environmetal biotechnology

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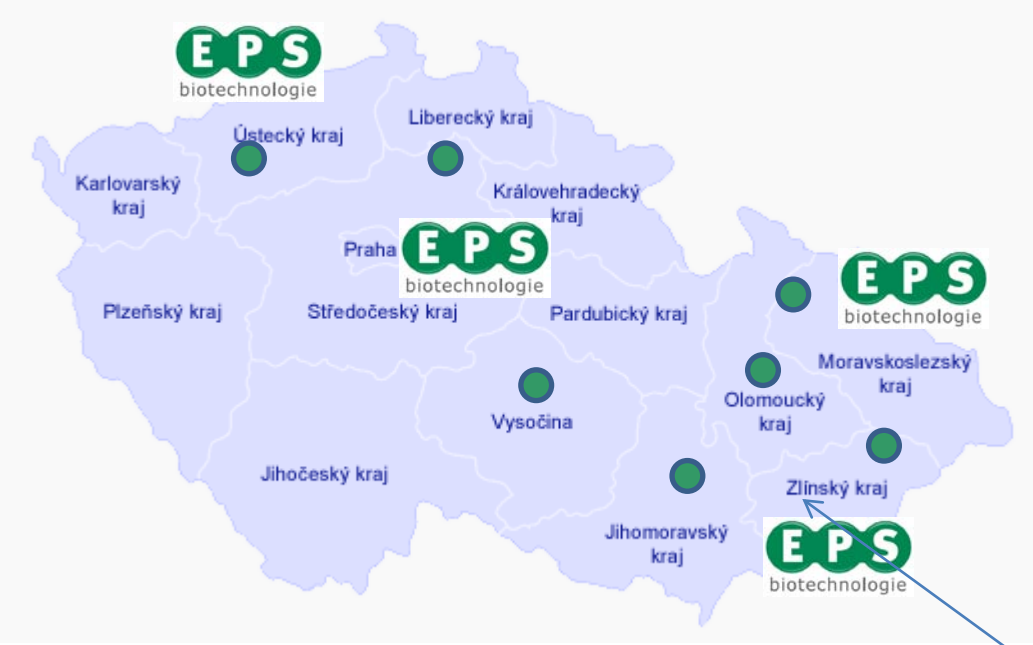
One of the founding members of CzechBio
Cooperation in the joint activities – education and presentation



ENVIRONMENTAL SERVICES
WASTE MANAGEMENT
RENEWABLE ENERGY

EPS biotechnologie

Established in 2002
City of Kunovice
SME
30 employees
Cooperation in the R&D projects with the universities
Membership in CzechBio and BIOM (renewable sources of energy)

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Site assessment and investigation

Environmental monitoring and total contaminant control

Waste management

Anaerobic digestion / renewables

EPS biotechnologie

Laboratory services and commercial testing

Cleanup option, design, and implementation

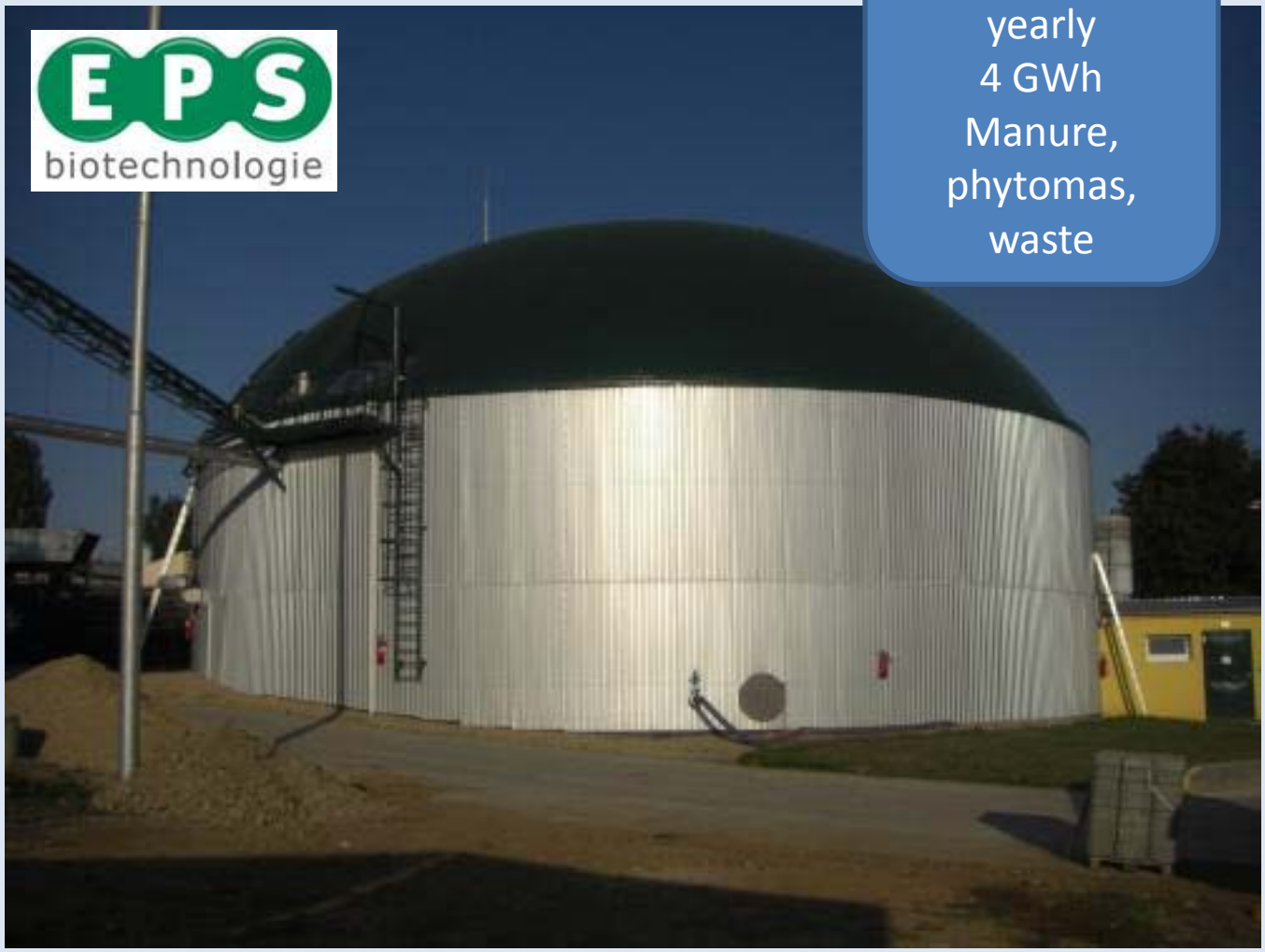
Develop and carry out detailed cleanup plans for the site

R&D


Hydrocarbons
EPS-INOK
Chlorinated
hydrocarbons
EPS-CLU
Oils
EPS kvasinka
Endocrine
disruptors
EPS-Ft
EPS
biotechnologie

BIOGAS PLANT Nový Dvůr

- substrate
- hydrolysis
- acidogenesis
- acetogenesis
- methanogenesis
- biogas
- power generation
- heat generation



1970 m3
644 kW
712 kW
2 500 000 m3
yearly
4 GWh
Manure,
phytomas,
waste

Project bioaugmentation agents

Project biological detergents from unique yeast strains

Project stimulation of biogeochemical processes – bioremediative composting

Project biological desulfurization of the biogas

EPS biotechnologie

Project lithotrophic denitrification

Project mobile bioremediative unit

Cleanup treatment train

Technical assessment of bioavailbaility and bioaccessebility

"use of living organisms (e.g., bacteria) to clean up oil spills or remove other pollutants from soil, water, and wastewater.“
Source: United States Environmental Protection Agency, Office of Compliance and Assurance

“clean-up of pollution from soil, groundwater, surface water and air, using biological, usually microbiological processes”
Source: Philp et al., 2001

Bioremediation relies largely on the enzymatic activities of living organisms, usually microbes, to catalyze the destruction of pollutants or their transformation to less harmful forms.

Why are microorganisms so important in this process?

They have extraordinary metabolic diversity!

A complex process depending on many factors including:

ambient environmental conditions

composition of the microbial community

nature and amount of pollution present

pH

temperature

lack of nutrients &
molecular oxygen

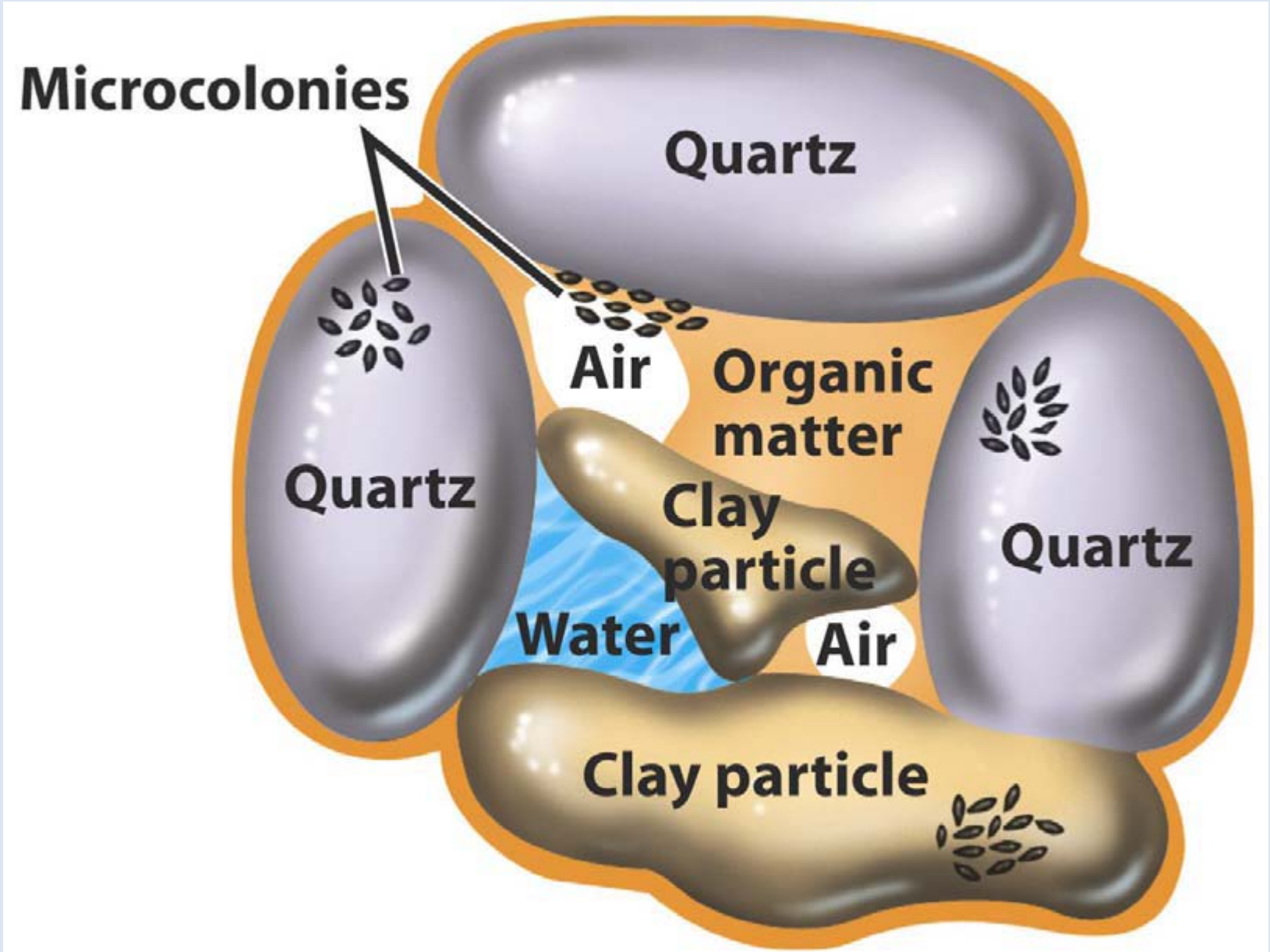
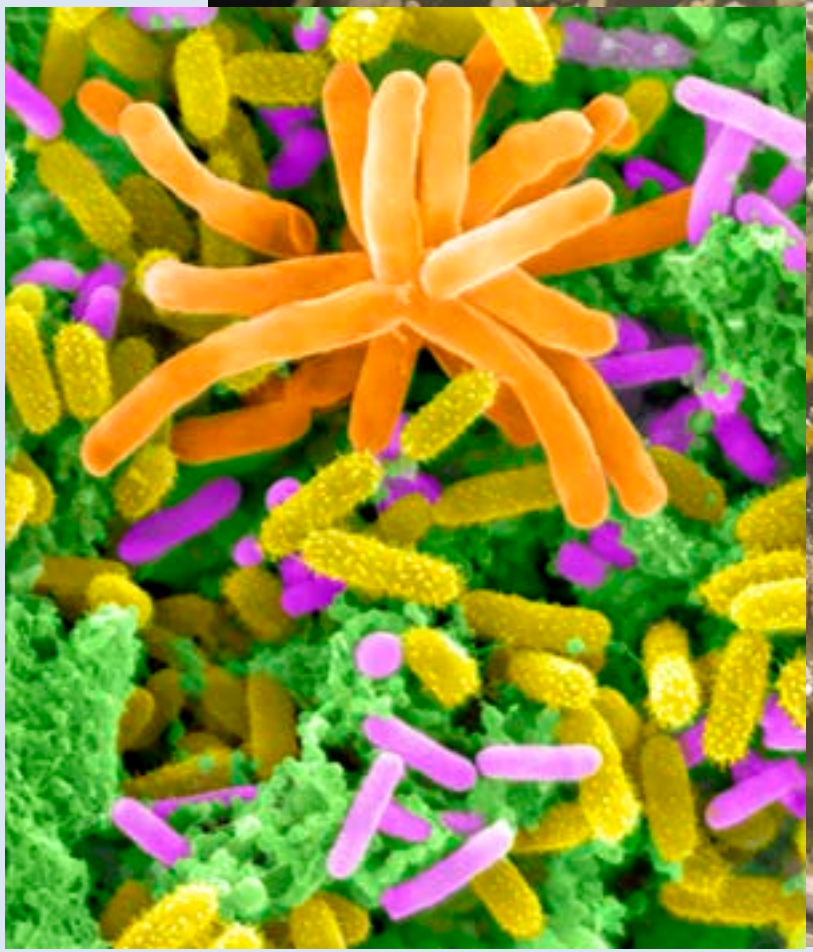
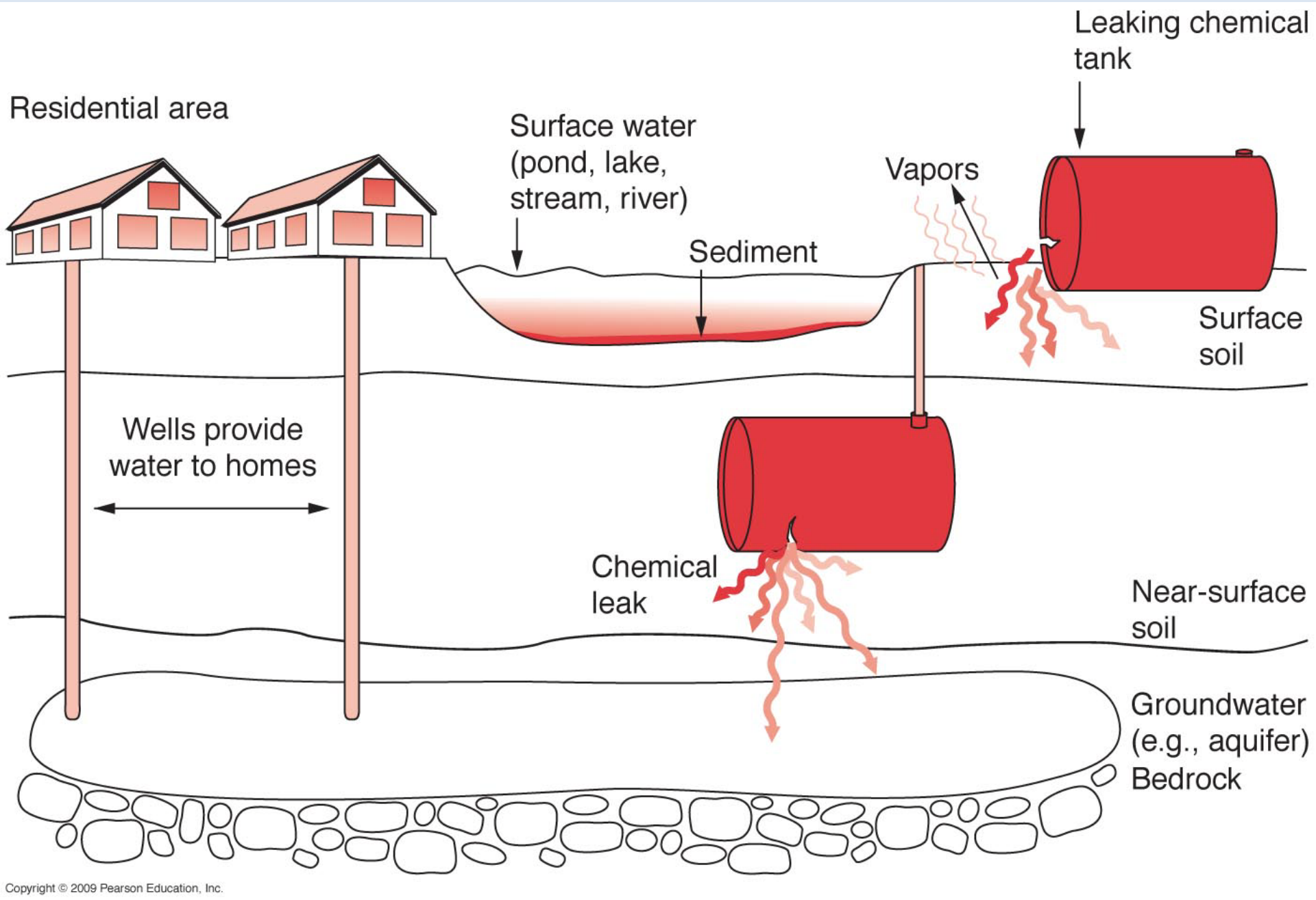
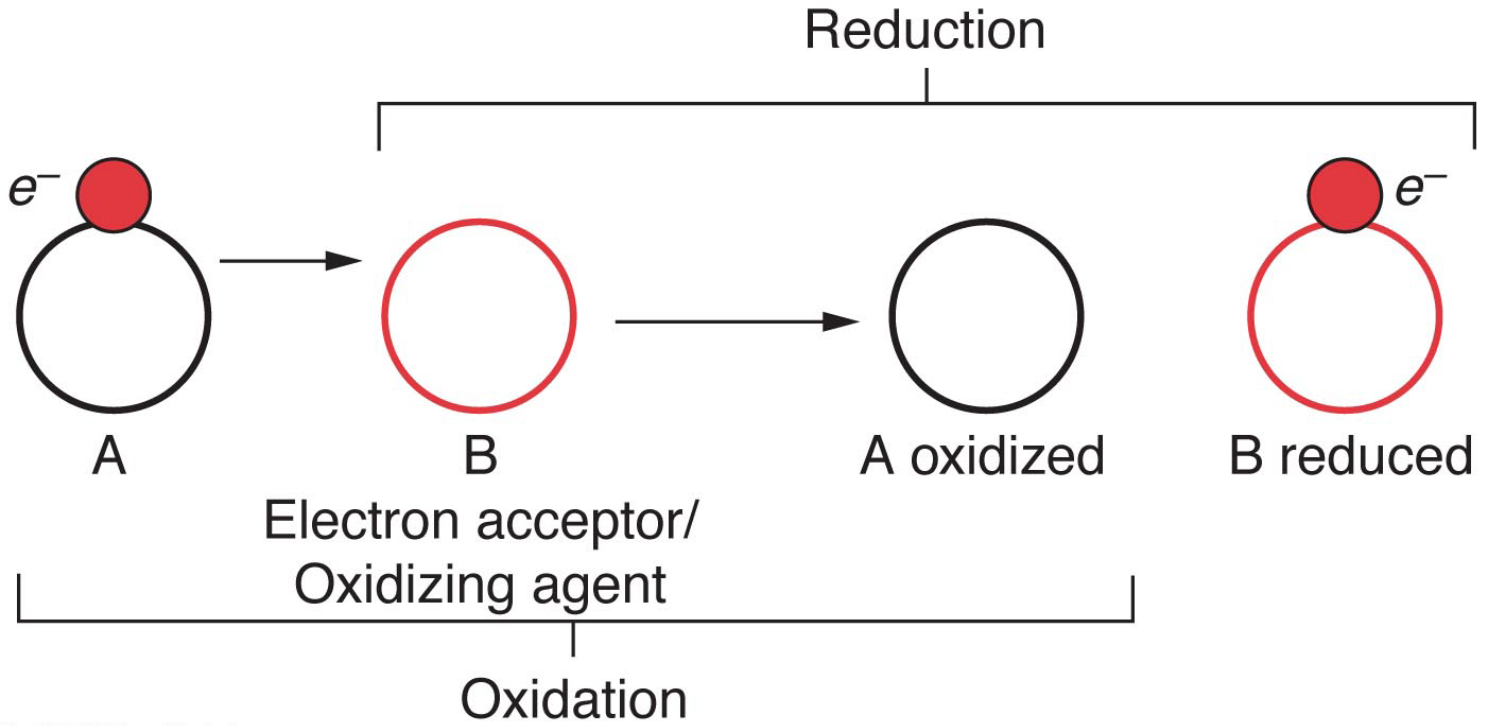


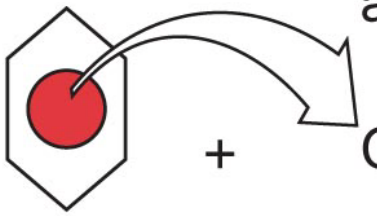
Figure 19-7 Brock Biology of Microorganisms 11/e







Aerobic biodegradation

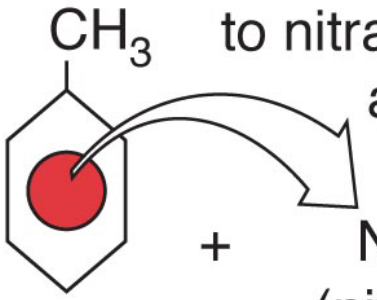


Electrons transferred to oxygen as electron acceptor

+ O_2 → $CO_2 + H_2O$ + Biomass (increased number of bacteria)

Organic chemical (e.g., benzene)

Anaerobic biodegradation

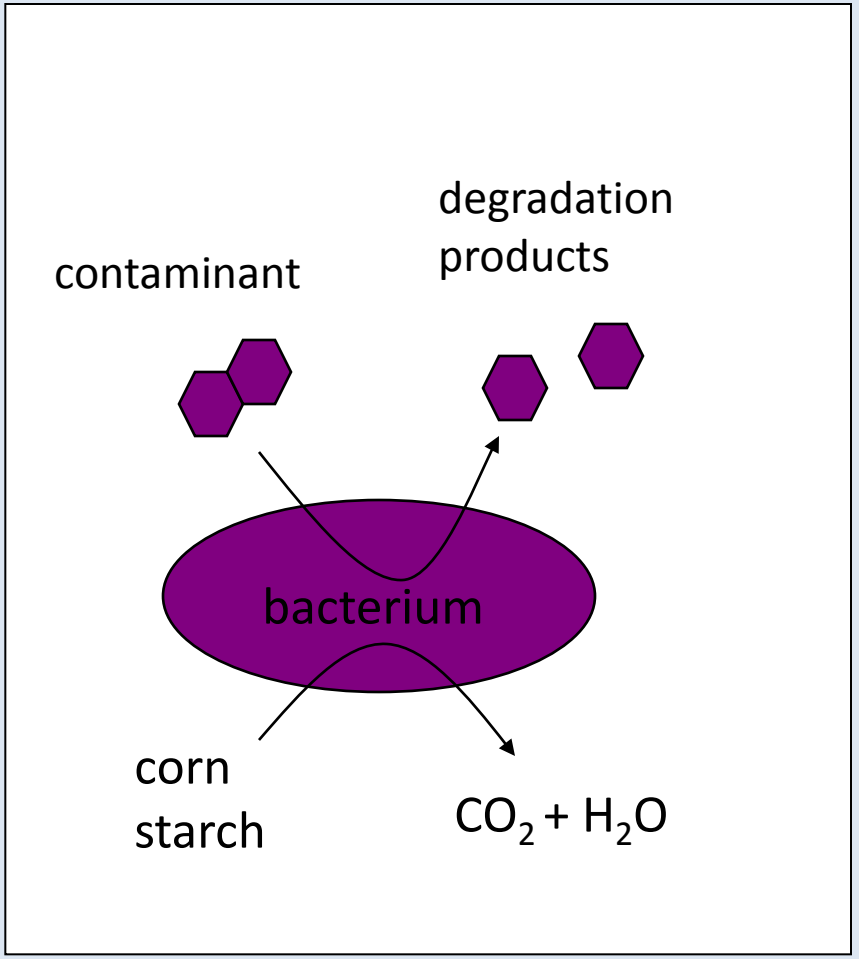


Electrons transferred to nitrate as electron acceptor

+ NO_3^- (nitrate) → $CO_2 + N_2 + H_2O$ + Biomass

Organic chemical (e.g., toluene)

Bacteria use some other carbon and energy source to partially degrade contaminant (organic aromatic ring compound)



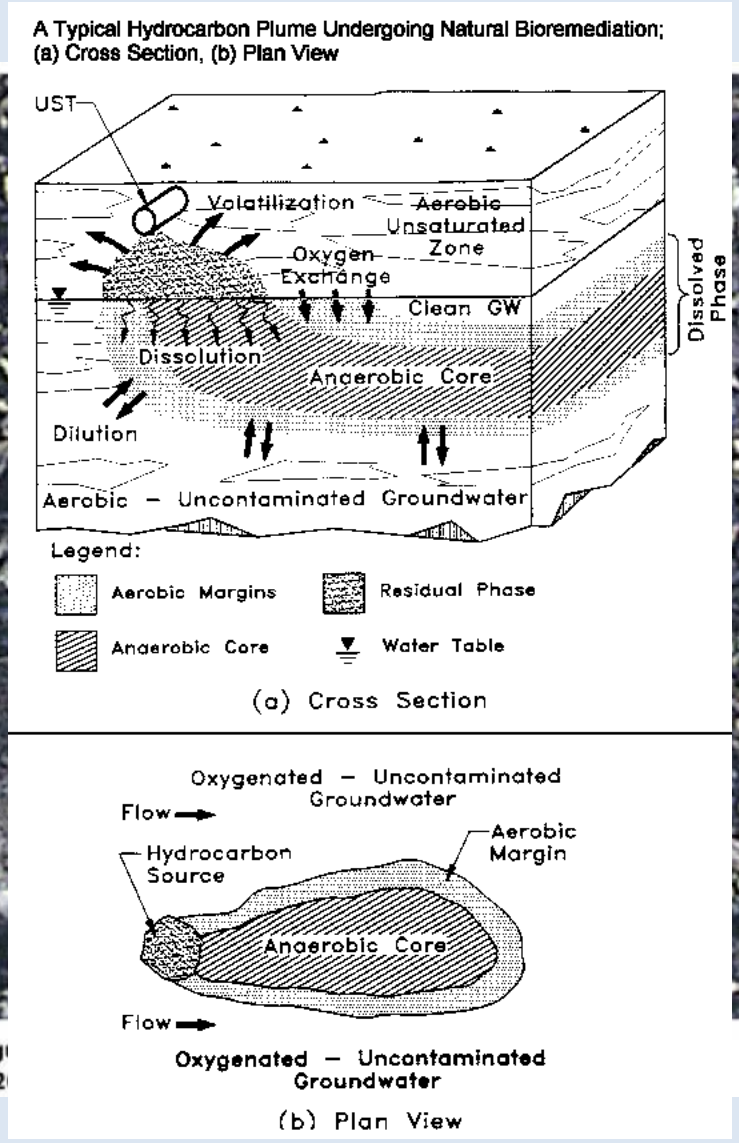
What types of treatment technologies are in use to remove contaminants from the environment?

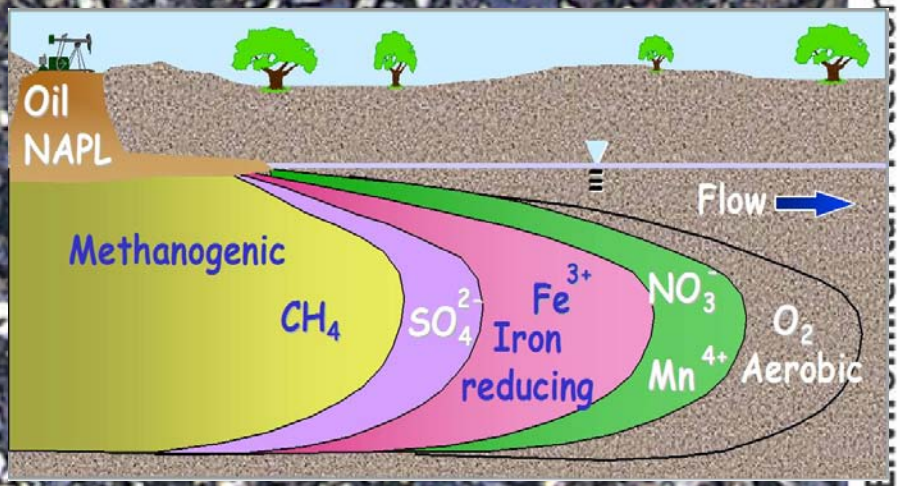
- Soil vapor extraction
- air sparging
- bioremediation
- thermal desorption
- soil washing
- chemical dehalogenation
- soil extraction
- *in situ* soil flushing

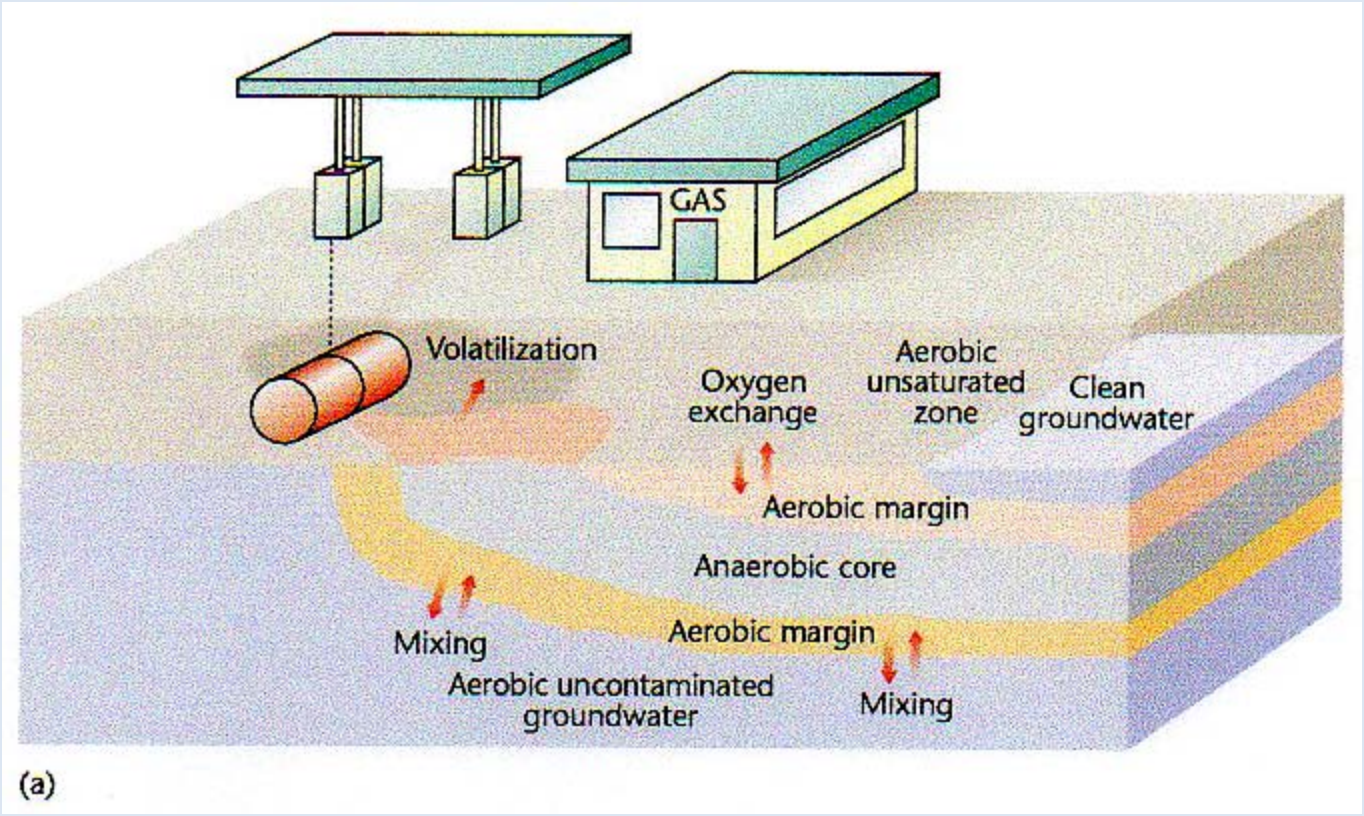
Economics of *in-situ* vs. *ex-situ* remediation of contaminated soils

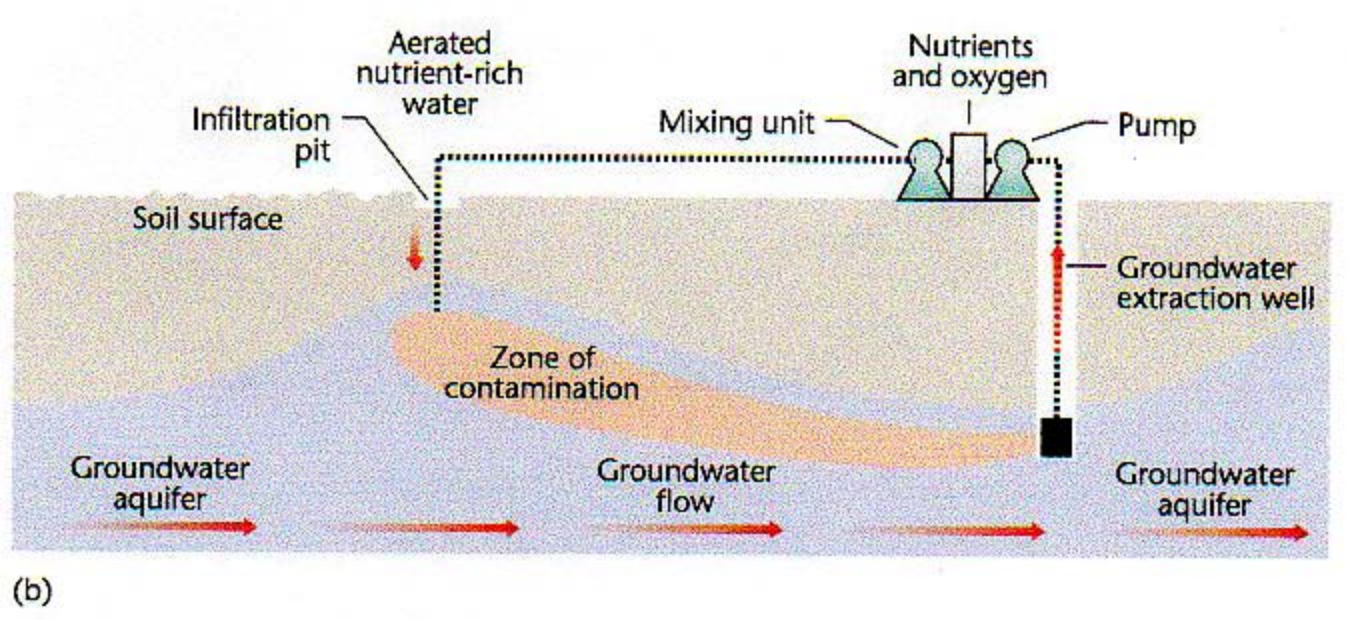
- Cost of treating contaminated soil in place $80-$100 per ton
- Cost of excavating and trucking contaminated soil off for incineration is $400 per ton.
- Over 90% of the chemical substances classified as hazardous today can be biodegraded.

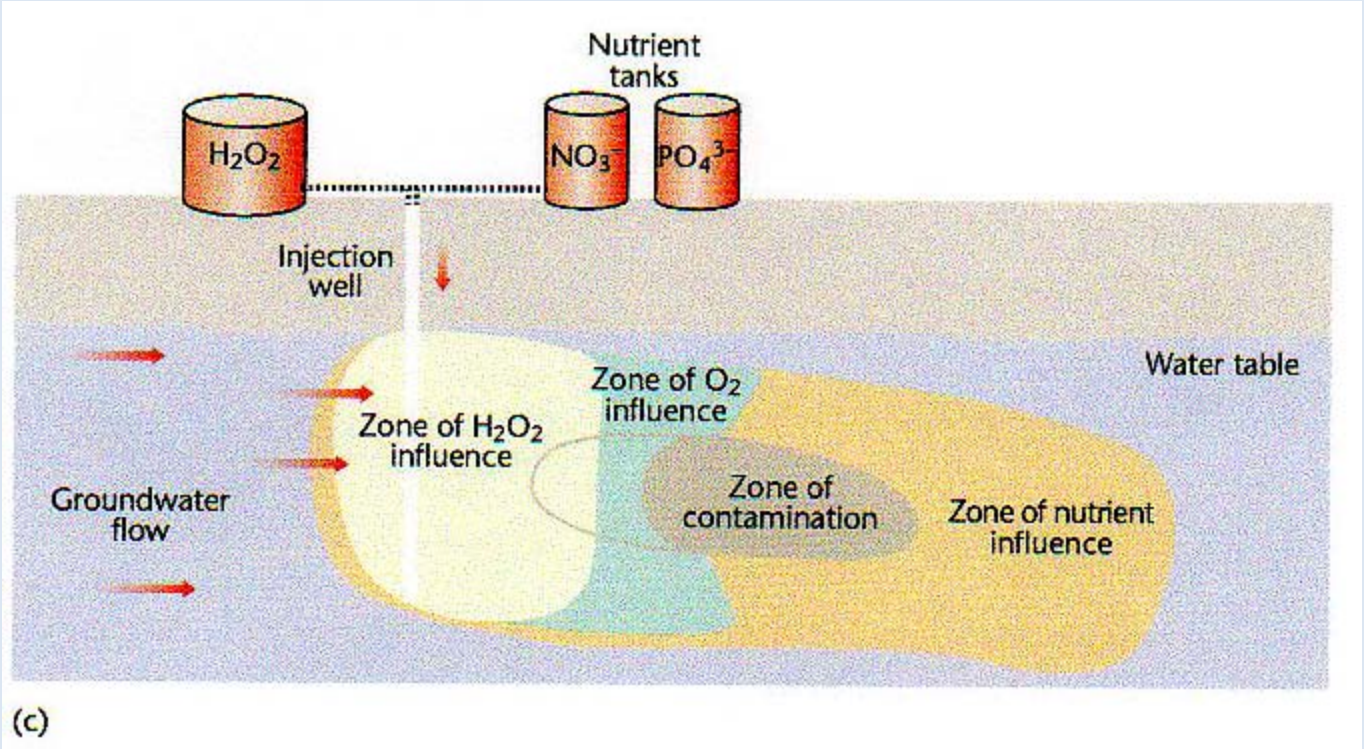
Natural Attenuation






GAS
Volatilization
Oxygen exchange
Aerobic unsaturated zone
Clean groundwater
Aerobic margin
Anaerobic core
Aerobic margin
Mixing
Aerobic uncontaminated groundwater
Mixing
(a)


Aerated
nutrient-rich
water
Infiltration
pit
Nutrients
and oxygen
Mixing unit
Pump
Soil surface
Groundwater
extraction well
Zone of
contamination
Groundwater
aquifer
Groundwater
flow
Groundwater
aquifer
(b)


Nutrient tanks
H_2O_2
NO_3^-
PO_4^{3-}
Injection well
Water table
Zone of O_2 influence
Zone of H_2O_2 influence
Groundwater flow
Zone of contamination
Zone of nutrient influence

(c)

Bioremediation Research

Bioaugmentation vs. biostimulation:

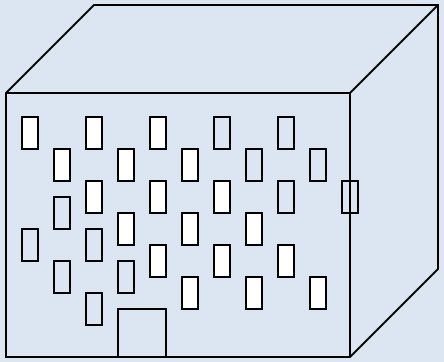
Biostimulation involves the modification of the environment to stimulate existing microorganisms capable of bioremediation.

Indigenous populations may not be capable of degrading the xenobiotics or the wide range of potential substrates present in complex pollutant mixtures.

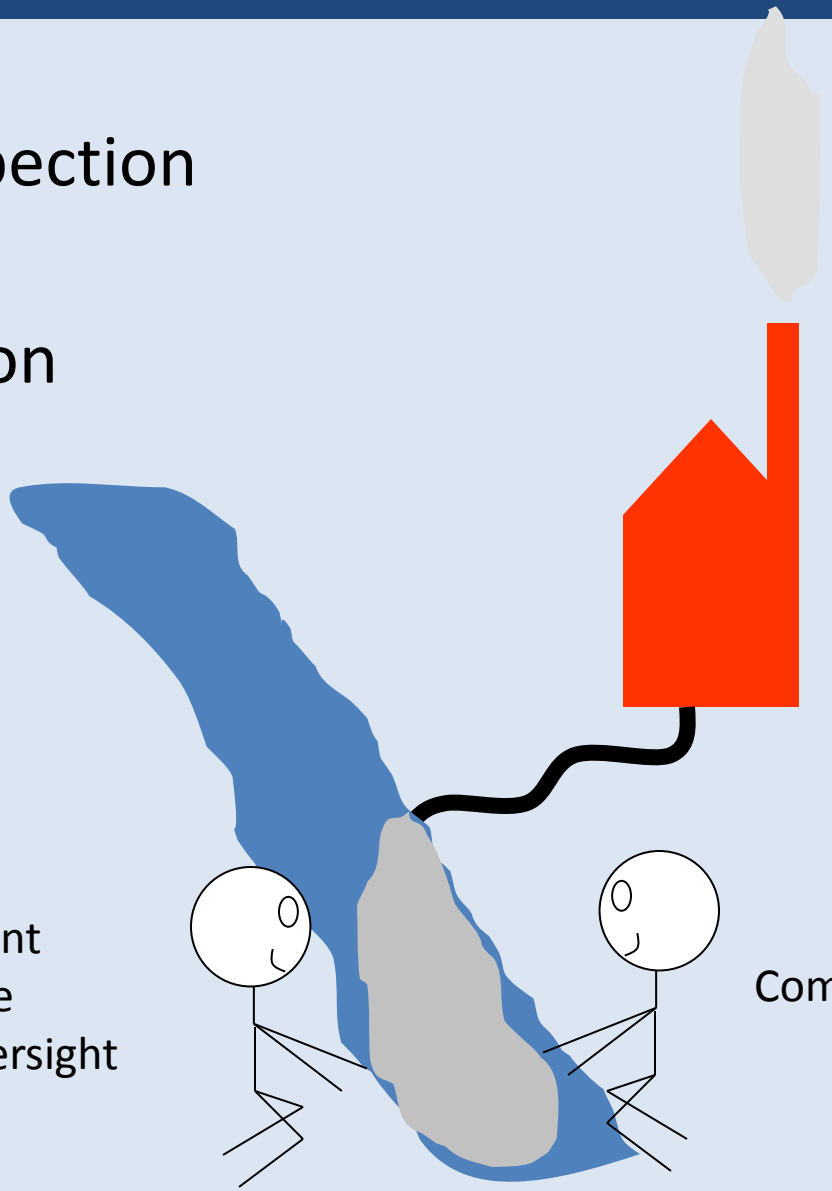
Bioaugmentation is the introduction of a group of natural microbial strains or a genetically engineered variant to treat contaminated soil or water.

Careers in Bioremediation

- Outdoor inspection
- Lab testing
- Administration



Government
Employee
Regulatory oversight



Company employee