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Chlorinated Solvent Investigations: Tips, Tricks and Tragedies

REMTECH
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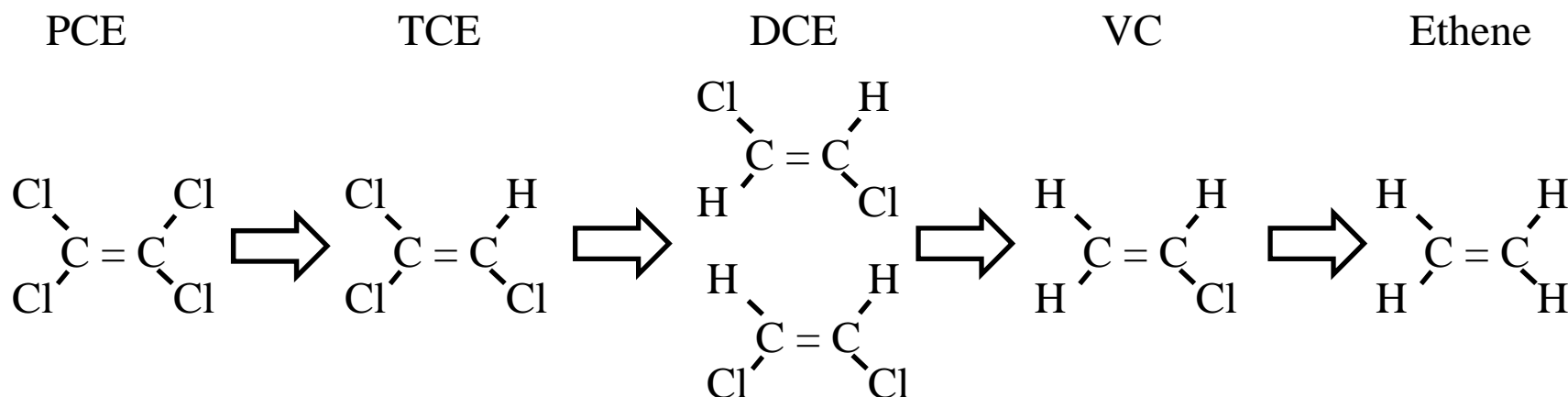
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What are Chlorinated Solvents

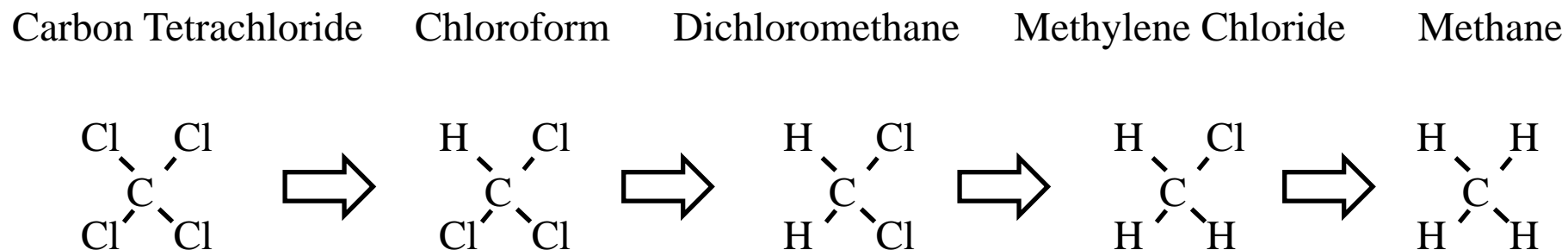


- A chlorinated Solvent is a carbon molecule or chain that contains chlorine.
- They tend to have relatively low solubility in water
- They tend to be environmentally recalcitrant
- Some will degrade into more toxic chemicals
- Some will be picked up by a VPH analysis
- Some are naturally occurring, but others are man-made.
 - PCE only became commercially available and popularized in the early 1930s.

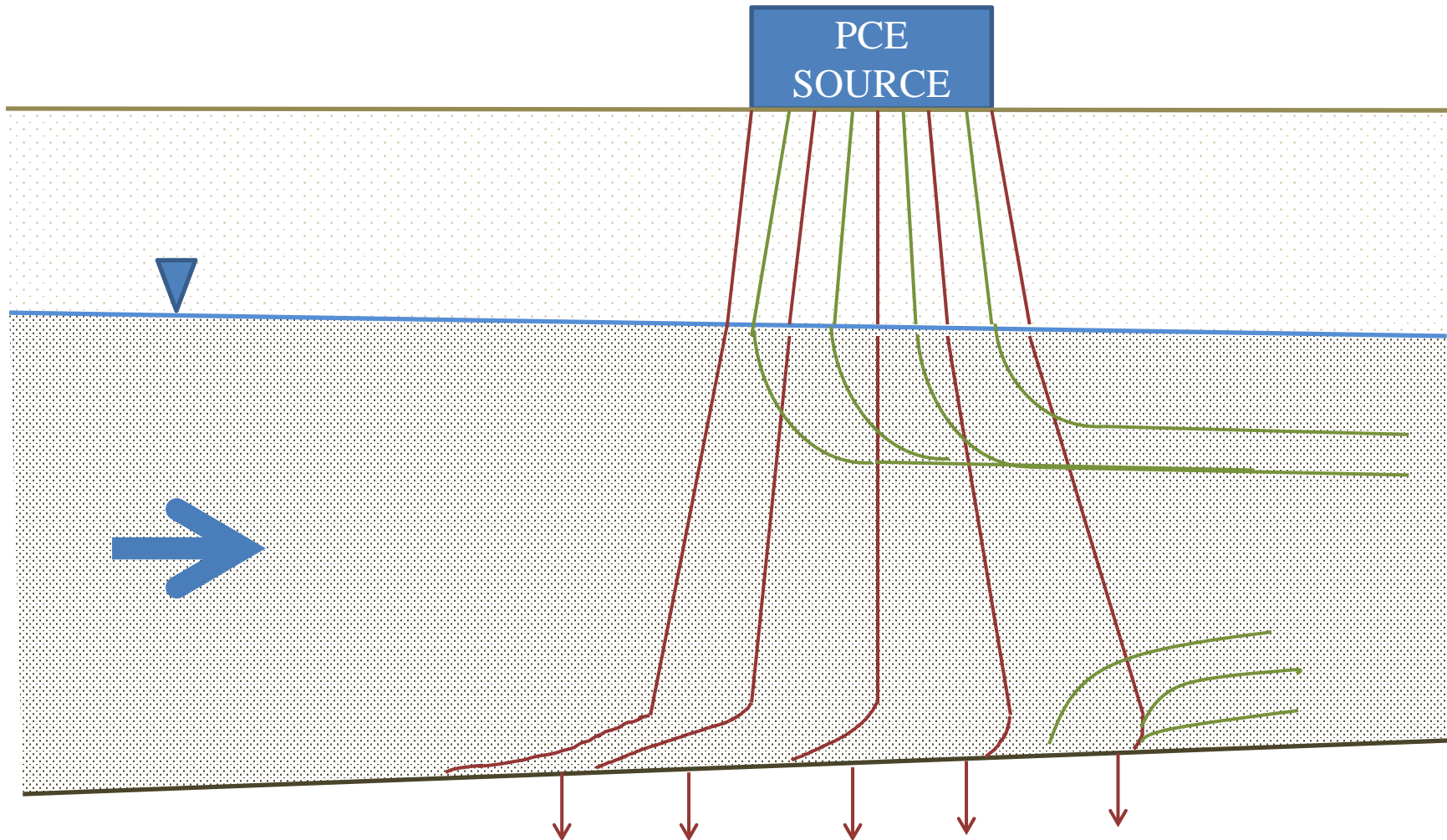
Reductive Dechlorination



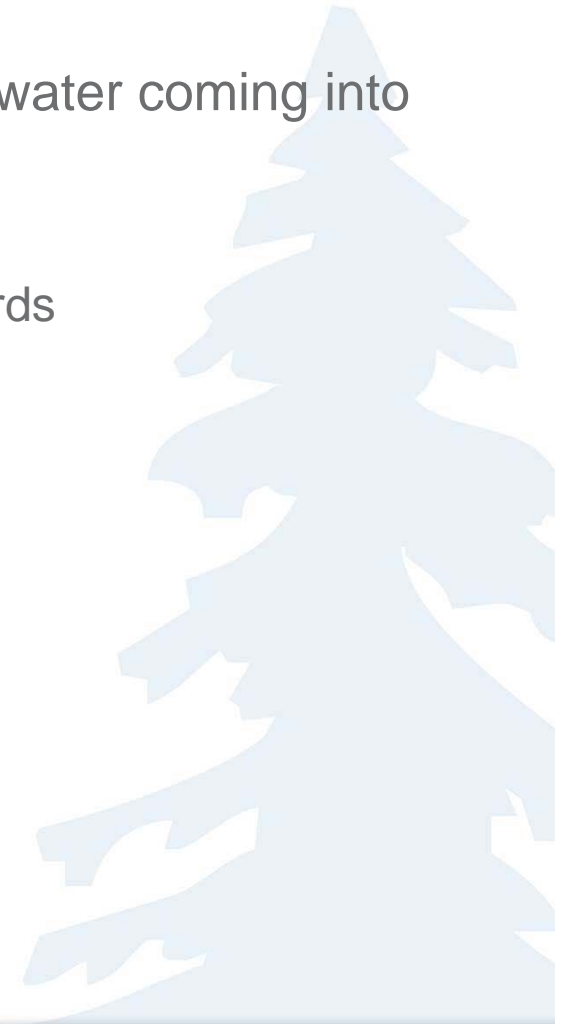
Oxidation Reaction attacks the double bond and thus does not produce the toxic daughter products



Migration



- Chloroform can form as a result of chlorinated tap water coming into contact with natural soils.
 - This can result in exceedances of regulatory standards
 - This does NOT explain all chloroform exceedances



Could There Really be a Concern?



- Chlorinated Solvents tend to be very aggressive in attempting to reach the subsurface environment.
 - Will penetrate concrete, floor tiles, etc.
 - Will leak from waste water pipes
 - Have been found under buildings with multiple levels of underground parking

- Shallow excavations during a redevelopment will not necessarily remediate a property. Solvents will often easily go below the excavation.

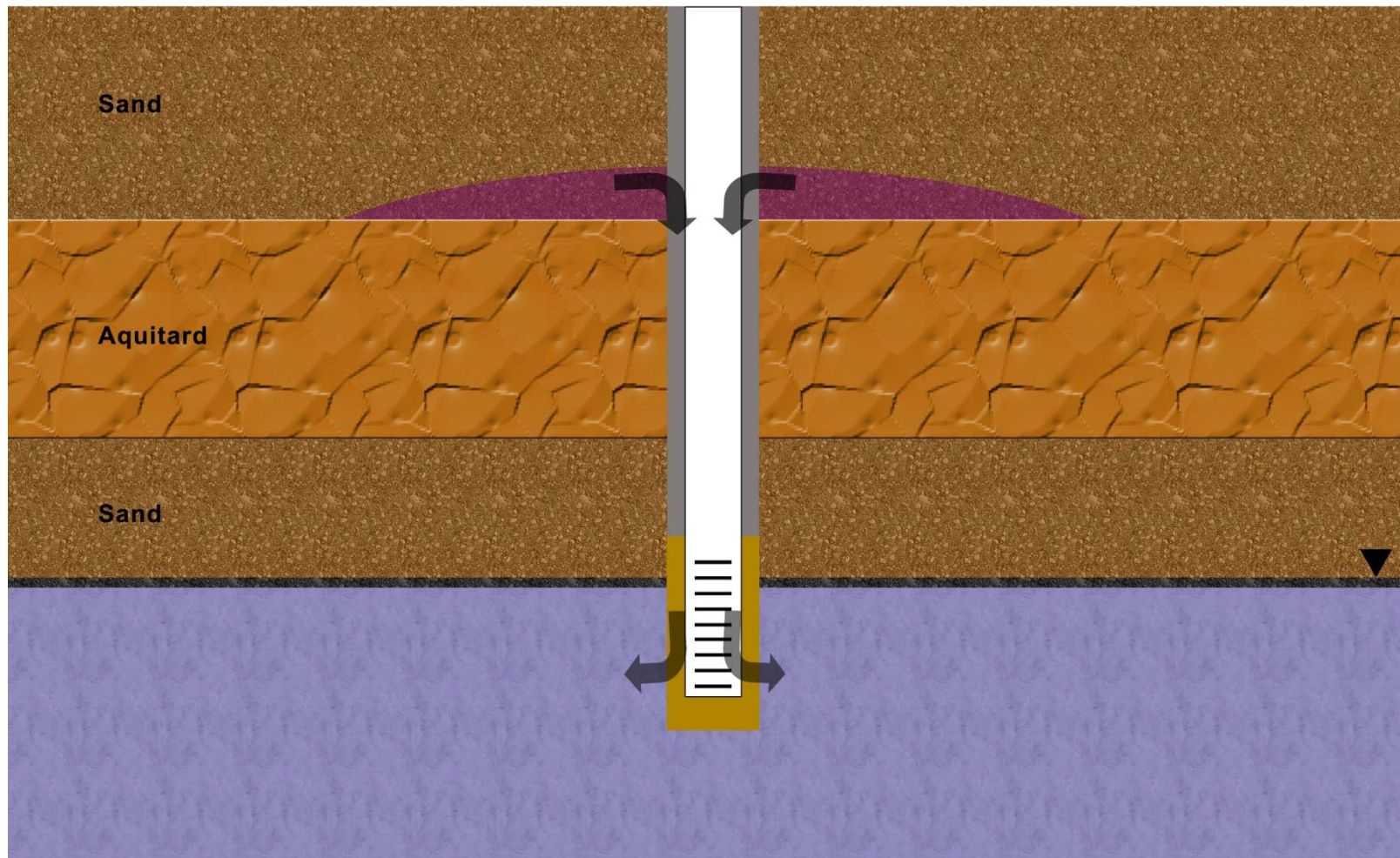
- Dry Cleaners can result in severe impacts in very short periods of time

Wrong Well in the Wrong Place

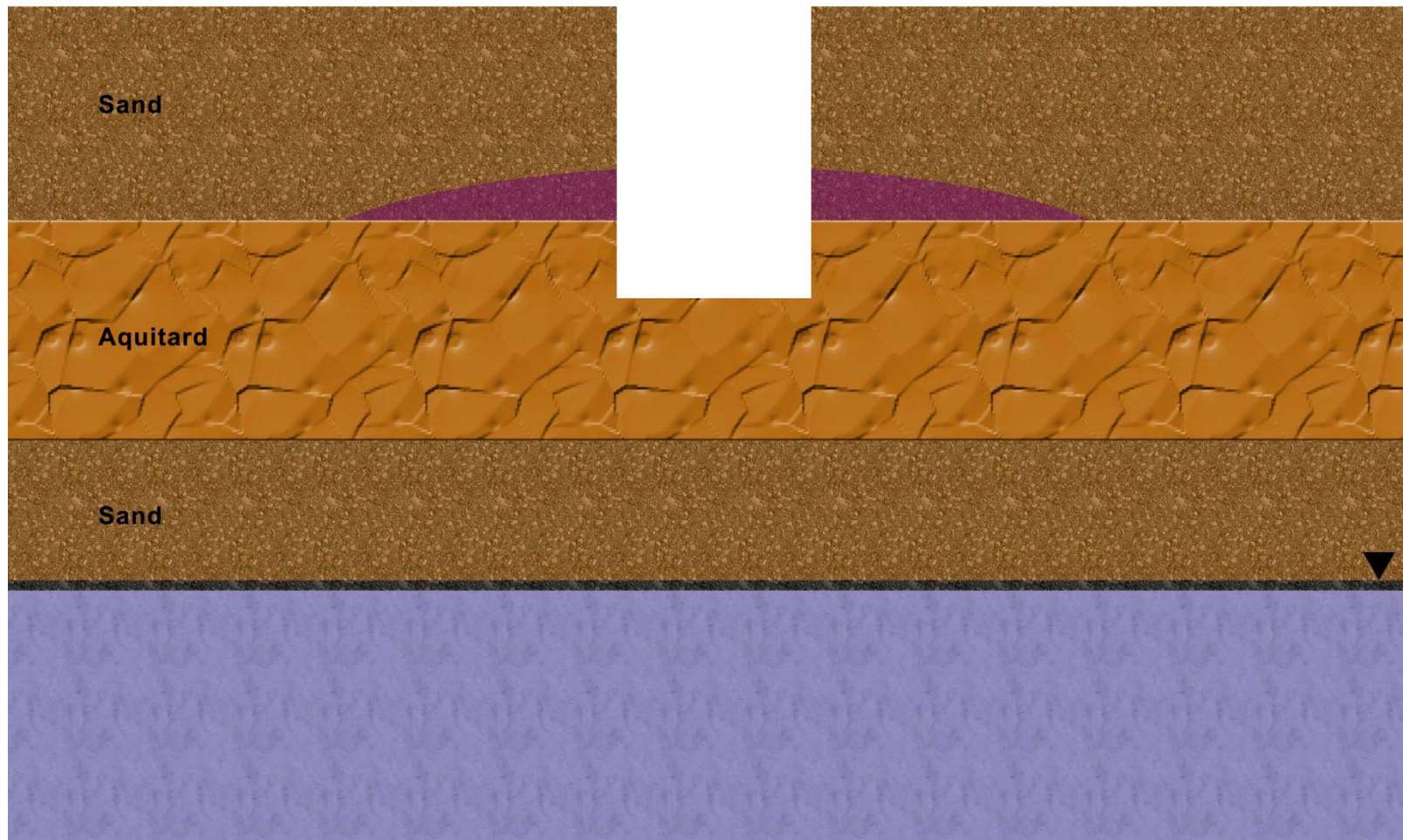


- The wrong kind of well drilling in the wrong location can result in the creation of a downward preferential pathway for the PCOC. Thus you well can actually result in contaminating a previously clean deeper groundwater zone.
 - During drilling, impacted soils can slough or be pulled down by the drill rig.
 - The PCOCs if at high concentration can desiccate bentonite. This will crack it and provide a fast pathway down through the plug.
 - The PCOCs can dissolve PVC piping. Thus may enter the well laterally and fall to the bottom.
- To prevent the above, consider the following before installing the well
 - Avoid drilling through a DNAPL.
 - Consider using stainless steel wells.
 - If you cannot avoid the location, use telescoping wells.

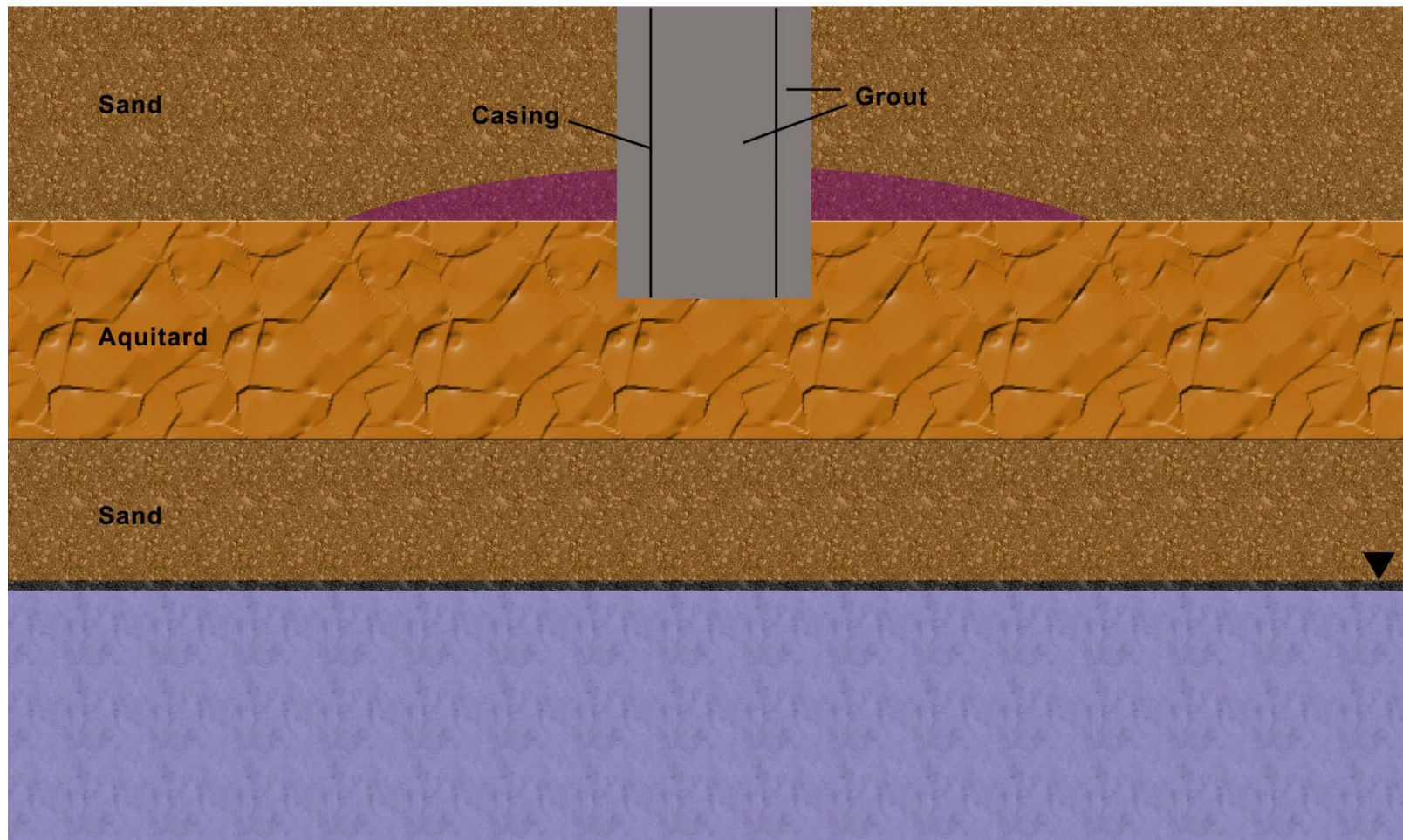
Bad Well



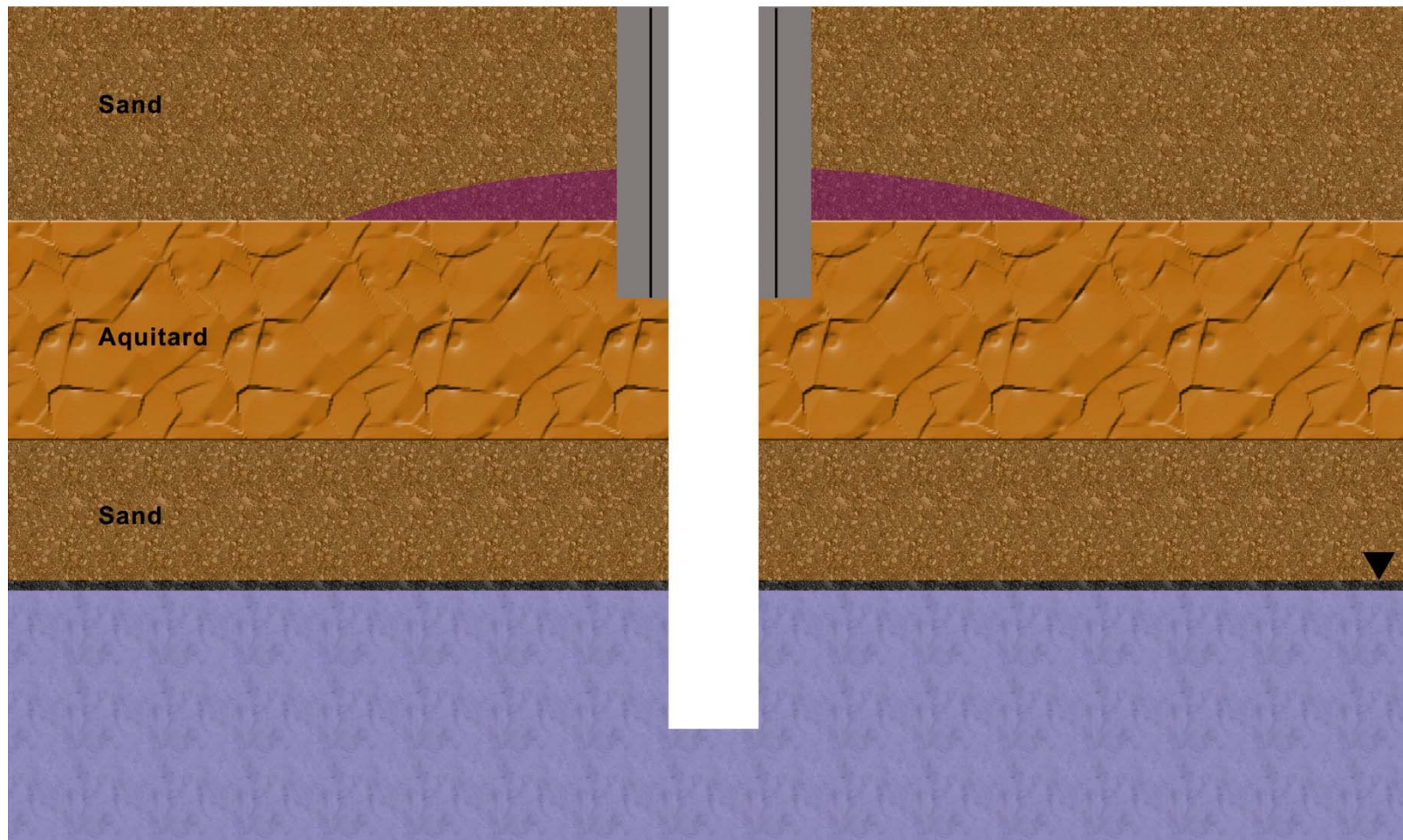
Telescoping Well

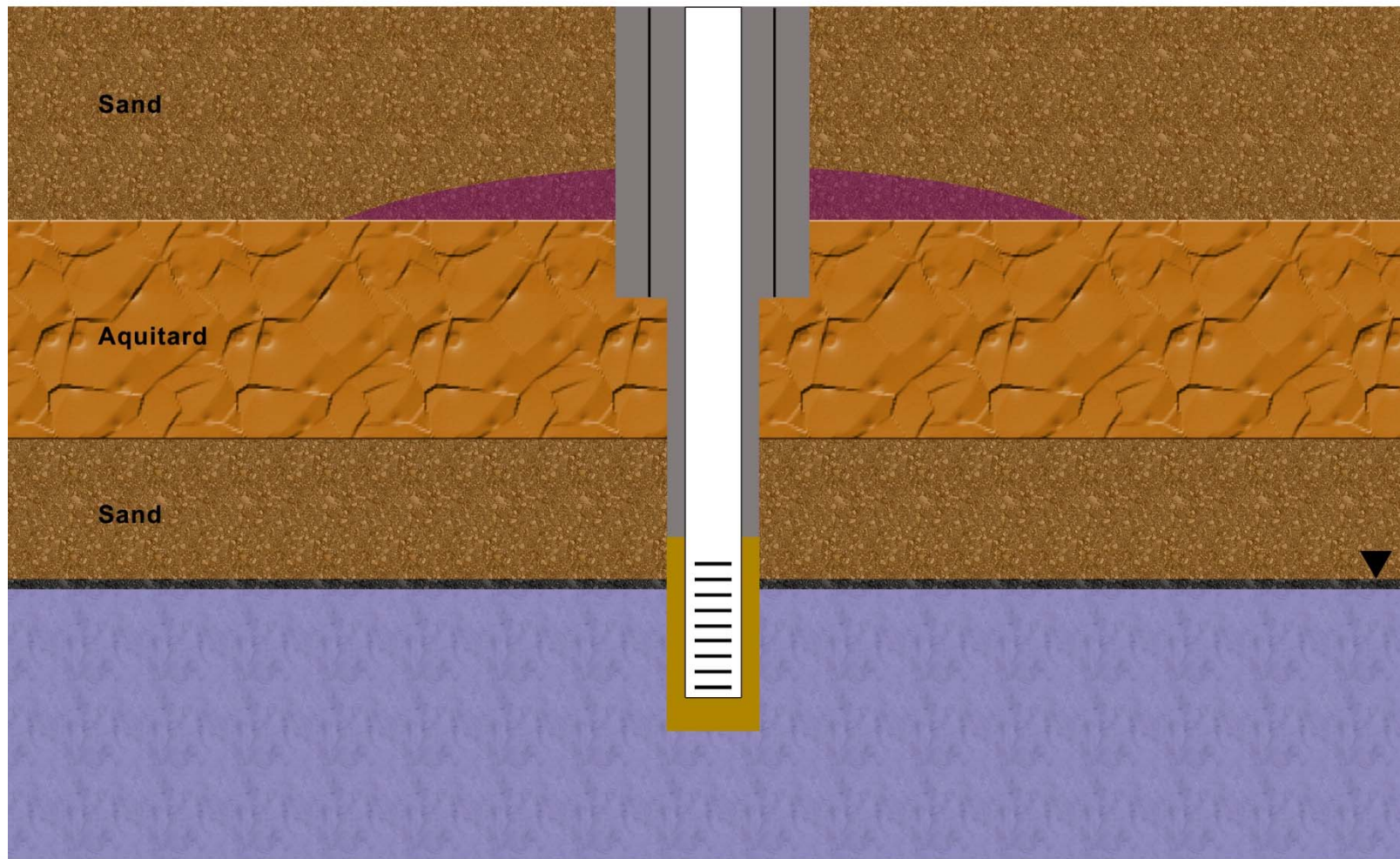


Telescoping Well



Telescoping Well

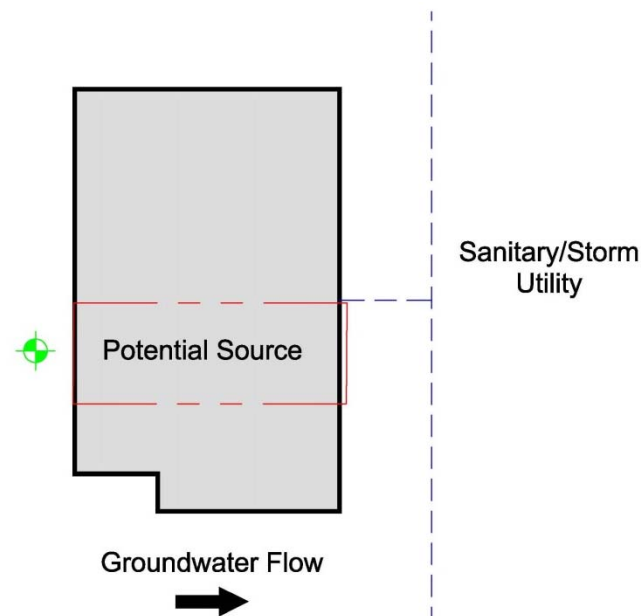




Drilling Where it is Guaranteed to be Clean

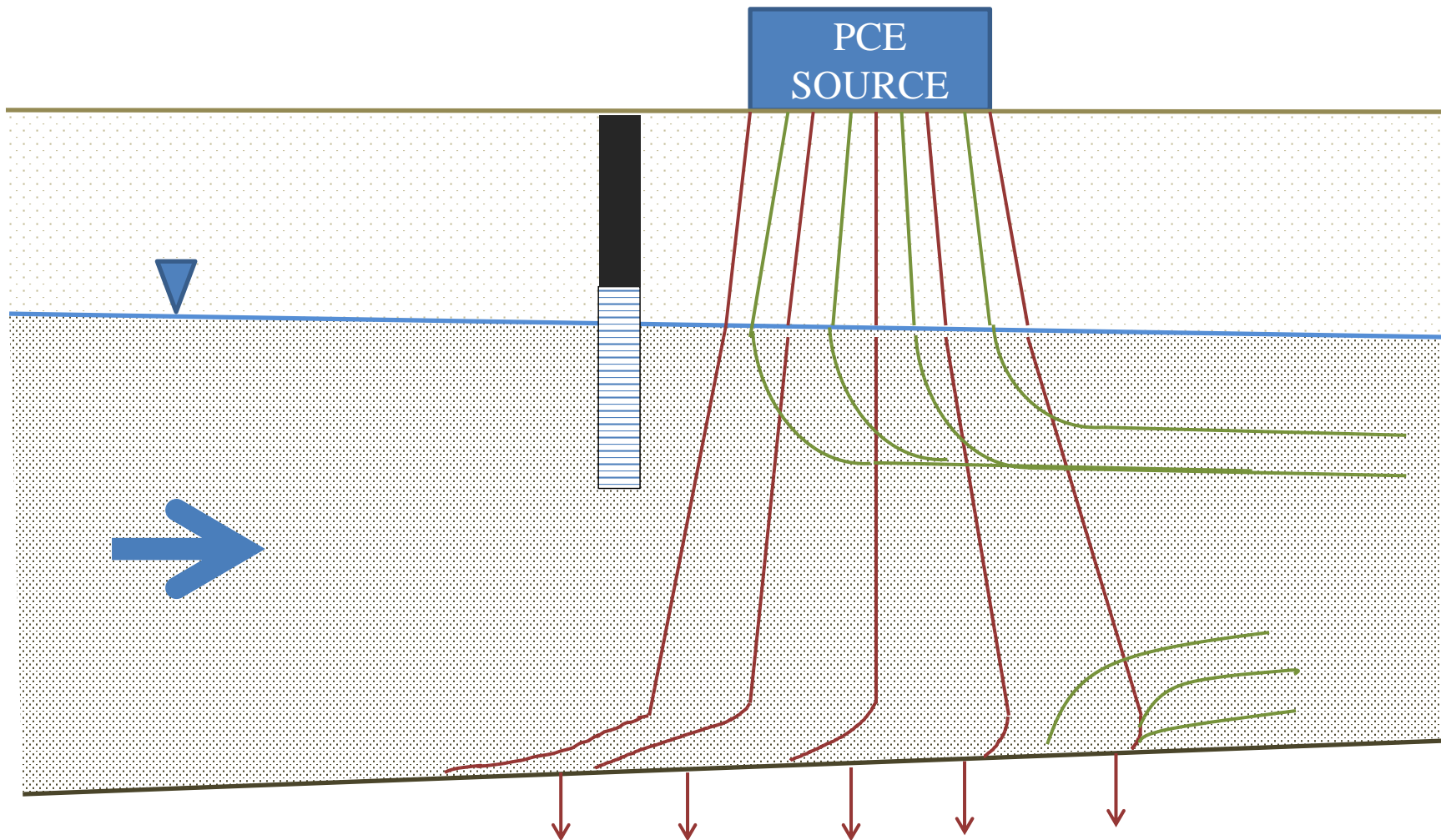


- A common error when investigating a chlorinated solvent Site is to locate the borehole in the most convenient location with close proximity to the Site, without due consideration of fate and transport mechanisms. The result is that many boreholes get placed in locations that are almost guaranteed to be clean, regardless of actual Site conditions.



This kind of sampling is even worse, when no groundwater is encountered, and only soil data is collected.

Drilling Where it will be Clean



When There is Nowhere to Drill



- Vapour Sampling can be used as a screening tool
 - Not ideal option
 - Validity dependant on subsurface conditions
 - This should be more of a presence/absence assessment, verses a direct comparison to standards
 - Non-detect support the likely absence of a source in the subsurface.
 - Detections suggest there is a source. The location of the source or conclusions regarding exceedances in soil and groundwater are difficult to make.
 - Regulatory exceedances means that further investigation and remediation is required.
- Vapour samples at multiple depths can help indicate shallow off-Site sources verses deep on-Site sources.

Sludge Samples from Sumps



- Assessment method for current and historical dry cleaner facilities in multi-level buildings.
 - Can provide clues, but non-detects does not necessarily demonstrate clean subsurface conditions
 - Cause & Affect not always clear
 - Are sludge detections a remnant from historical operations when fewer controls were in-place?
 - Is sludge leaching to the groundwater?
 - Is/was impacted groundwater entering the sump and contaminating the sludge?
- If sludge has detections, then there is a possible source and further investigation should be considered, regardless the concentrations.

Poorly Interpreted Data



Let's consider a single groundwater well located outside the Site building, with a concentration of a PCOC of 1080 and a standard of 1100.

Does the above result warrant further investigation?

If very large screen, then dilution effects could should also be considered.

Interaction with Hydrocarbons



Positive

- When a dissolved solvent plume encounters a dissolved hydrocarbon plume, as the two plumes mix they can serve to promote natural attenuation of each other. The hydrocarbon is the electron donor and the solvent is the electron acceptor.

Thus while mixed plumes can be harder to remediate, consider the potential for one plume to be holding the other at bay, and thus the order of remedial activities should be adjusted to take fullest advantage of this process.

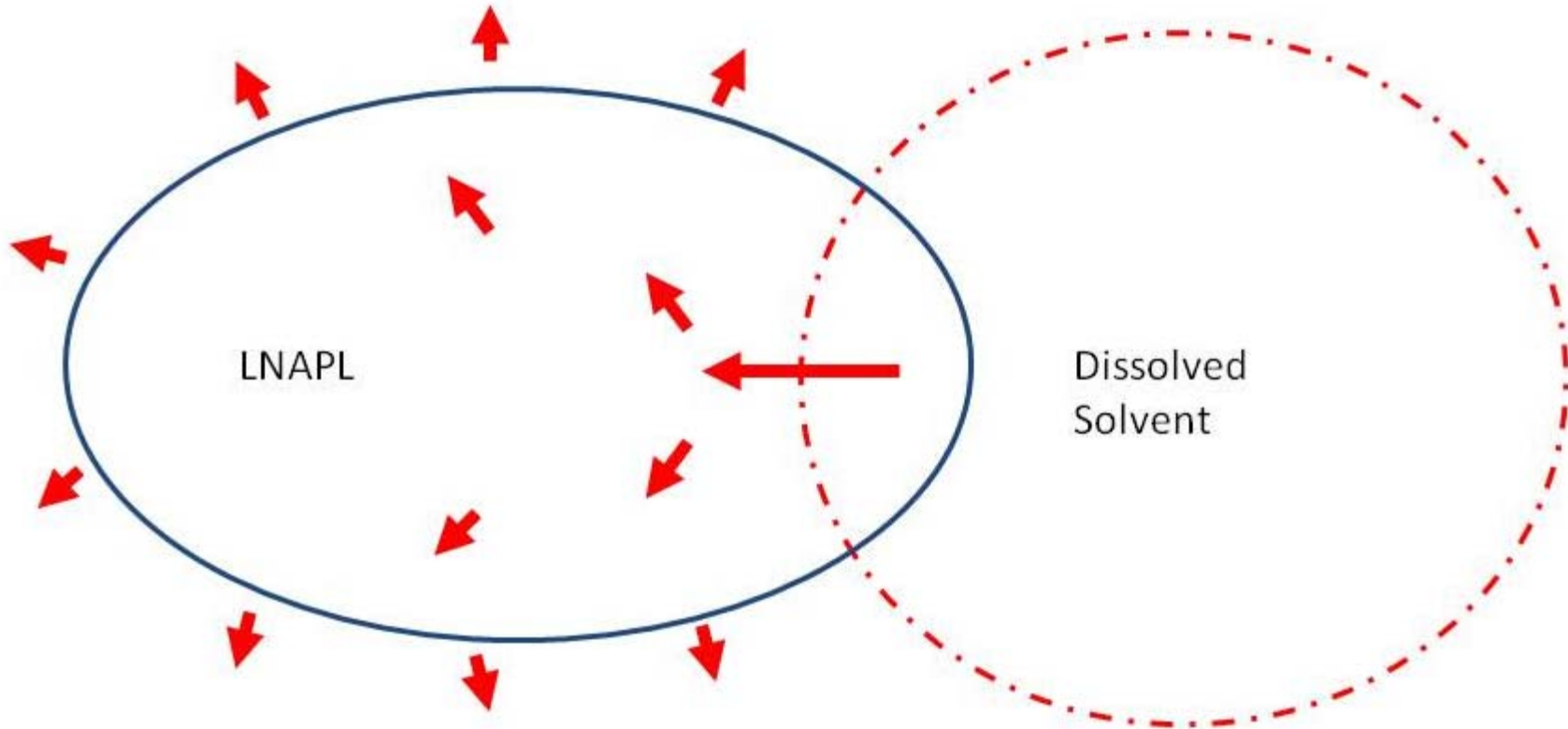
When concentrations are very high (LNAPL/DNAPL) natural attenuation processes are defeated by the toxicity of the chemicals.

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Interaction with Hydrocarbons

Negative

- While chlorinated solvents do not dissolve well in groundwater, they are more soluble in hydrocarbons.
- Thus the chlorinated solvent can use the LNAPL to spread.





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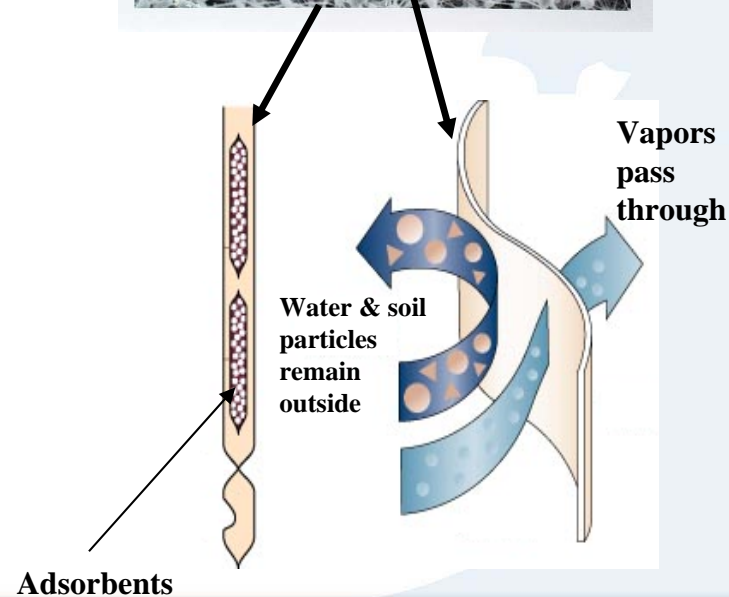
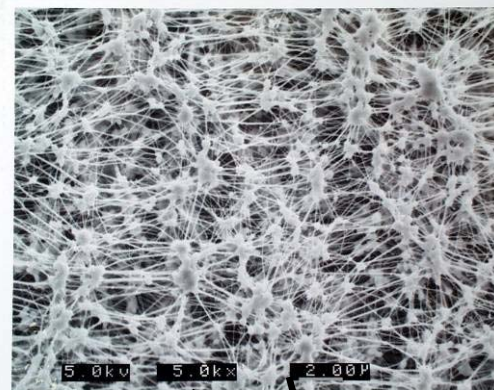
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Passive Vapour Samplers



ePTFE® Membrane



Example of Output

