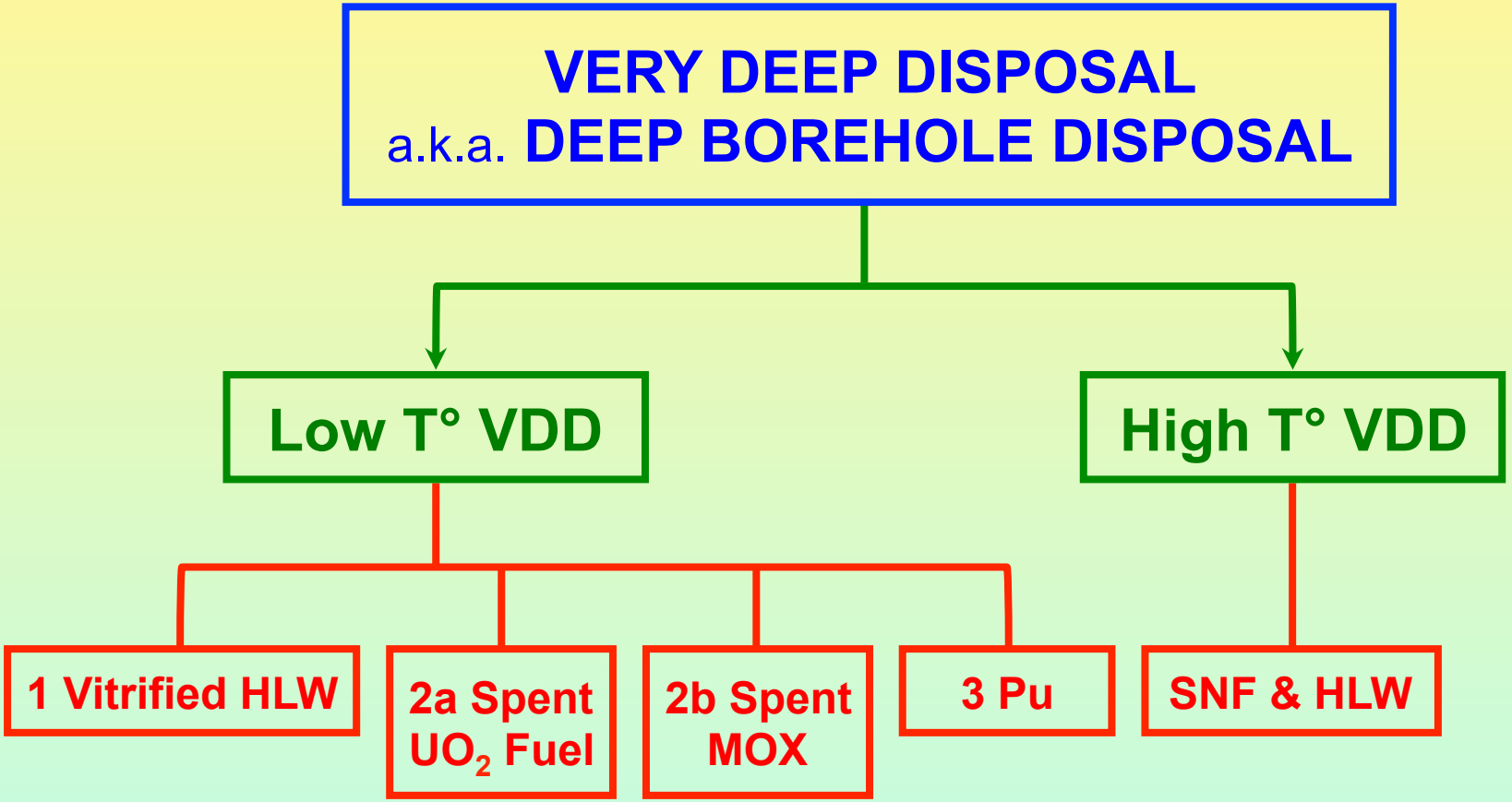
RWIN April 2009

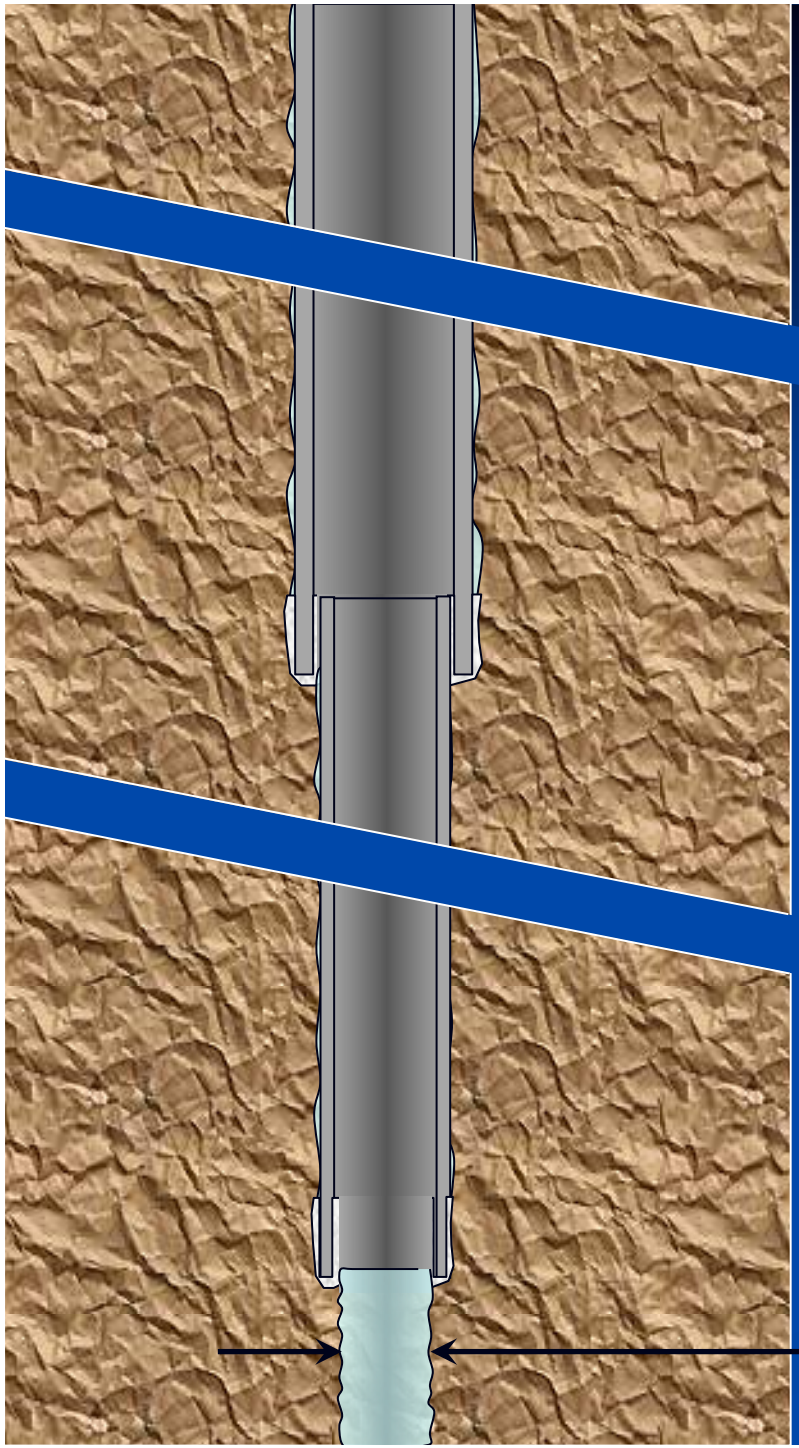

GEOLOGICAL DISPOSAL
Emplacement in the Earth's crust with no intent to retrieve
Near-Surface
Sub-Sea Bed
Mined Repository
(= Deep geological disposal)
Disused Mine Workings
Deep Boreholes
(= Very deep disposal)



Adapted from Chapman & Gibb, 2003



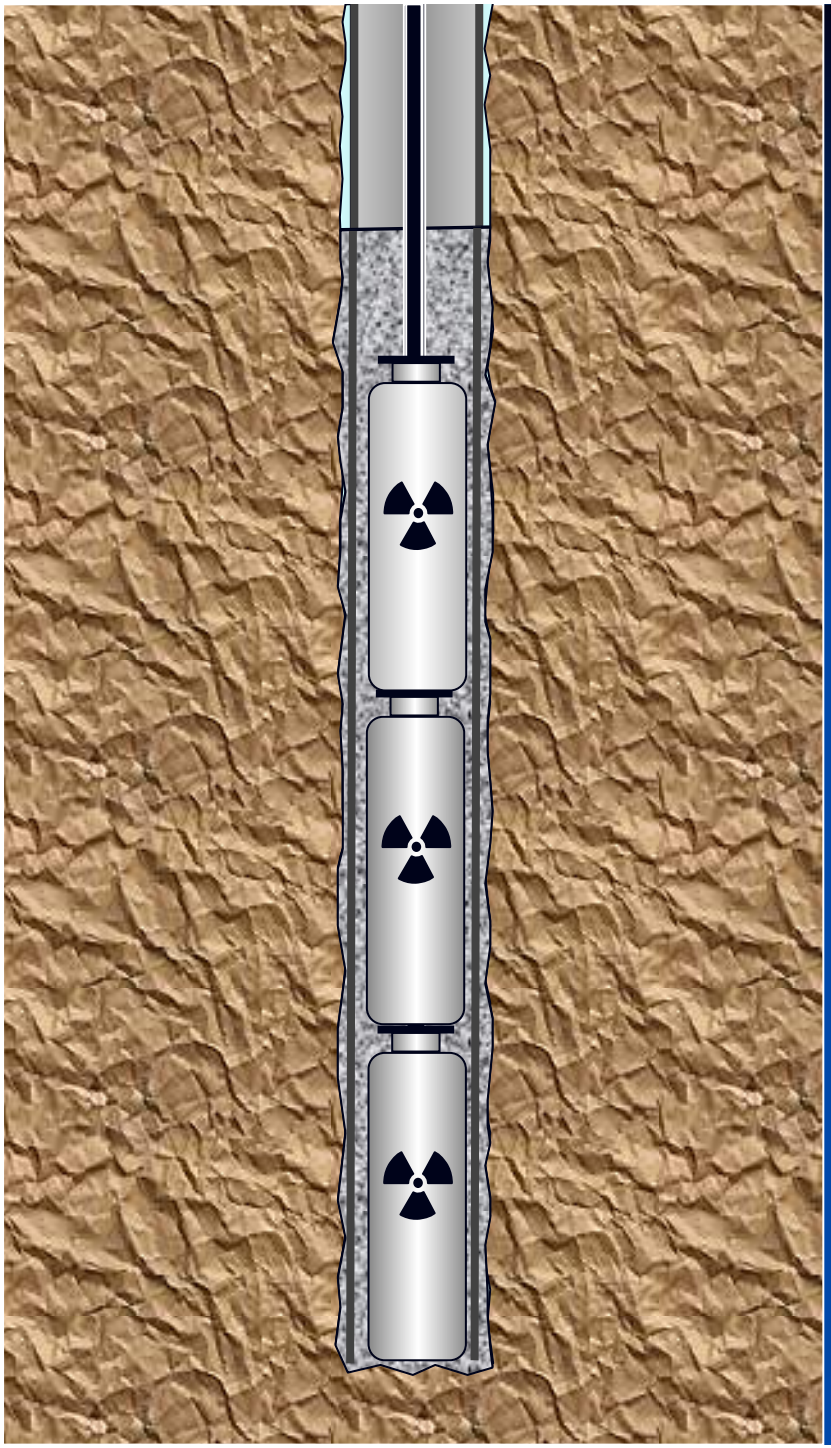
Important differences in detail between versions



Creating the borehole

- Drill the first stage of the borehole
- Insert the casing.
- Pour a cement base-plug.
- Drill the next stage of the borehole.
- Insert the casing.
- Pour the cement base-plug
- Drill the next stage of the borehole

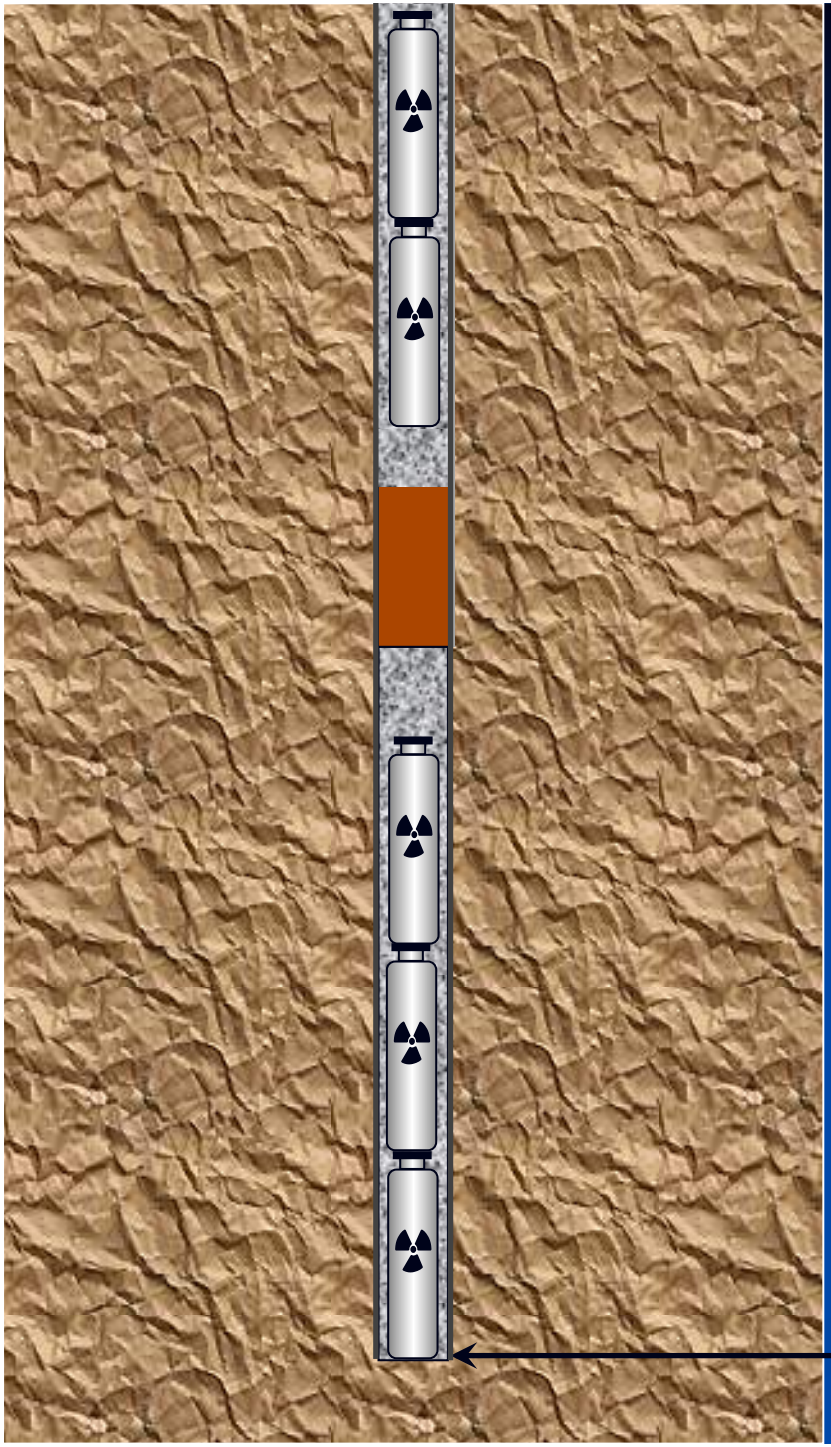
And so on, down to > 4 kms



Low Temperature
Very Deep Disposal

Vitrified waste

- Insert the final run of casing (Surface to TD)
- Emplace the first batch of HLW canisters
- Pump in the special grout and allow it to set

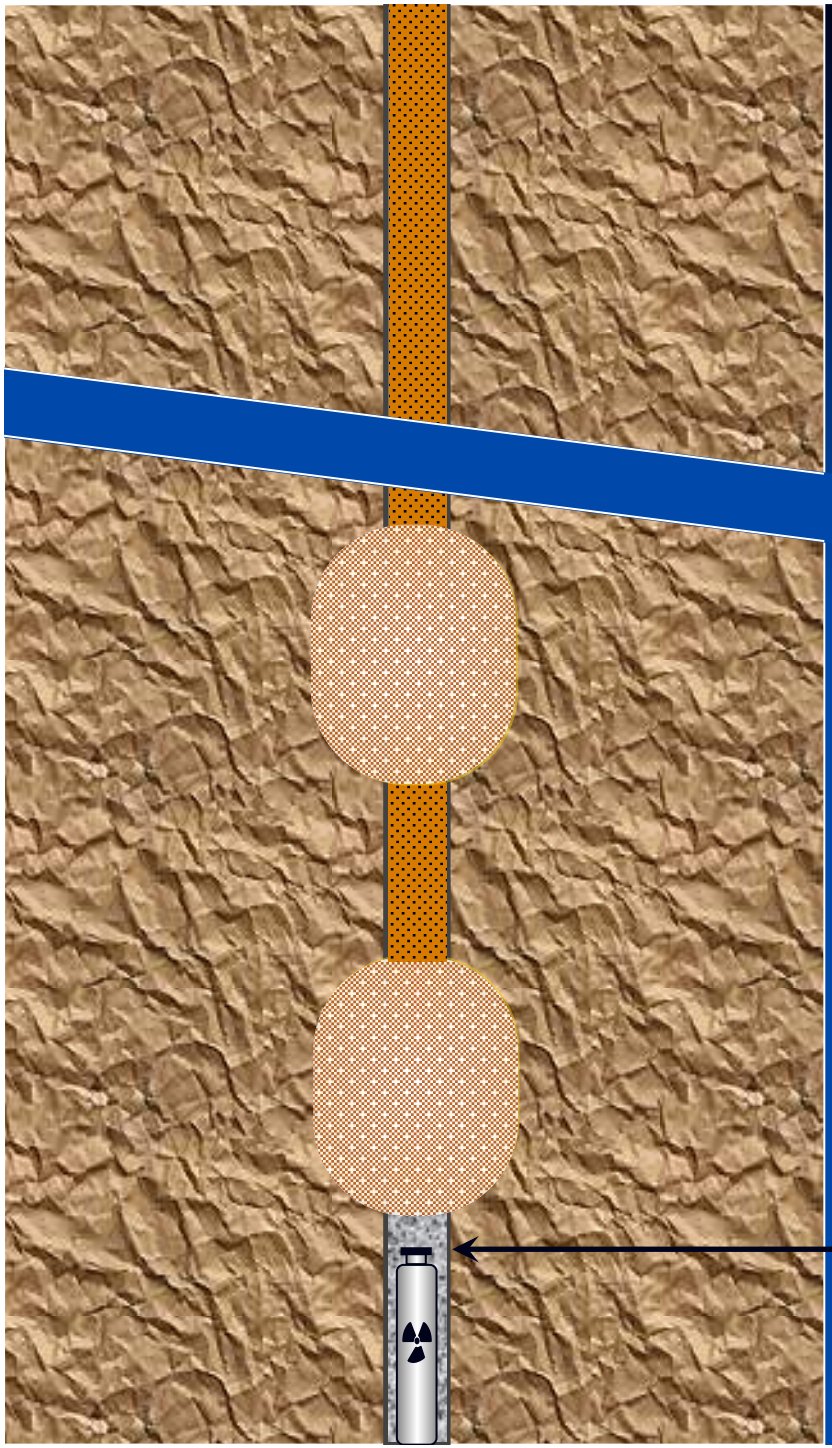


Low Temperature
Very Deep Disposal

Vitrified waste

- Insert bentonite clay (*Optional seal*)
- Insert another batch of canisters, pour the grout & allow to set

Repeat until the bottom km of the borehole is filled



Sealing the borehole

- Insert some backfill (crushed granite)
- Insert heater and melt backfill & wall-rock to seal the borehole
- Pour in more backfill and seal the borehole again
- Repeat as often as required then fill the rest of the borehole with backfill

3 km deep (topmost canister)

Advantages of Deep Boreholes

1. SAFETY
2. COST EFFECTIVE
3. ENVIRONMENTAL IMPACT
4. SMALL ‘FOOTPRINT’
5. SITE AVAILABILITY
6. SECURITY
7. INSENSITIVE to HLW COMPOSITION
8. LONGEVITY
9. EARLY IMPLEMENTATION

SAFETY CASE

1. **PRE-DEPLOYMENT**

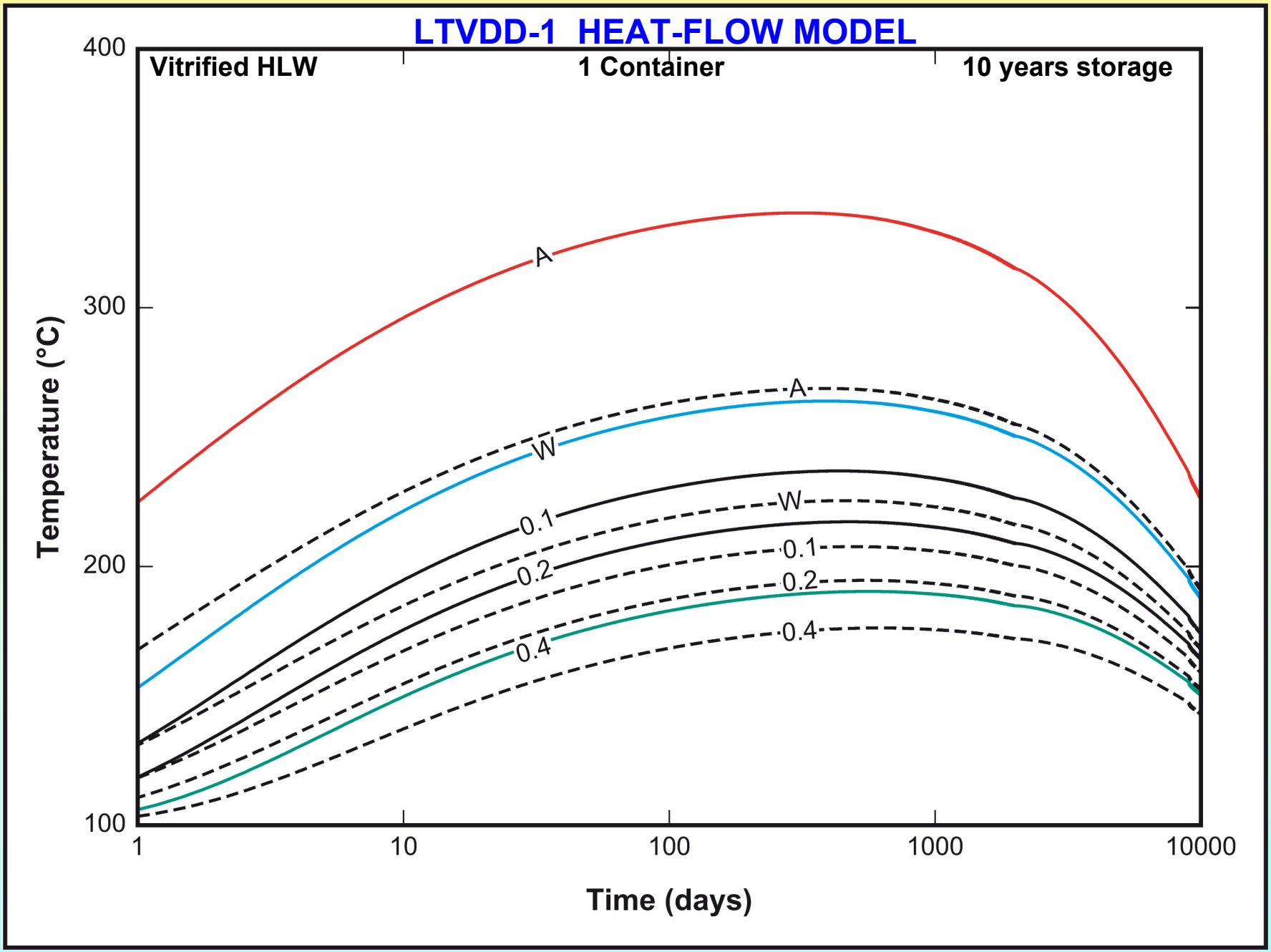
   Removal from store
   Overpacking *(Stainless ? + Deployment fittings)*
   Transport to well-head *(Horizontal ?)*
   Transfer to well-head facility *(Shielded)*

2. **OPERATIONAL**

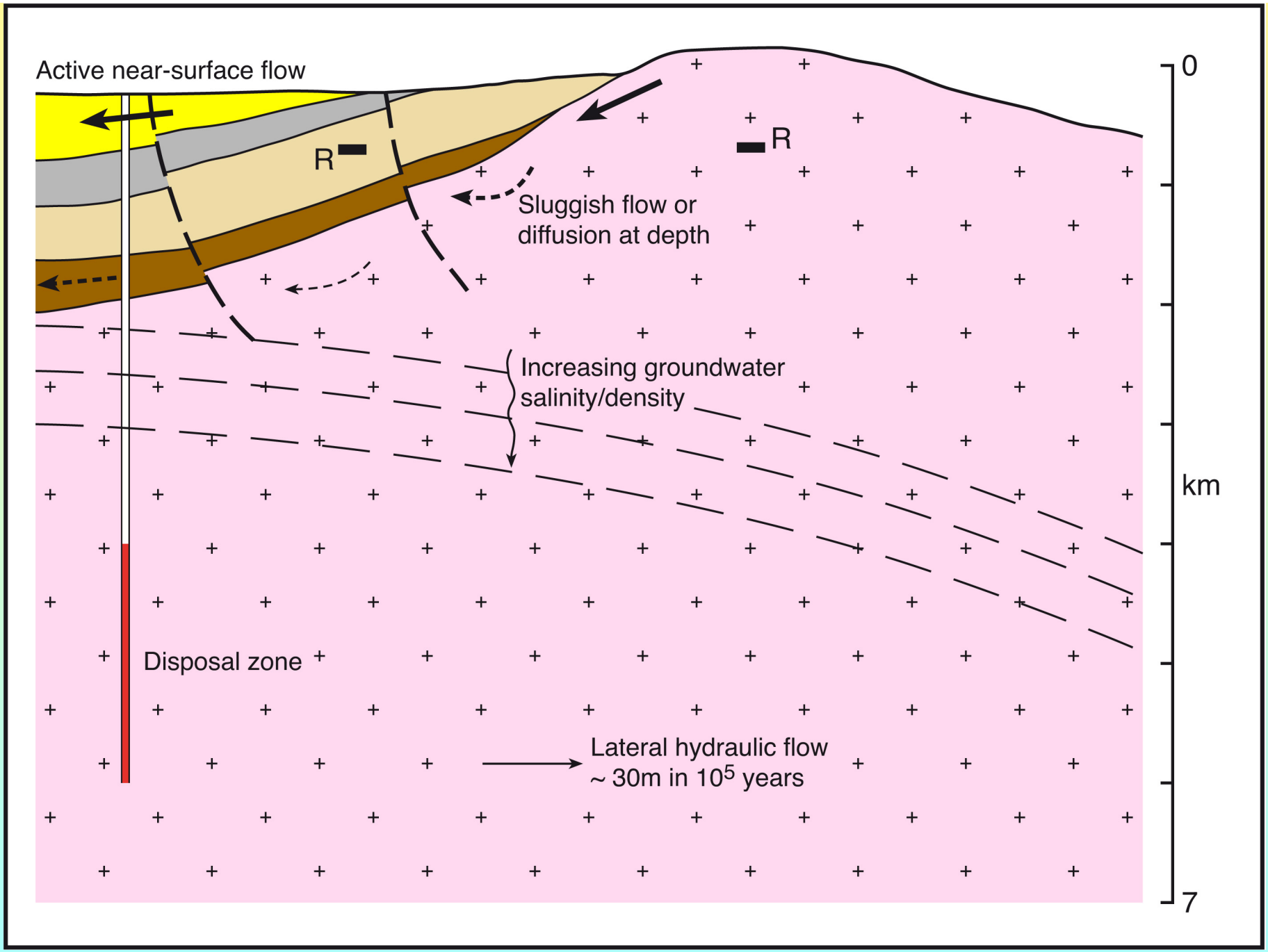
   Reorientation to vertical *(If transported horizontally)*
   Insertion into borehole
   Lowering to final position
   Release of waste package
   Grouting/support matrix
   Sealing borehole

3. **POST-CLOSURE**

   Near field
   Far field



After Gibb, Travis, McTaggart & Burley (2008)



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COST EFFECTIVE (LTVDD-1)

0.5 m Borehole to 4 km = £25 - 35 M

With up to 50% savings for multi-borehole programme (J. Beswick, 2008)

No. of packages per hole = 650 - 700

UK Total HLW containers = 7,250

(2007 UK Inventory, current & future arisings)

No. of 4 km holes required = 10 - 11

Approximate cost = £210 - £330 M

(Assuming minimum savings per hole of 15%)

NDA R.R.C. (ILW + HLW) = ~ £14 Billion

SITE AVAILABILITY

Suitable basement underlies much of the continental crust

Within 3 km of surface in many places

Potentially good site availability

Small footprint

Waste producers (e.g. NDA, MoD) could already own, & volunteer, suitable sites.

EARLY IMPLEMENTATION

Small diameter test drillings **(Incl. geological & hydrogeological evaluation)**	**1 – 2 years**
Disposal borehole to 4 km	**~ 1 year**
HLW emplacement	**~ 2 years**
Sealing & Backfilling	**< 1 year**
Time to first completion	**~ 5 – 6 years**

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9. EARLY IMPLEMENTATION
10. ACCEPTABILITY ?

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ISL

DBD is an option we can't afford to ignore for the HLWs to which it is especially suited.

It is not a technology that can be dismissed as "immature" requiring decades of development.

Thank you.