Groundwater Plumes, Contaminants, and Remediation

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Control of Groundwater Plumes

- Multiple wells can be used to protect production wells

Contaminants in Groundwater

- Nonaqueous-phase liquids (NAPLs) are sparingly soluble in water
  - Dense NAPLs (DNAPLs) are more dense than water, for example, phenol has s.g. 1.24 and solubility $9.3 \times 10^4$ mg/L
  - Light NAPLs (LNAPLs) are less dense than water, for example, benzene has s.g. 0.873 and solubility $1.75 \times 10^3$ mg/L

 LNAPLs

- LNAPLs float on water

DNAPLs

- DNAPLs form pools


Remediation by Pump and Treat

- Almost impossible restore aquifer to drinking-water quality by this technique

Remediation by Soil Vapor Extraction

- Removes vapors from unsaturated zone


Remediation by Soil Vapor Extraction

- Can be used with air sparging in saturated zone

In Situ Bioremediation

• Provides nutrients and air to microorganisms


Permeable Reactive Barriers

• Most common barrier is iron (Fe\(^0\)) which can reduce halogenated organic pollutants