

1.1 Aerobic Biodegradation

Organic compounds metabolized by oxygen using organisms.
Applicable to compounds such as: TCE \rightarrow Vinyl chloride

Field Processes

- Wellhead or infiltration gallery injection (nutrient + air)
- Similar to pump-and-treat methods
- Pulsed (cyclic) injection of amendments \rightarrow prevent biofouling @ inj well
- Biostimulation may change aqueous chemistry, viscosity, and flow paths of media.

Sparged O_2

- Oxygen supplied to (usually) anaerobic subsurface
 - in water usual saturation ($O_2 \rightarrow DO = 8-12 \text{ mg/L}$) Sparger $\rightarrow 40 \text{ mg/L}$
- Nutrients (nitrate) supplied in dissolved form (high solubility).
- Delivery to contaminated zone complicated by heterogeneity

Hyd. Peroxide

Hydrogen Peroxide (H_2O_2) may be used as an oxygen supply.

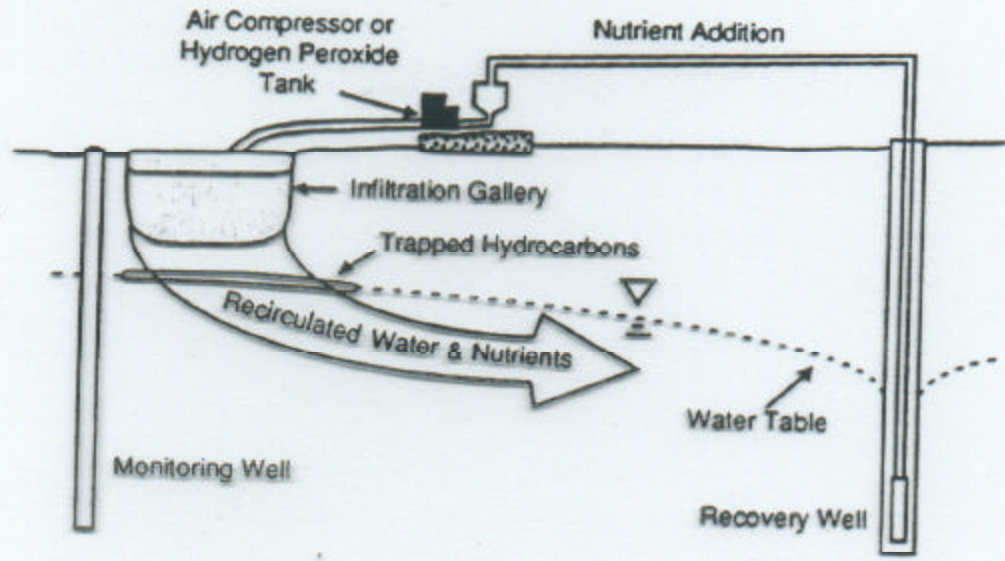
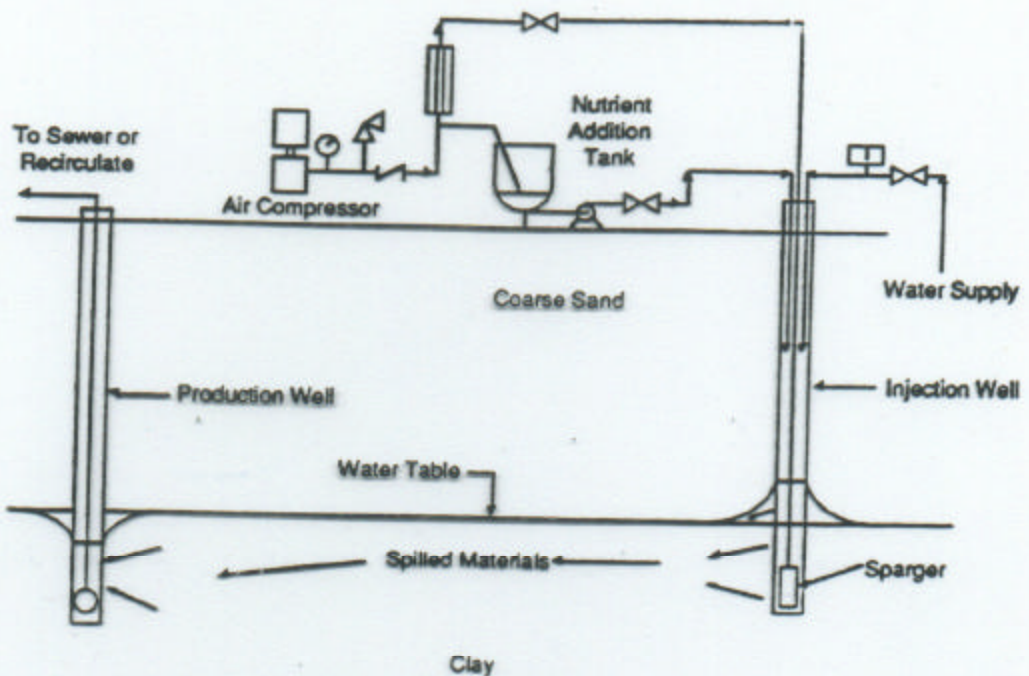
- Oxidizes some organic compounds directly.
- Increases mobility of lead and antimony

Colloidal Gas

Colloidal Gas Aphrons (CGAs) may deliver O_2 .

- essentially a foam (colloidal microdispersion of O_2)
- 65% O_2 by volume





EXAMPLES

Moffett Field Naval Air Station, Mountain View, CA

- Anaerobic, shallow, confined sand-gravel aquifer
- Bromide tracer studies → flow field
→ capture efficiency
- Nutrient stimulation of TCE degradation.

Also applied to coal tar.

Applicability/Limitations

- Free phase → toxic to microbial populations (removes)
- Lab studies continue to exhibit biodegradability of DNAPLs believed non-biodegradable
- $K > 10^{-4}$ cm/s (nutrient delivery)
- Heterogeneity → inability to deliver nutrients
- Other treatability factors: Nutrient demands; cultures; pH; redox potential; moisture conds.
- Esp. useful for petroleum hydrocarbons
10-100 years naturally ⇒ months to years

Cost and Availability

- Hardware and expertise available. Esp for petroleum hydrocarbons
- Pump and treat systems
- \$ 15-60 / yd³