

When chlorinated solvents have reached bedrock

Now what?

Nordrocs
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Solutions?

You all understand the inherent difficulties.

- Drill a hole in the bedrock?
 - Yes... but what about vertical migration? PCE/TCE sinks like lead.
- Drill quickly, get some grab samples (potentially using packers) and grout the borehole?
 - Expensive grab samples and no going back for more
- What else then?

Need a silver bullet?

FLUTe liners

- Seal the borehole immediately upon completion – no vertical migration
- Visually delineate cVOC dnapi at depth in bedrock
- Identify fractures with dissolved chlorinated solvents and break-down products
- allow groundwater to be repeatedly extracted at individual fracture levels
- can be installed to great depth (>200m) in bedrock
- Undertake detailed hydraulic conductivity and transmissivity studies

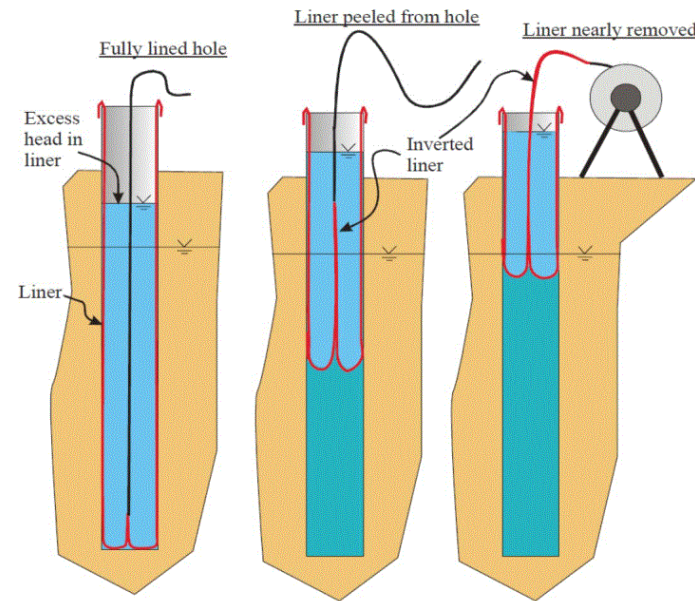
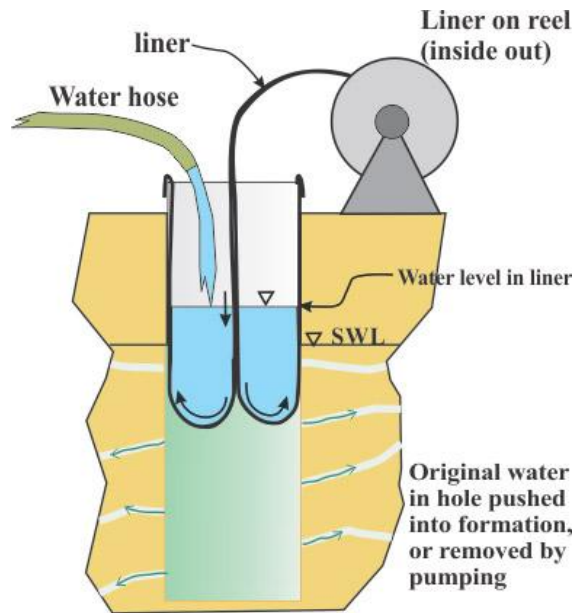
FLUTe Liner Concept

- Outer protective (solid or translucent) Carrier Liner – nylon fabric coated with urethane
- Inner NAPL FLUTe Liner – hydrophobic material with reagent stripes that react to cVOC DNAPL in fractures
- FACT (FLUTe Activated Carbon Technique) – continuous strip of felt with microgranular activated carbon



Solinst® Flute

**Rosmarus
Enviro**



Advancing/everting a liner downhole by turning it inside-out and filling the annular space with water.

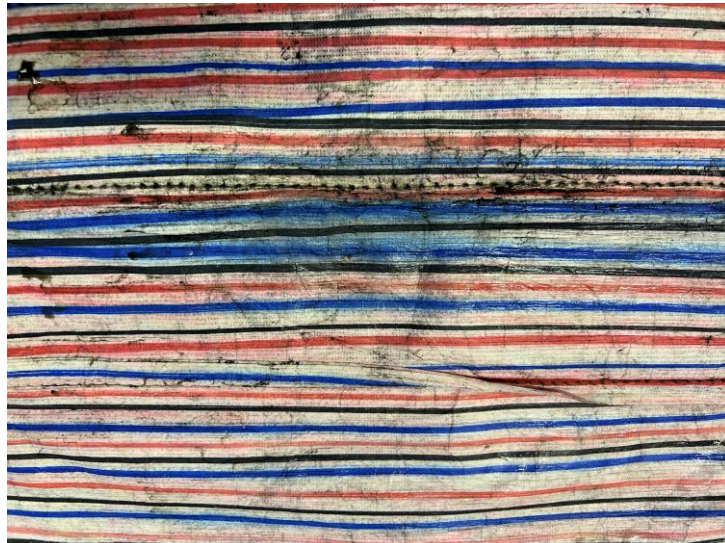
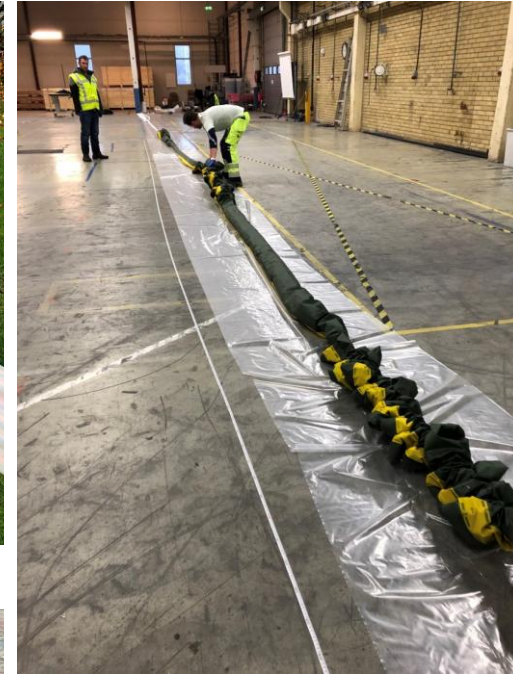
Two weeks later...



Clean vs impacted



DNAPL at depth



Near free phase



DNAPL

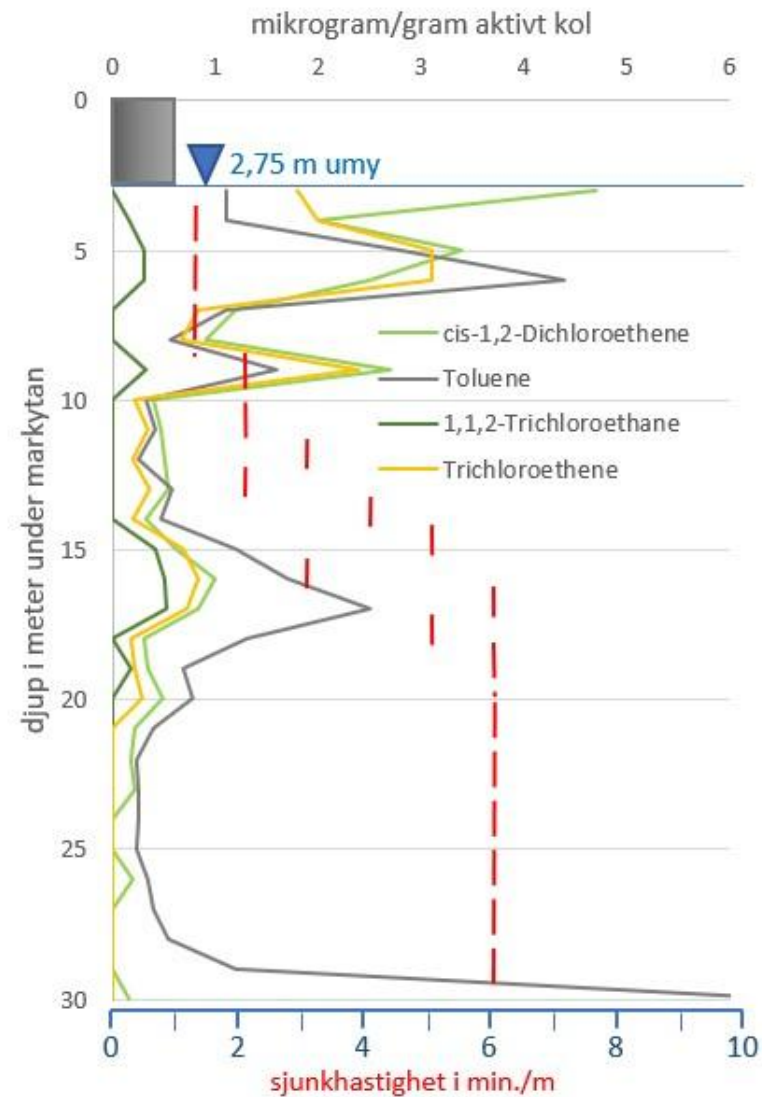


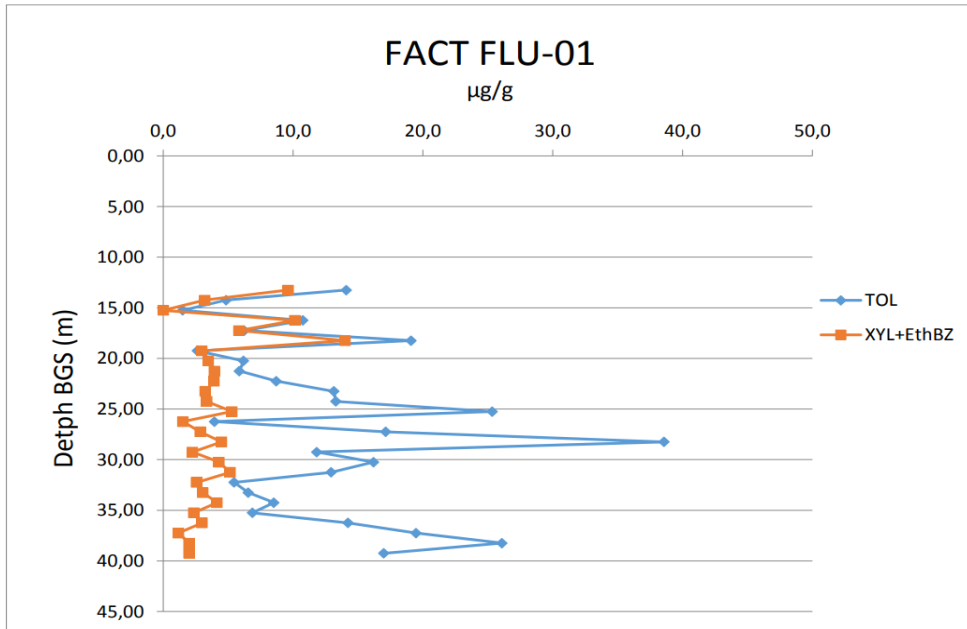
Creosote

 **GREENSOIL**
Sustainable Soil Remediation

 **Rosmarus**
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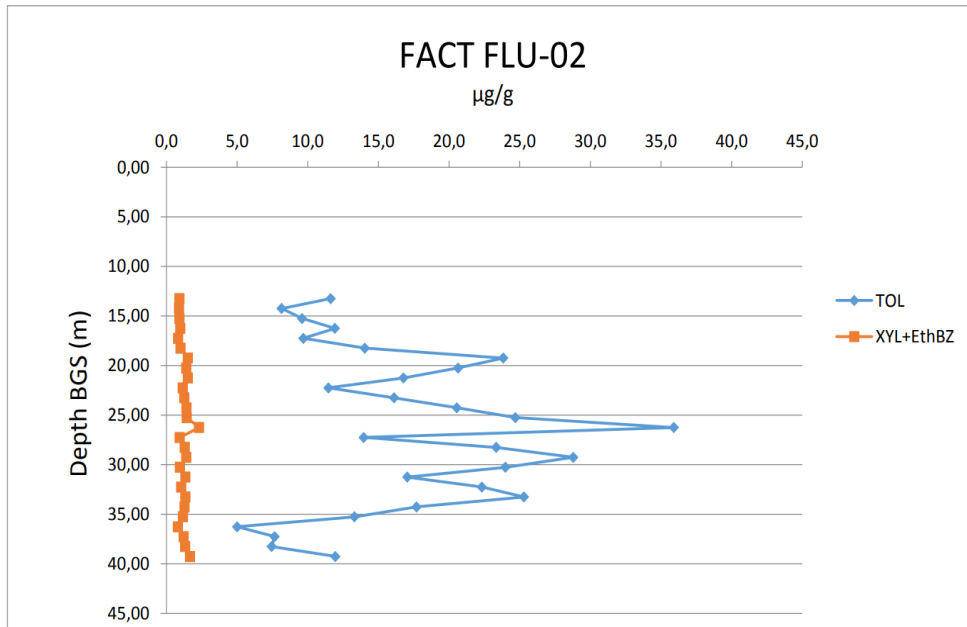
 **SWECO**



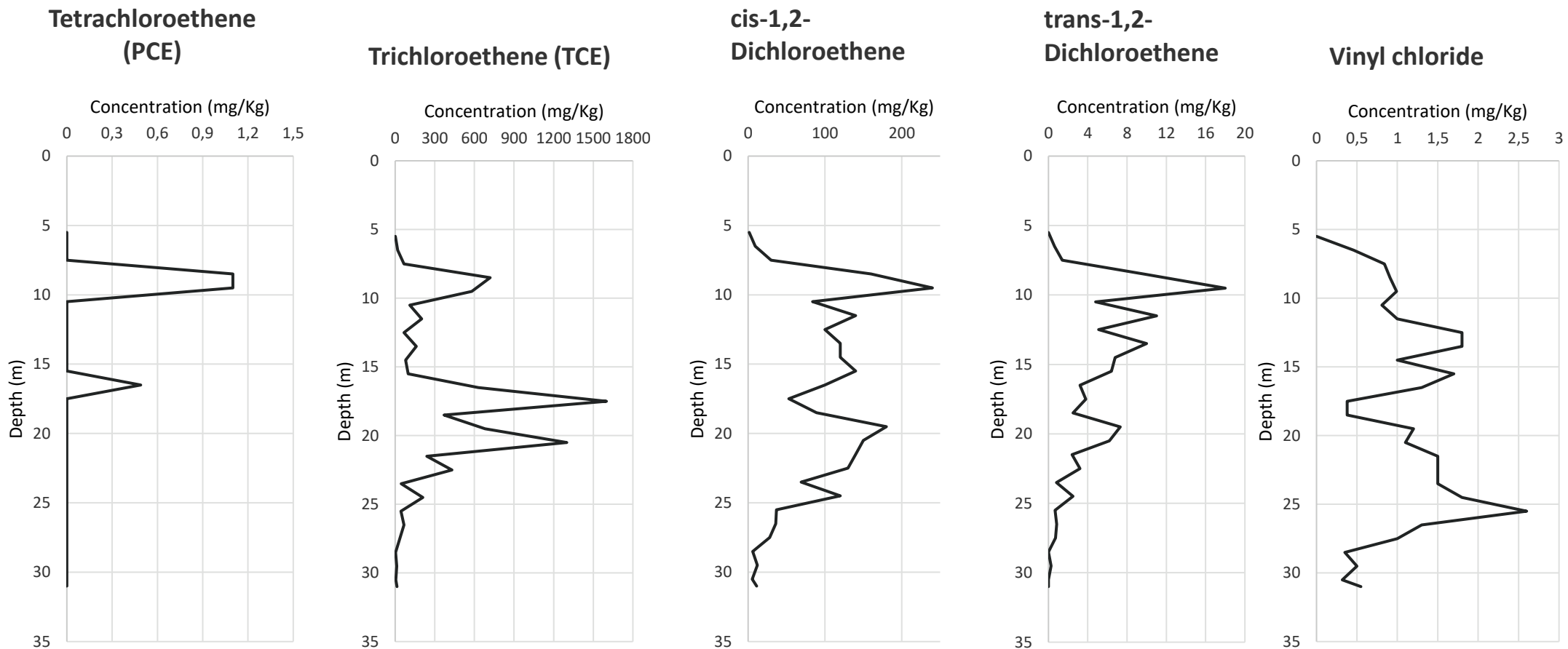


Clean bedrock

- Toluene from the urethane in the FLUTe Liner trapped in the FACT strip
- Many fractures/fracture zones identified
- Complete absence of cVOC in bedrock



Natural attenuation on-going...but stalled?



Who should use FLUTe Liners

Who are the people in need of this info?

They are:

- Consultants delineating a source area in bedrock to cost and procure a remediation technology contractor.
- Hydrogeologists requiring detailed groundwater flow data
- Environmental regulators (for groundwater protection)
- Geotechnicians (major underground infrastructure projects)

They are YOU!

Clients finding new uses

Geothermal wells for Green Energy

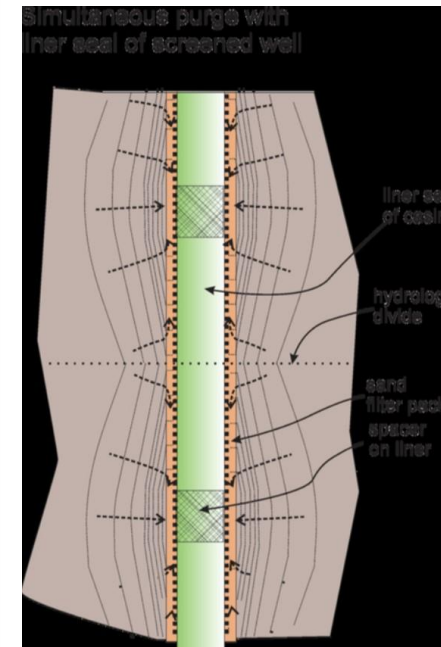
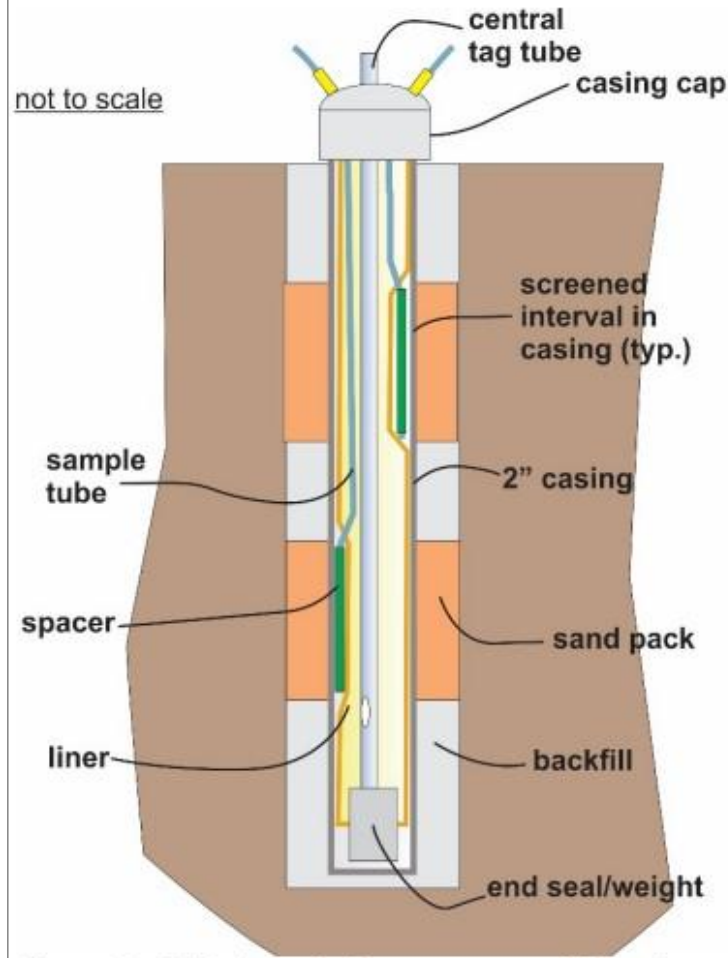
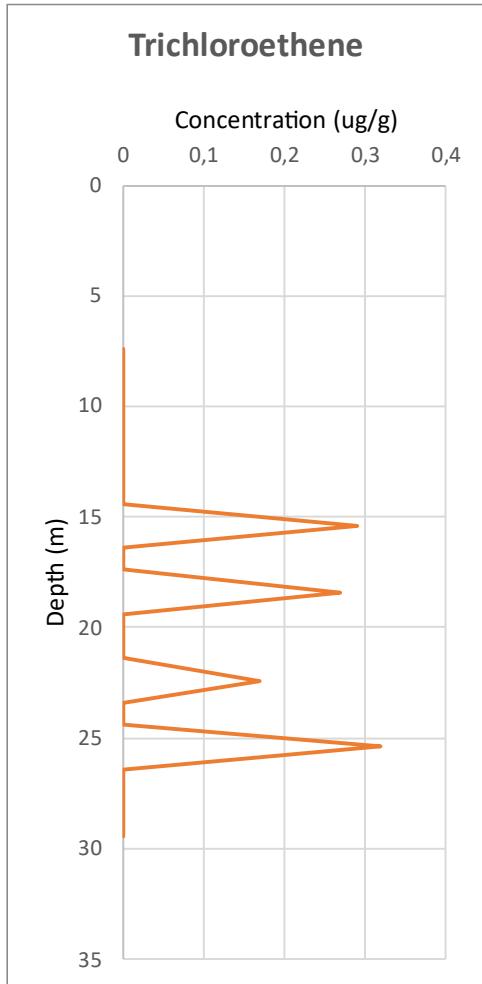
Imagine having a site developer requesting approval for a fan-shaped cluster of 22 energy wells to 180 metres and you suspect there may be impacted bedrock near that line. How do you, as the municipal regulator responsible for signing off on the drilling permits, reduce the potential risk of unknowingly allowing a negative bedrock impact? Include burden of proof with the permit! Test holes prior to full implementation using FLUTe Liners can be used as a line of evidence in a Go or No Go situation if solvents rate high in a risk-based assessment.

Need actual groundwater samples

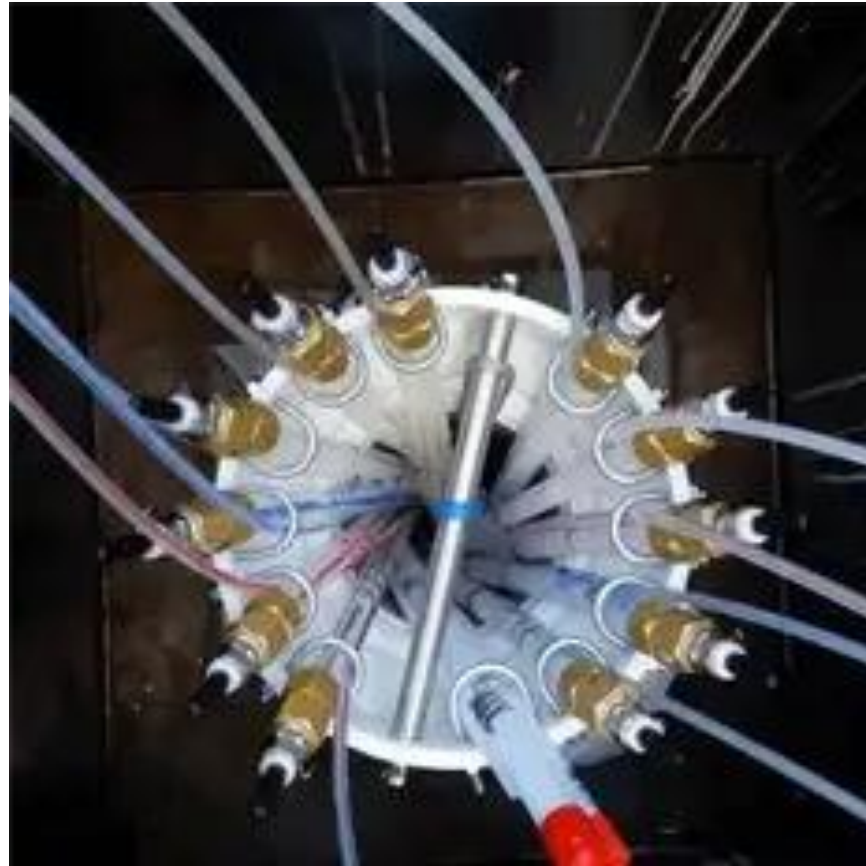
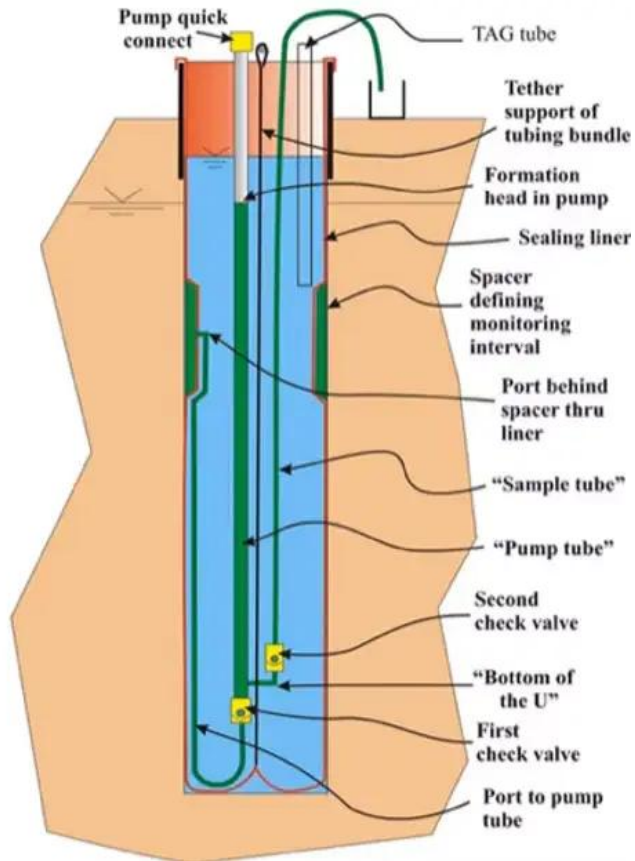
Cased Hole Samplers/Water Flutes

- Seal the borehole like a normal FLUTe Liner – no vertical migration
- Allow pumping of groundwater from specific, identified units
- No cross-contamination from surrounding groundwater
- Have been installed to 400 metres depth
- Install once – monitor for years

Cased Hole Samplers (CHS)



Water Flutes for deep boreholes



FLUTe liners

- Save you time – get results quickly
- Provide factual data on which to plan remedial efforts
- Delivers confidence in results
- Reduces uncertainties in planning and costs
- Close down forever-projects
- Are great crowd pleasers with clients

Thank you