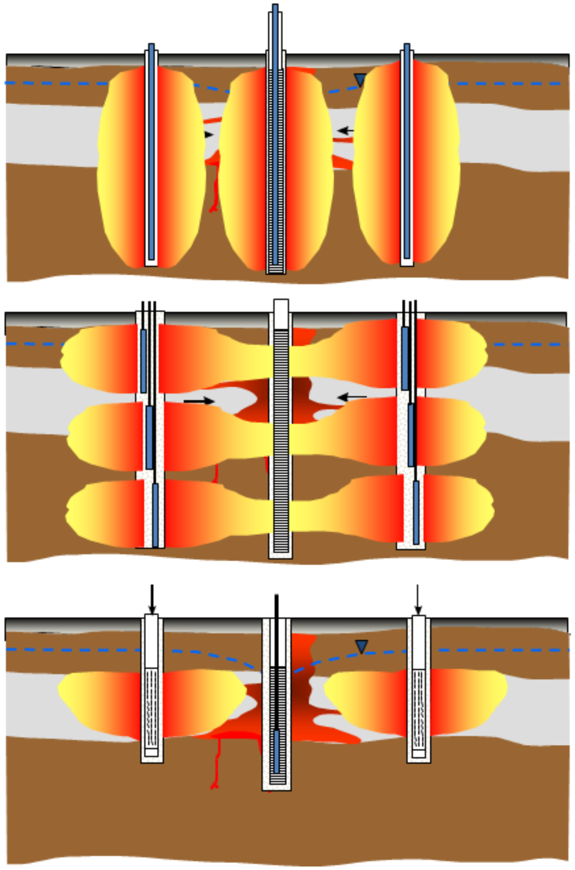
How To Choose?

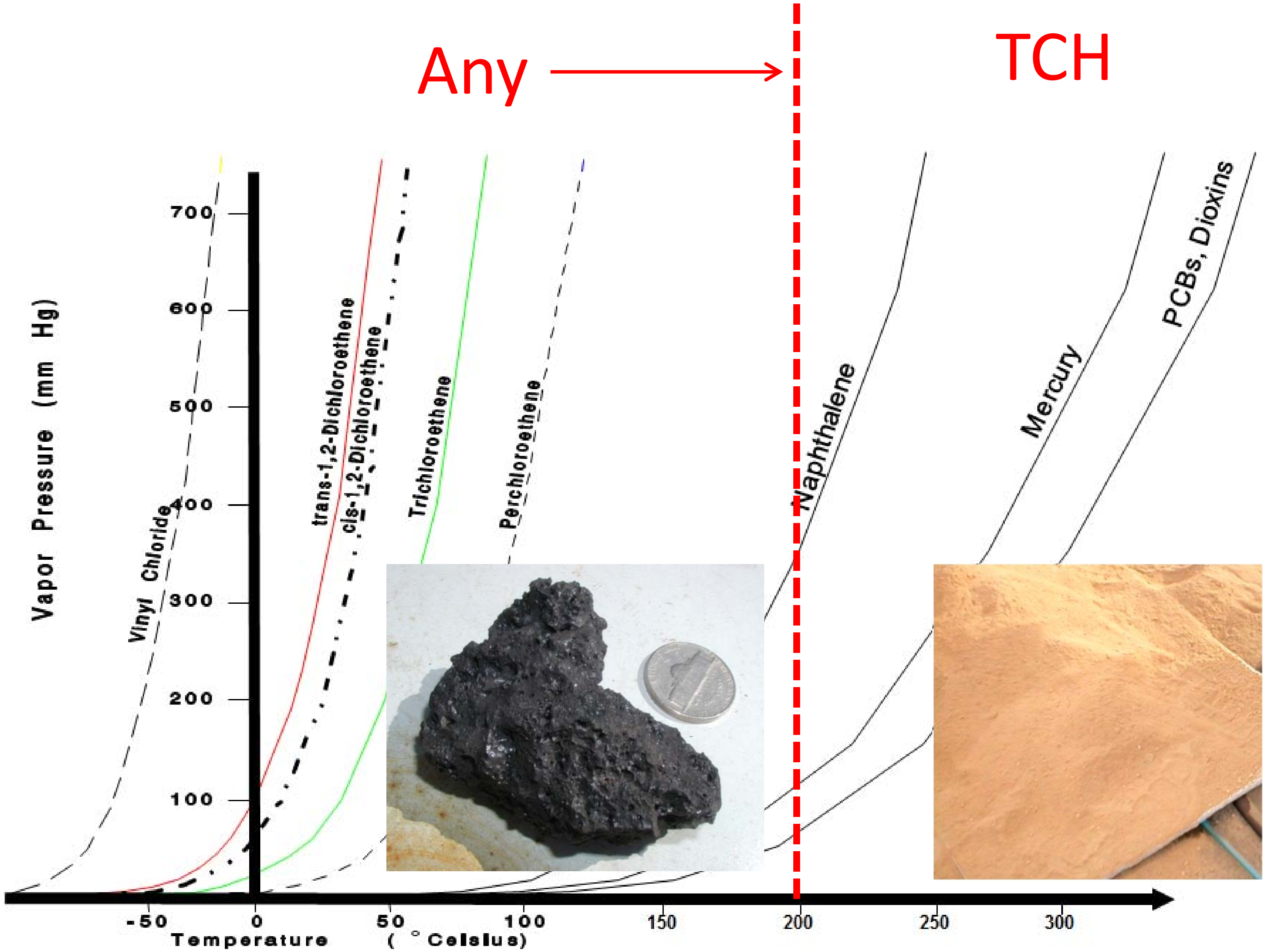


Gorm Heron, Steffen Nielsen, Michael Dodson, Robert D'Anjou

Cascade Thermal

Contaminants

Boiling points rule



SVOC Treatment – above grade

In Pile Thermal Desorption
(USAID- Danang Vietnam)

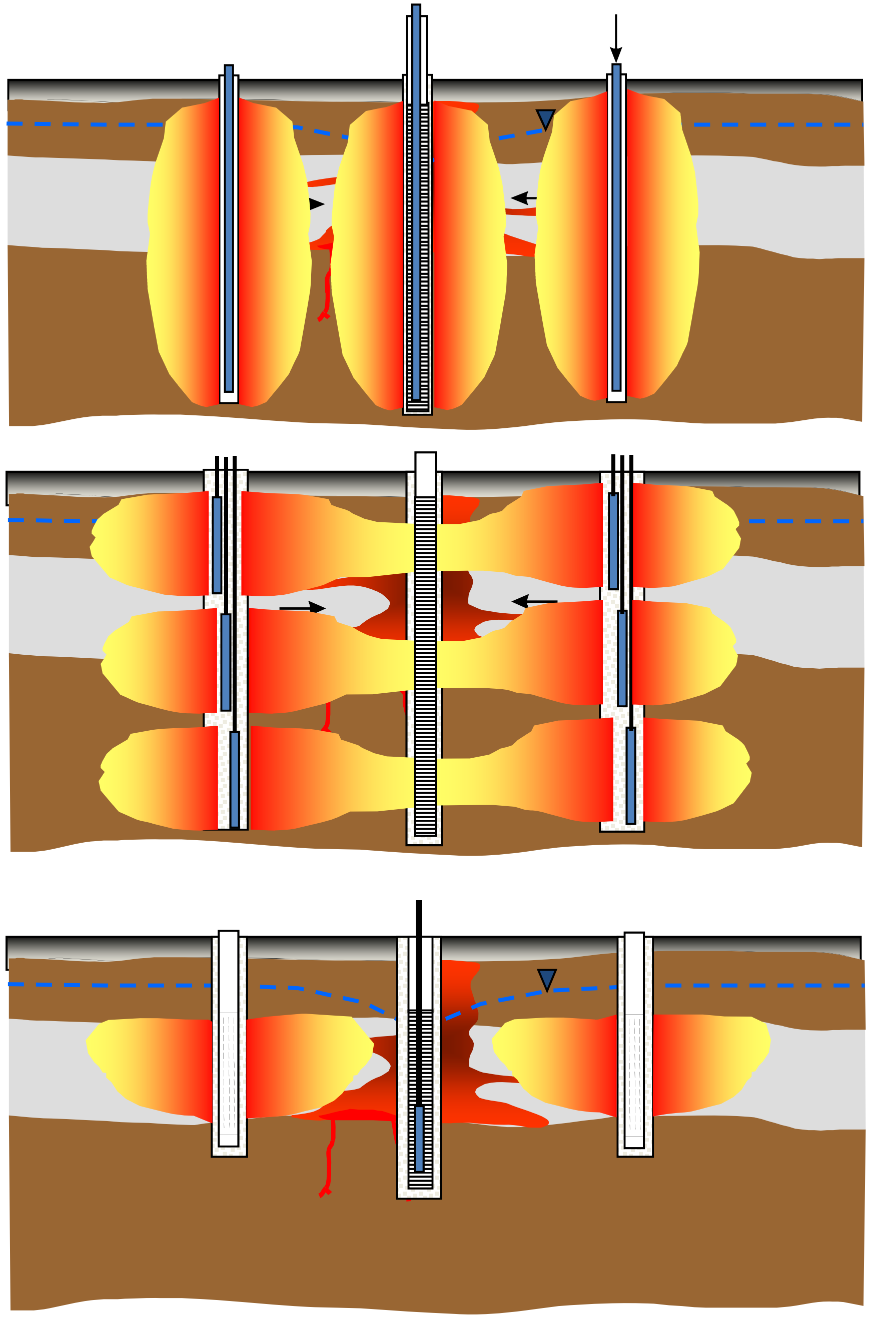
HB-1100

Permeability

TCH - governed by **thermal conductivity** (*f*~3)

ERH - governed by **electrical conductivity** (*f*~200)

SEE - governed by **hydraulic conductivity** (*f*~10^6)



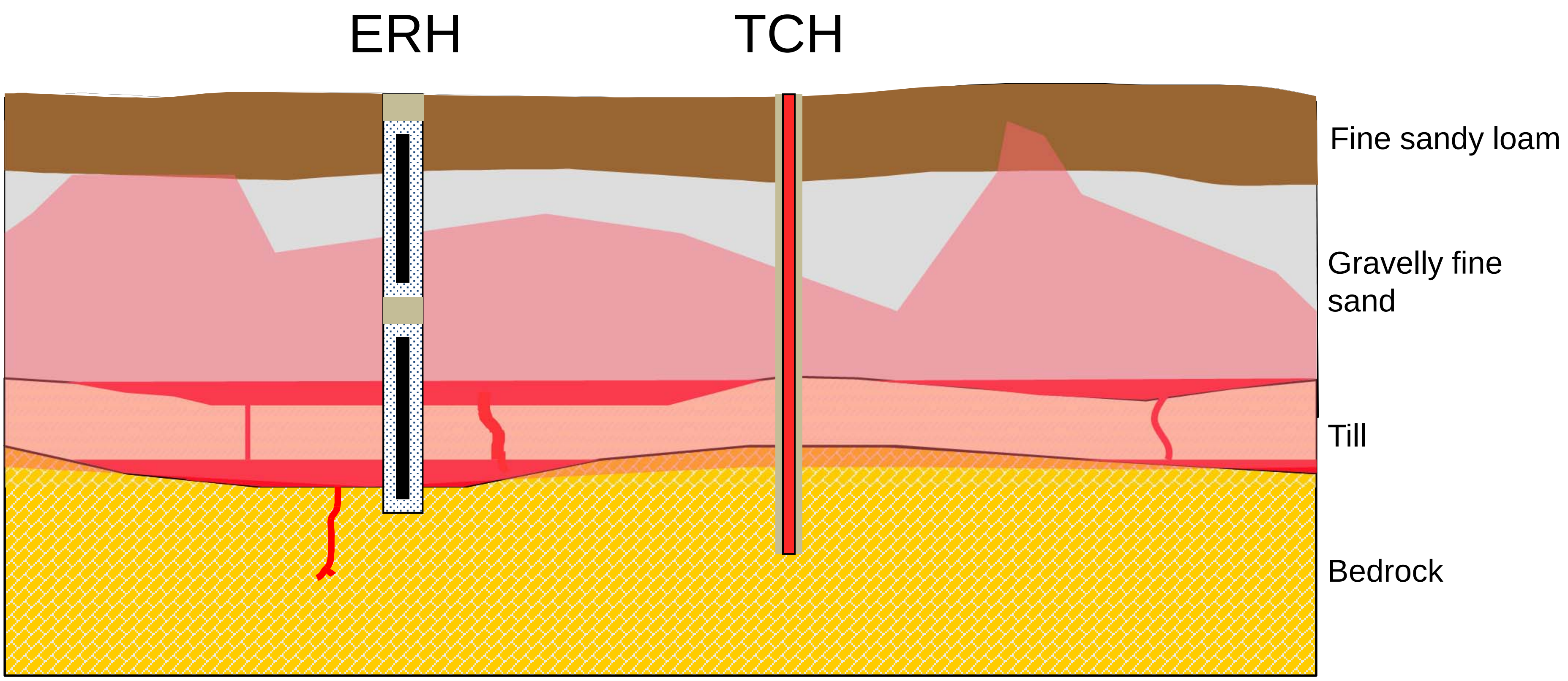
Long plume?

Flowing groundwater in touch with NAPL

- *Need to keep hydraulic control*
- *Be aware of cooling*
- *Use SEE if you can*

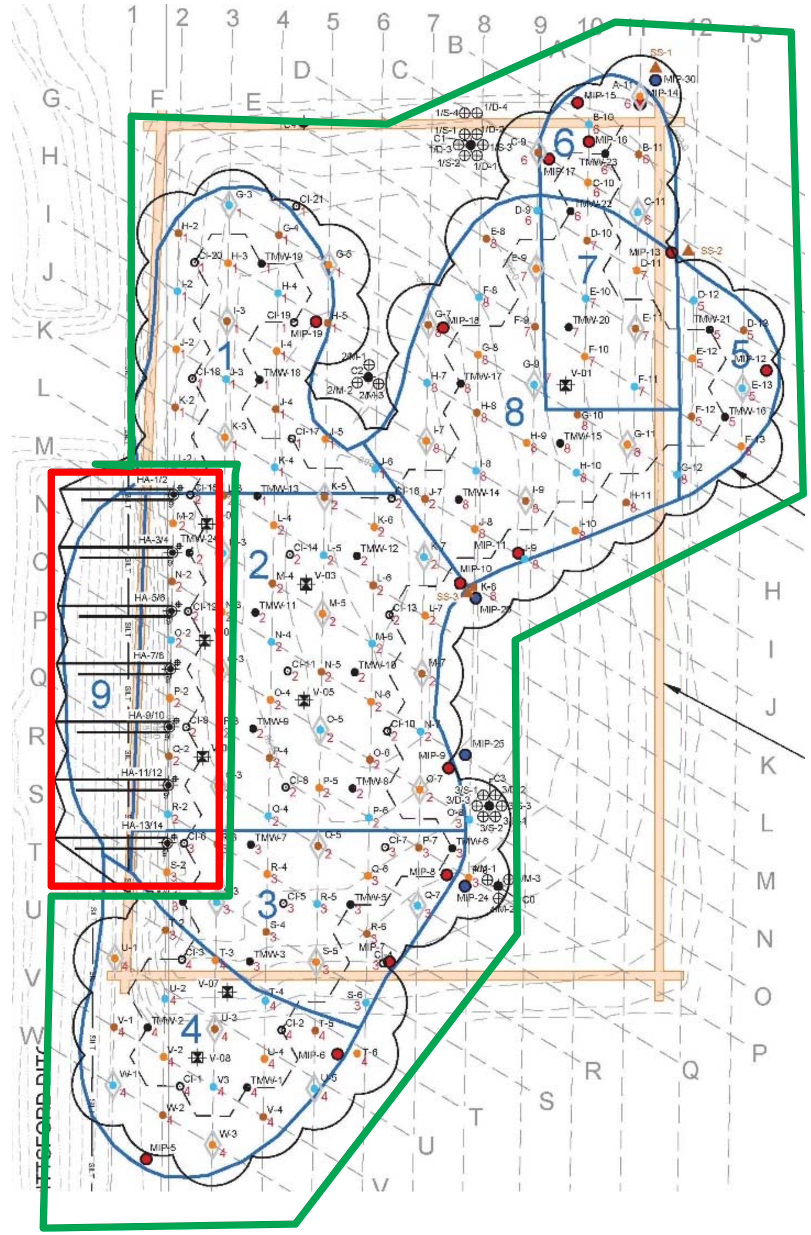
DNAPL spreading risk

(case: SRSNE Superfund Site, Southington CT)



SRSNE - TCH

Safety: ERH-TCH Combined



Anderson IN: ERH-TCH

Access
(case: Knullen, Denmark)

TCH

Small diameter boreholes

Drilling space limited

Access
(ERH site with subsurface completions)

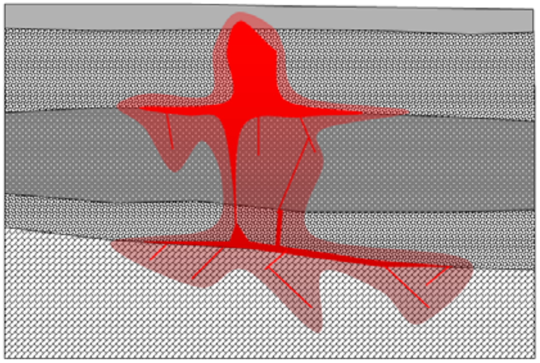
Cost
(main factors)

1. Drilling and well materials

2. Construction

3. Duration and labor

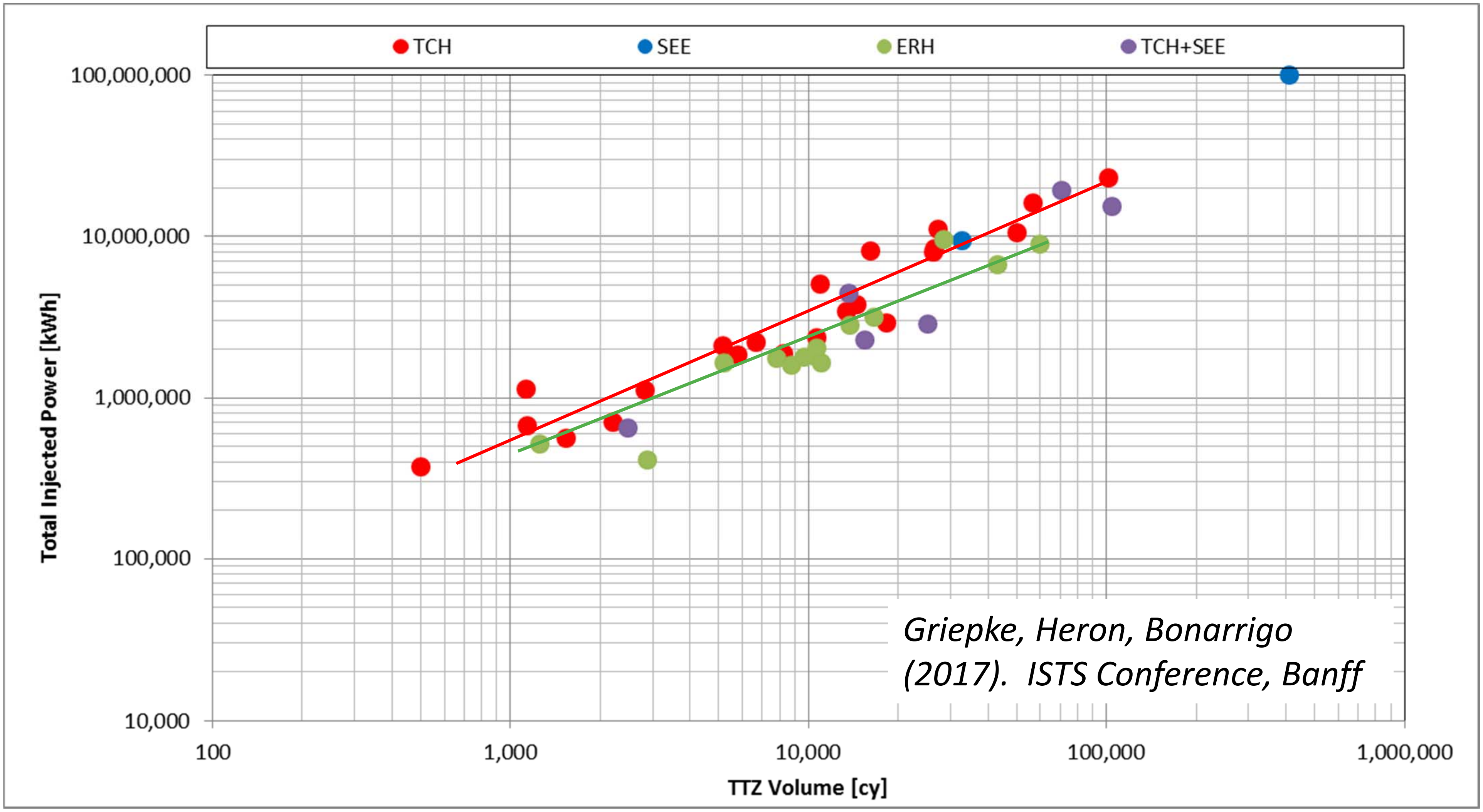
4. Fuel and power



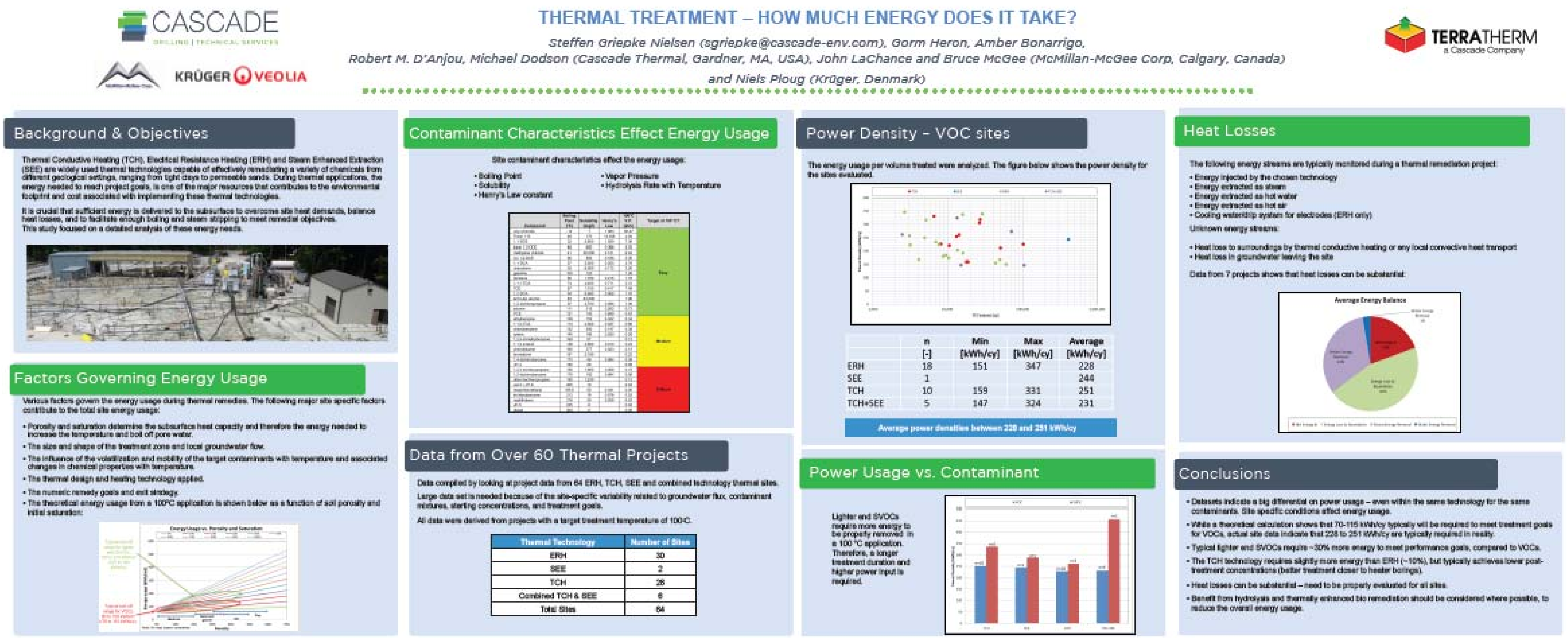
5. Guarantees

Drilling and depth
(case: Norco, CA)

Power usage (60 sites)



Poster 78 tonight in B1



Facts

1. The cost of energy is less than 20% of the total project cost

2. Steam is 70% cheaper per BTU

3. ERH and TCH are within 15%

4. TCH used to reach more stringent goals

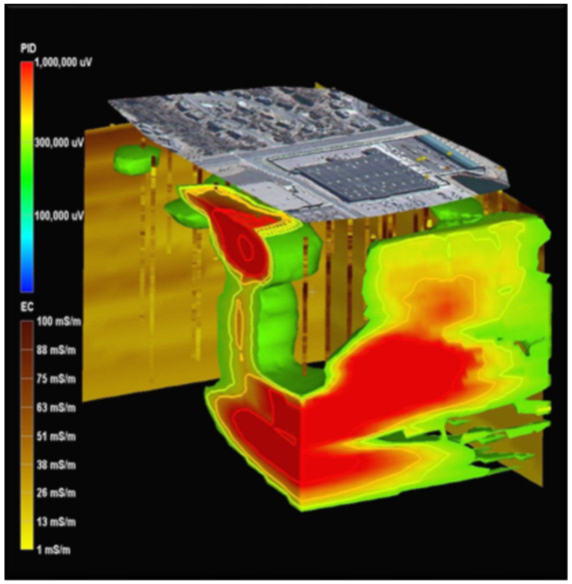
5. Certainty and guarantees

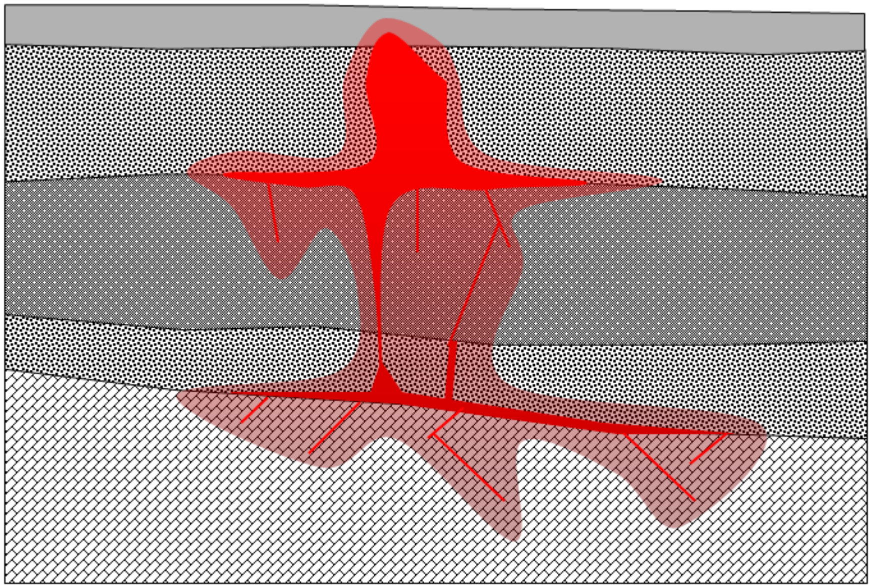
	GFPR all-in	GRPR with assumptions	GFPR for tasks that are not variable
Drill and construct system	fixed	fixed	fixed
Operate and ensure function per design	fixed	fixed	fixed
Collect data to optimize	fixed	fixed	fixed
Expanded duration due to higher than expected contaminant mass	fixed	Unit price for GAC or daily rates	Unit price for GAC or daily rates
Revisions to counter unknown groundwater flow	fixed	Unit rates for wells and operations	Unit rates for wells and operations
Other unforeseen expenses and delays	fixed	negotiated	Cost covered
Thermal vendor potential exposure	**HIGH**	**MEDIUM**	**LOW**
Cost premium (typical)	20-30%	10-20%	none

TCH
ERH + MPE/barriers
Combinations

Single approaches

Basis for choice – solid CSM





Geology

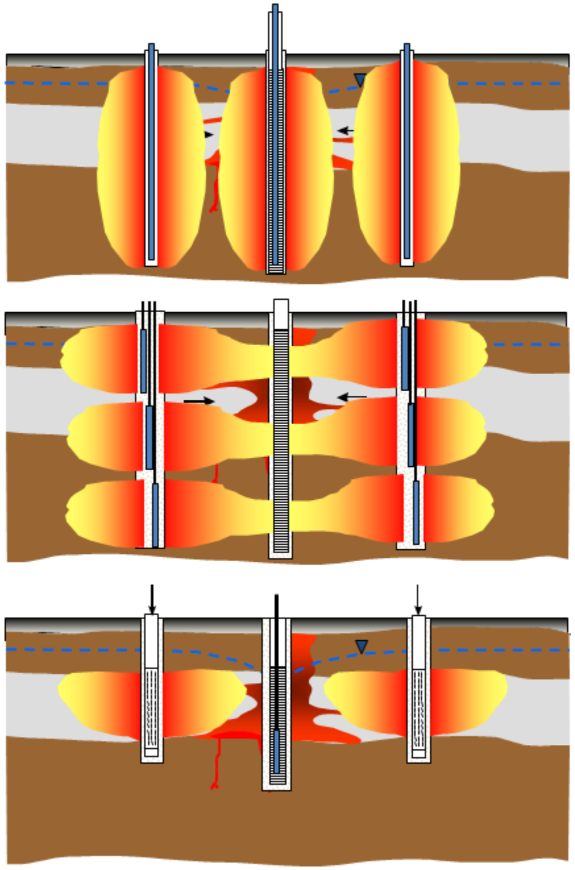
Water

COC

Goals

Certainty needed

Summary - how to choose



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