

REMEDIATION OVERVIEW

Presented by:

Tina A. Reese, PG
Principal
Avantti Environmental Group

REMEDIATION is a response to released contaminants that pose a risk to human health and/or the environment



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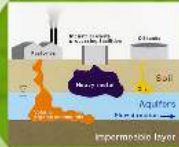
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REMEDIATION is a
response to released
contaminants that
pose a risk to human
health and/or the
environment



Air Contamination



Groundwater Contamination



Asbestos
Fiber
Air
Water
Soil
Food
Clothing
Dust
Inhalation

Remediation is used to address



Soil Contamination



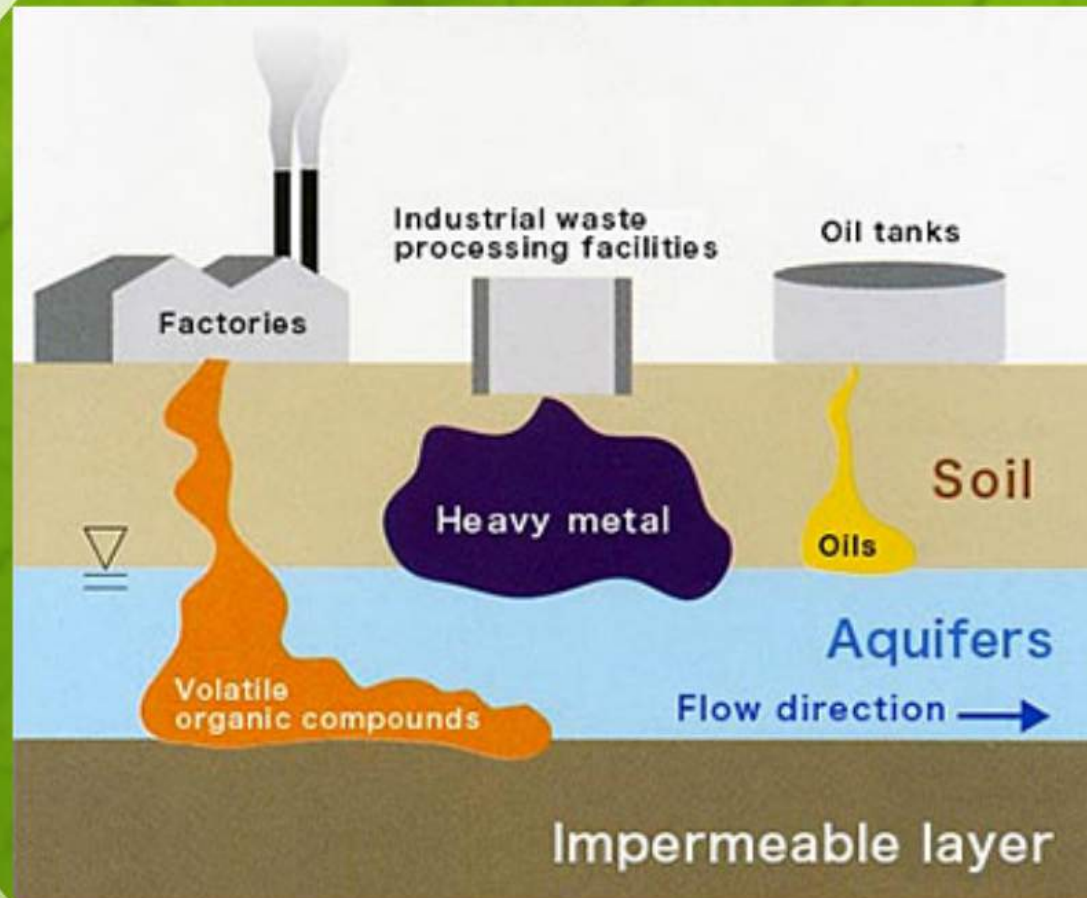
Sediment Contamination



Surface Water Contamination



Soil Contamination



Groundwater
Contamination

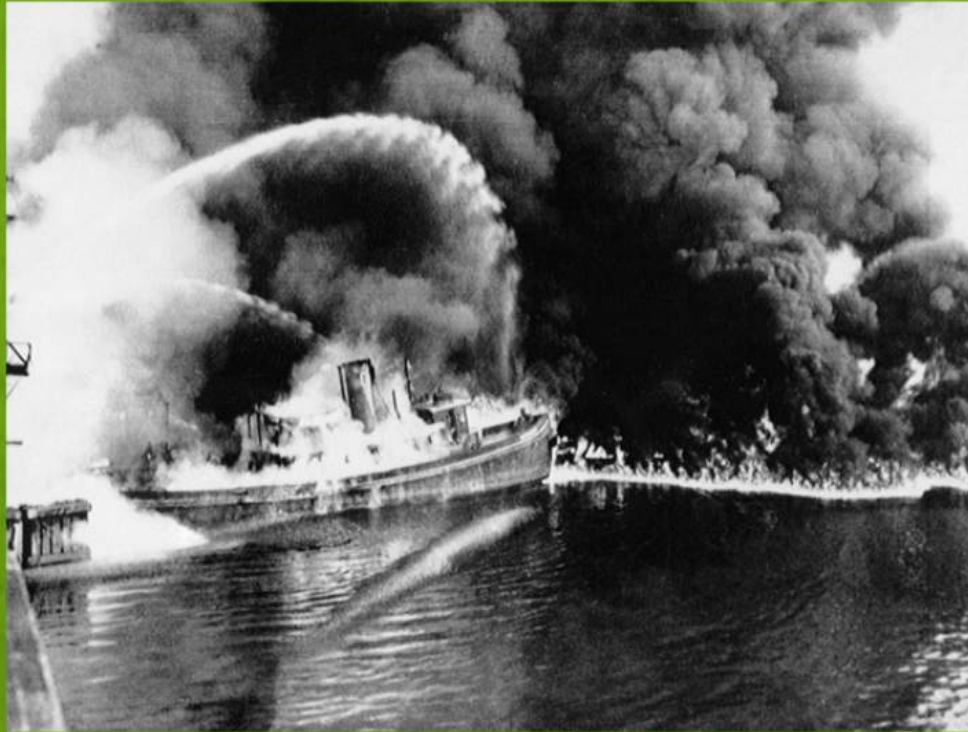


Air Contamination



Hazardous Building Materials

- Asbestos Containing Materials
- Lead-bearing Materials
- Mold
- Mercury Switches
- Flammable Liquids
- Etc.



Surface Water
Contamination



Sediment Contamination

Remediation is


- Active or Passive
- Complex or Simple
- Fast or Slow
- Broad or Focused



Time Consuming and Expensive



Multi-disciplinary Endeavor

- 
- A green leaf with a white circular outline containing a bulleted list.
- Active or Passive
 - Complex or Simple
 - Fast or Slow
 - Broad or Focused



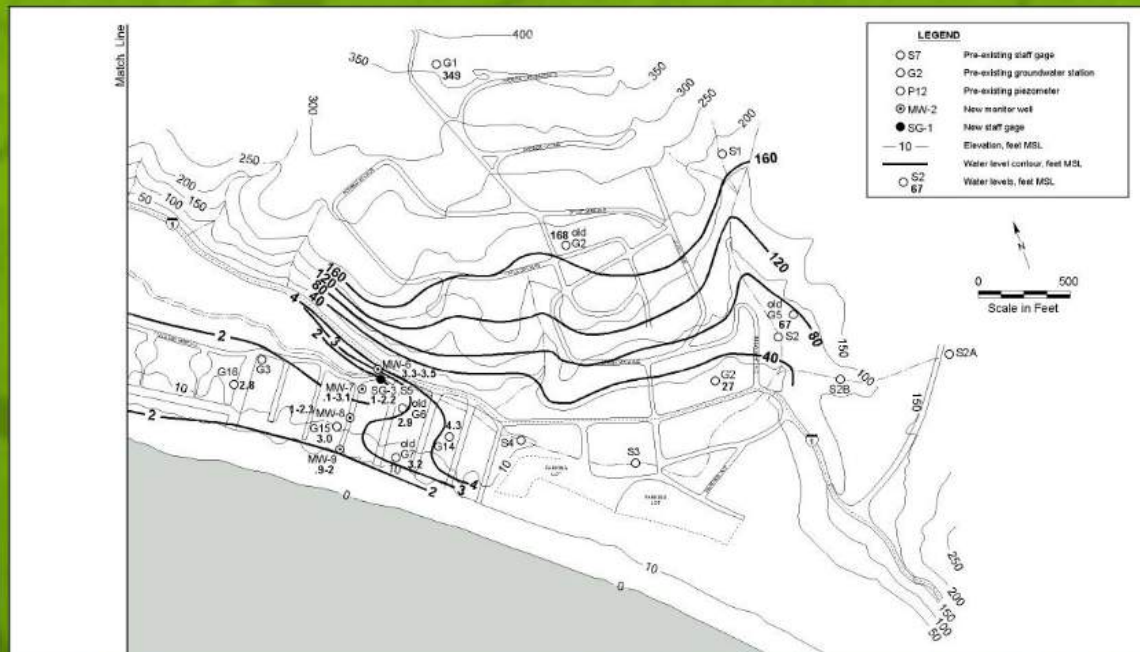
Time Consuming and Expensive



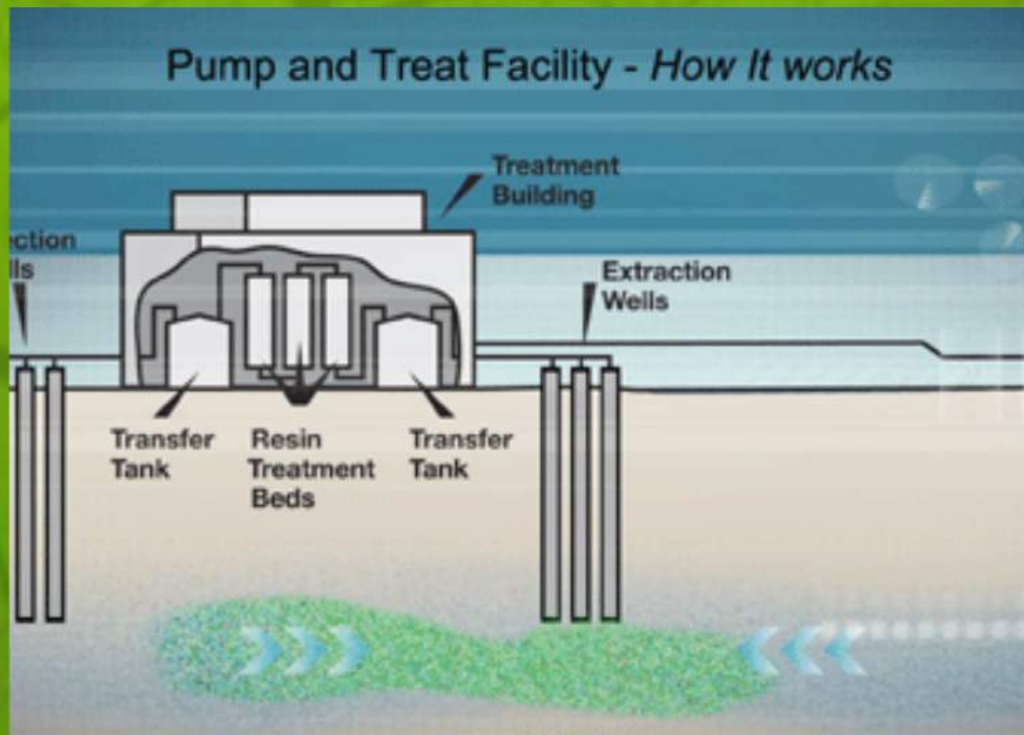
Community Outreach



Geology

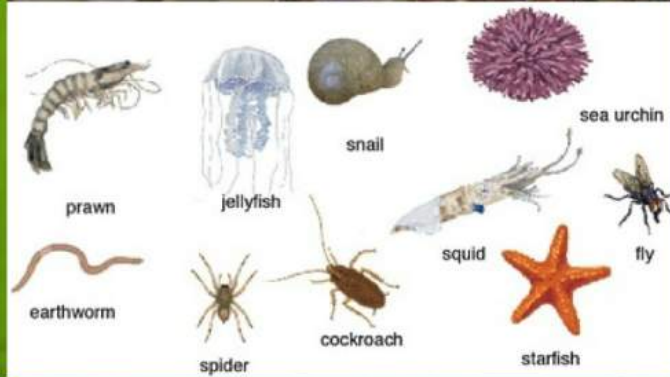


Hydrogeology



Engineering





Biology



Regulatory Specialists

WHY DO IT?



Meet State and
Federal Rules and
Regulations

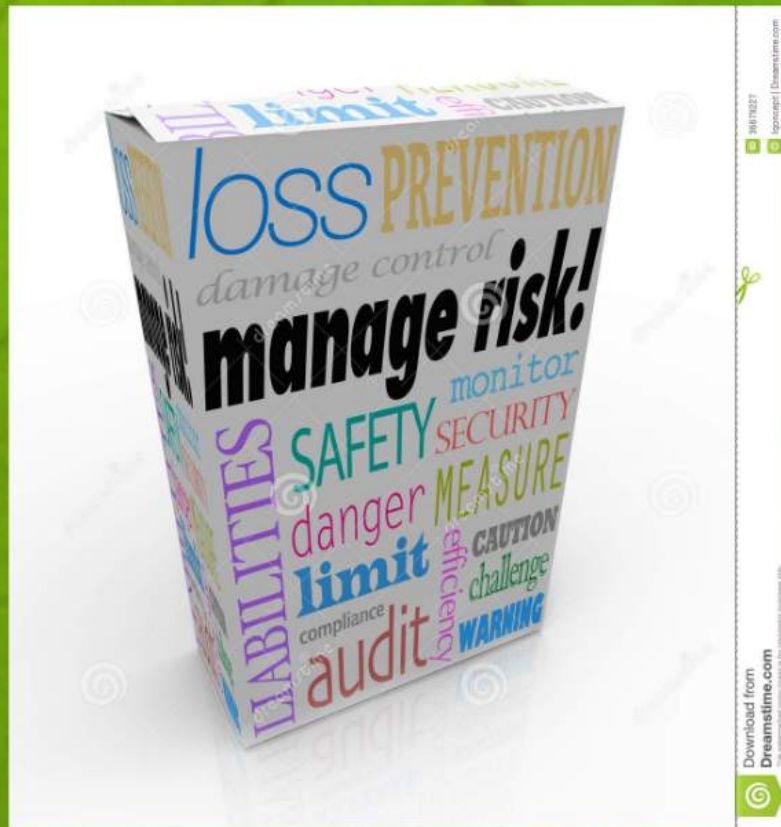


Manage Risk and Control Costs





Meet State and
Federal Rules and
Regulations



Manage Risk and Control Costs

protect environment



REGULATORY FRAMEWORK



- Regulated DTE - Impairments
- National Discharge to Surface Waters
- National Pollutant Discharge Elimination System (NPDES)

- Applicability to Remediation Projects
- Effluent Limits - CDD, etc.
- Remediation Discharge Permits



Safe Drinking Water Act (SDWA)

- Public Water Systems
- National Primary Drinking Water Standards
- Secondary Maximum Contaminant Levels

- Applicability to Remediation Projects
- CTR used for drinking

Toxic Substances Control Act



- PCBs/PCB-like substances
- Persistent, Bioaccumulative, and Toxic (PBT) substances
- Priority Chemical Substances
- PCBs
- PCBs

- Applicability to Remediation Projects
- PCBs and PCB-like substances
- PCBs and PCB-like substances



RCRA

- PCBs - Impairments
- PCBs - PCBs and PCB-like substances
- PCBs - PCBs and PCB-like substances
- PCBs - PCBs and PCB-like substances
- PCBs - PCBs and PCB-like substances

- Applicability to Remediation Projects
- PCBs and PCB-like substances
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CERCLA

- PCBs - Impairments
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- Applicability to Remediation Projects
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HWIS

- PCBs - Impairments
- PCBs - PCBs and PCB-like substances
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- Applicability to Remediation Projects
- PCBs and PCB-like substances
- PCBs and PCB-like substances

STATE LAWS

NR 700 Rules Series

- NR 701 - Site Investigations
- NR 702 - Soil Cleanup Standards
- NR 703 - Remedial Action Design, Implementation, & O&M
- NR 704 - Cost Cap
- NR 705 - Cleanup Obligations

- Focus is on Controlling/Managing the Site
- Remedial Action Design, Implementation, & O&M
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- Remedial Action Design, Implementation, & O&M



- Promulgated in 1972 + Amendments
- Regulates Discharges to Waters of the US
- National Pollutant Discharge Elimination System (NPDES)

Applicability to Remediation Projects

- GW discharges - LUSTs, etc.
- Remediation Discharge Permits



Safe Drinking Water Act (SDWA)

- 1974 + Amendments
- Public Drinking Water
- National Primary Drinking Water Regulations
 - Maximum Contaminant Levels (MCLs)

Applicability to Remediation Projects:

- GW used for drinking

Toxic Substances Control Act



- 1976 + Amendments
- Provides USEPA with authority to require:
 - Reporting
 - Record-keeping, and
 - Testing Requirements and Restrictions relating to Chemical Substances
 - PCBs,
 - Asbestos
 - Etc.

Applicability to Remediation Projects:

- Regulates toxic substances
- Risk-based sampling, remediation and decontamination

R C R A



- 1976 + Amendments
- Gives EPA the authority to regulation HW from Cradle to Grave
 - Generation
 - Transportation
 - Treatment
 - Storage
 - Disposal
- Provides a Framework for managing Non-Haz Solid Waste

Applicability to Remediation Projects:

- Investigation and Remediation Framework
- Regulates
 - Management and Disposal of HW - IDW.
 - How you conduct Site Activities



Comprehensive Environmental Responses, Compensation, and Liability Act (CERCLA)

- 1980
- "Superfund"
- Establishes EPA authority to cleanup abandoned hazardous waste sites.
- Defines liability for Cleanup Actions
 - Owner is responsible
 - Innocent landowner protection

Applicability to Remediation Projects

- Provides a framework to investigate and remediate "Superfund" sites
- Establishes Liability and Cost Allocations

2 Laws Cover Hazardous Waste Clean-up & Disposal

CERCLA--Superfund*

- CERCLA is NOT a regulatory statute; it is a cleanup & liability law.
- It cleans up abandoned or “orphaned” toxic sites by imposing strict clean-up liability on those parties responsible for creating them.

* CERCLA (*Comprehensive Environmental Response, Compensation, & Liability Act, 1980*)

RCRA (Resource Conservation & Recovery Act, 1976)

- RCRA is a regulatory law.
- It gives EPA “*cradle-to-grave*” oversight over the generation, transport, treatment & disposal of hazardous waste.



STATE LAWS

NR 700 Rules Series

NR 716 - Site Investigations

NR 720 - Soil Cleanup Standards

NR 724 - Remedial & Interim Action Design, Implementation, & OM&M

NR 726 - Case Closure

NR 727 - Continuing Obligations

- **Focus is on Controlling/Managing Risk**
 - Site-specific risk assessment
 - Site-specific cleanup goals
 - Continuing obligations

REMEDIATION RESPONSE PROCESS

Discovery / Emergency Response / Notification



Spill Reporting



ESTABLISHING REMEDIAL PRIORITIES/OBJECTIVES & NEGOTIATING SITE CLOSURE

- What regulations apply
- What is owners risk tolerance
- What is the long-term plan for the property
- What are the financial considerations



Expensive, Technically Challenging, Long-Term



Keep your eye on the End Game

IMMEDIATE ACTION

- Control Imminent Health Risk or Release Threat
- Stabilize or Minimize the Spread of Contaminants

- Secure the Site
- Control the Release of Contaminants
- Minimize Exposure
- Properly Dispose of the Waste



Site Investigation

Investigating the Nature and Extent of Contamination & Assessing Risk



Discovery / Emergency Response / Notification



Spill Reporting



IMMEDIATE ACTION

- **Control Imminent Health Risk or Release Threat**
- **Stabilize or Minimize the Spread of Contaminants**

- **Secure the structure**
- **Control the Release of Contaminants from the Source**
- **Properly dispose of the Waste**



ESTABLISHING REMEDIAL PRIORITIES/OBJECTIVES & NEGOTIATING SITE CLOSURE

- What regulations apply
- What is owners risk tolerance
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**Expensive, Technically Challenging,
Long-Term**



**Keep your eye on
the End Game**



Site Investigation

Investigating the Nature and Extent of Contamination & Assessing Risk





Site Investigation



Response to Released Contaminants that Pose a Risk to Human Health and/or the Environment

Removal of Waste or Toxic Components



Destruction or Transformation

- Reduces toxicity by changing contaminant nature or state
- Reduces volume of contaminants or contaminated media



Isolation

- Reduces contaminant mobility
- Results in receptor access, locational or mitigate exposure pathways



Removal of Waste or Toxic Components











Pug Mill - Mechanical Mixing

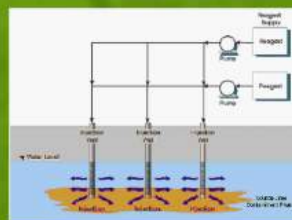


Wetlands

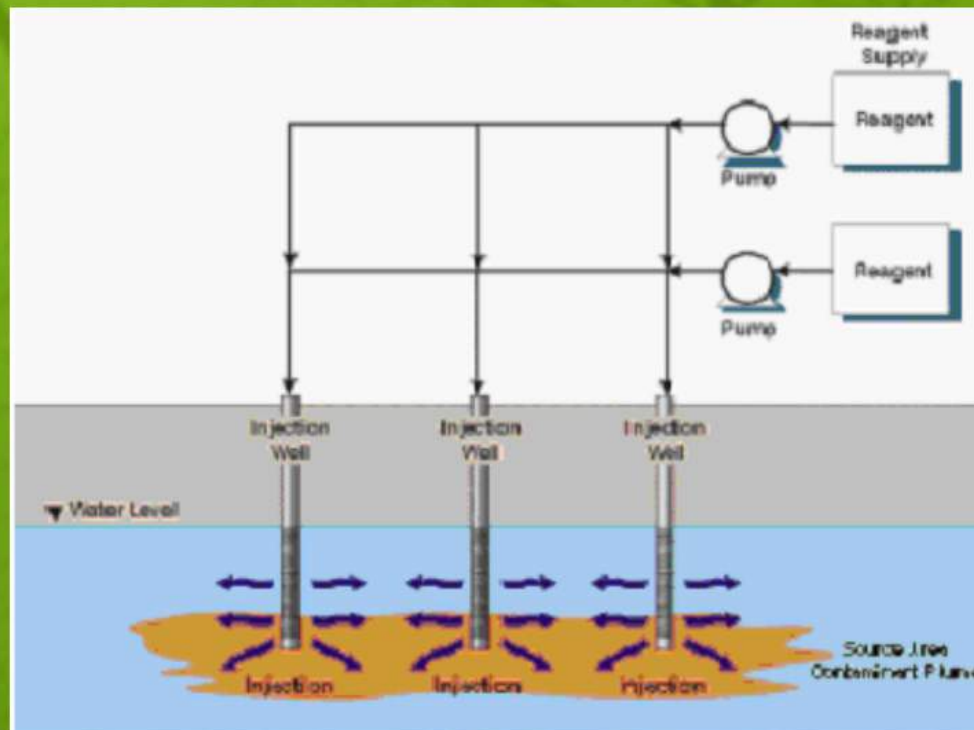
Metals Speciation Transformation

Destruction or Transformation

- Reduces toxicity by changing contaminant nature or state
- Reduces volume of contaminants or contaminated media



Insitu Chemical Oxidation



Insitu Chemical Oxidation



Wetlands

Metals Speciation Transformation

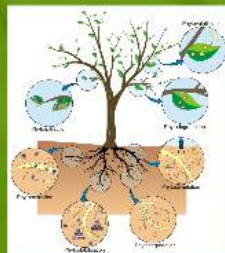


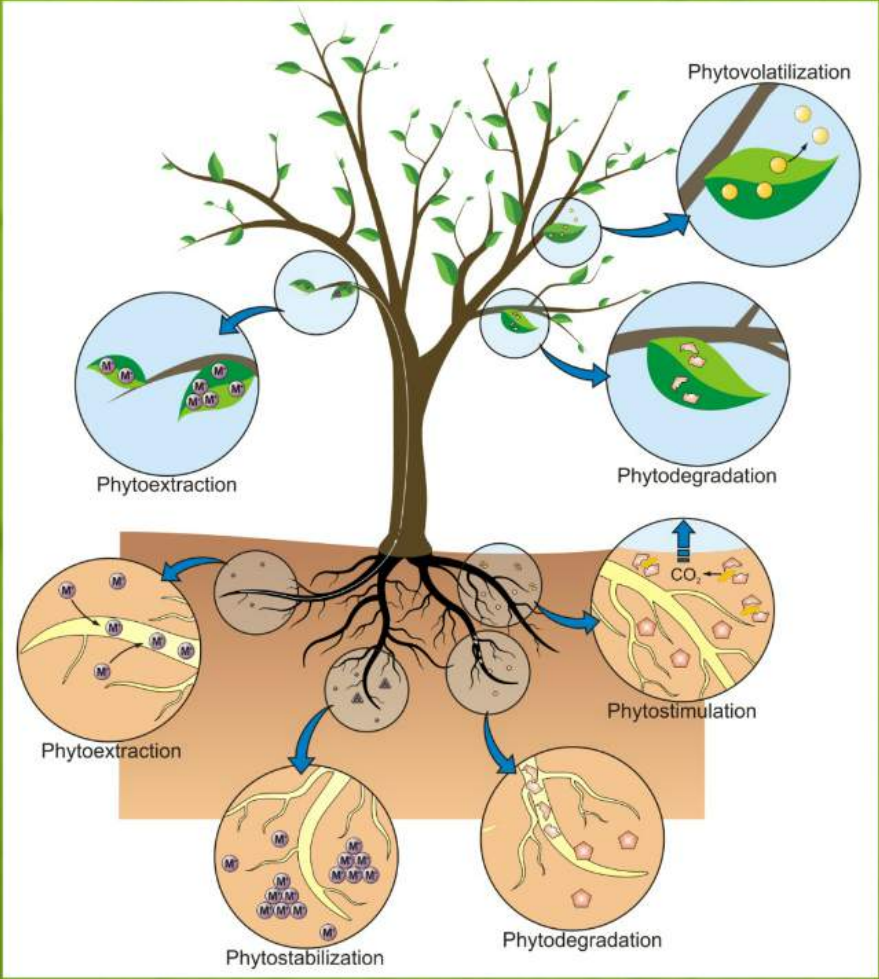
Pug Mill - Mechanical Mixing



Isolation

- Reduces contaminant mobility
- Restricts receptor access to control or mitigate exposure pathways



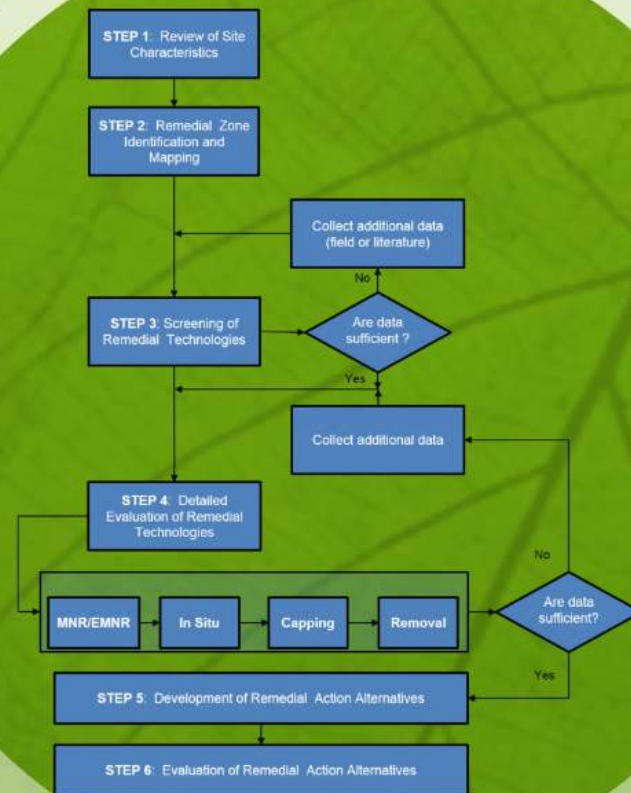


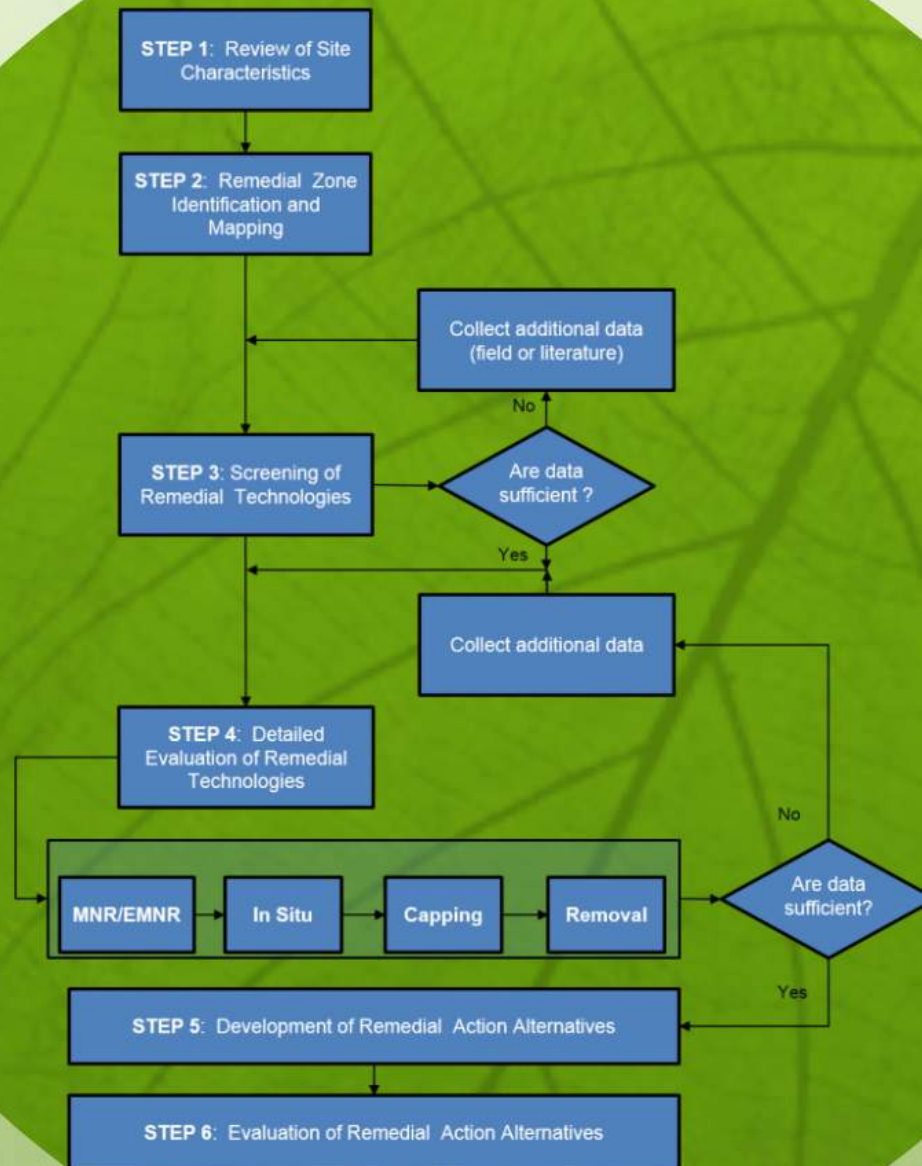






Evaluating & Selecting Remedial Alternatives

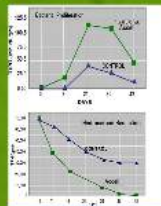






Implementability

Designing and Implementing the Remedy



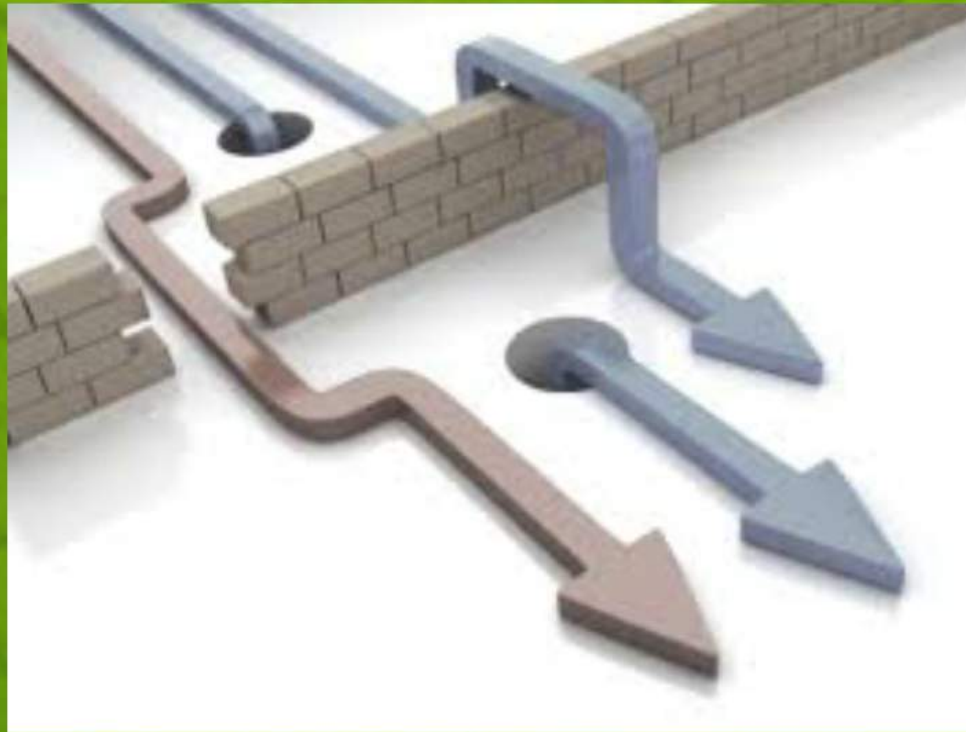
Effectiveness



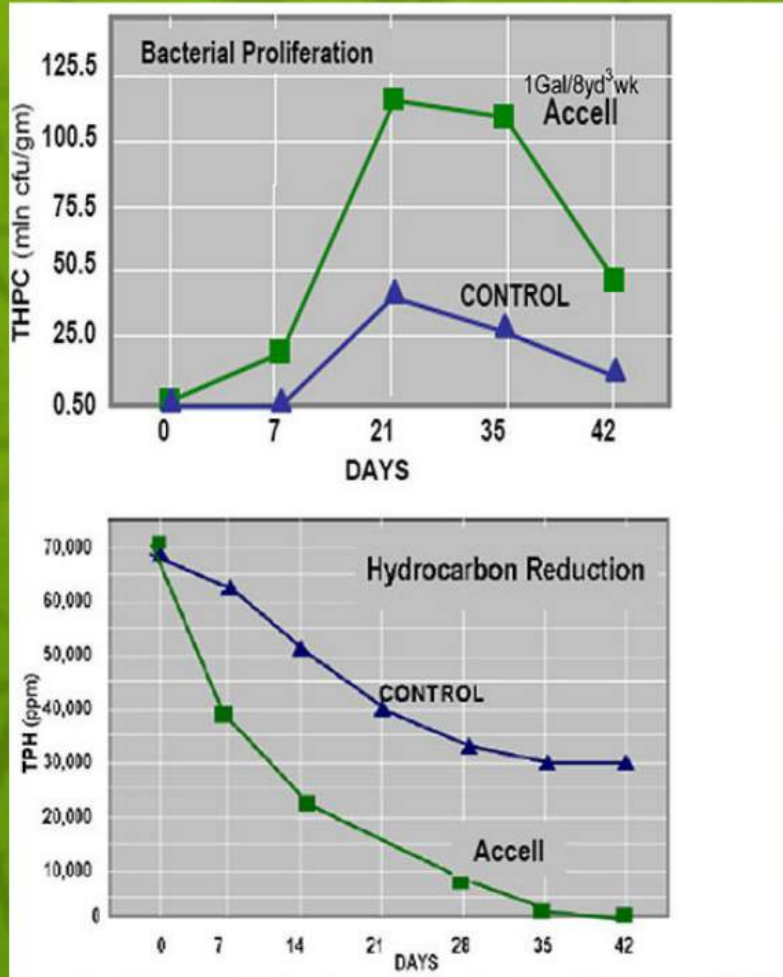
Cost



Cost



Implementability



Effectiveness

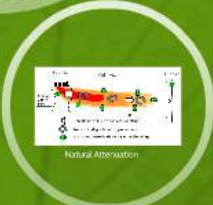
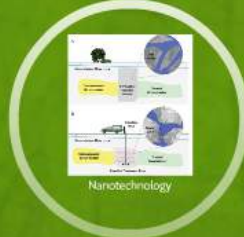
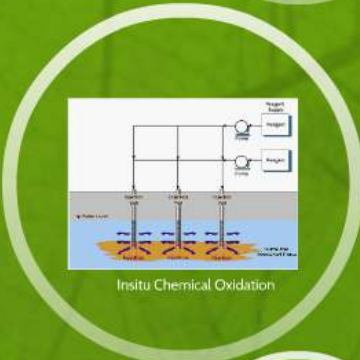
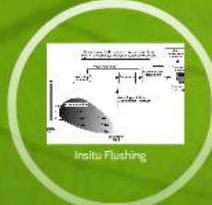
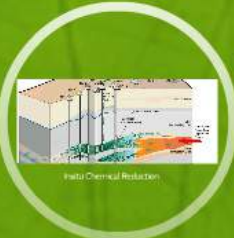
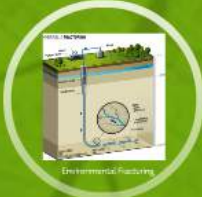
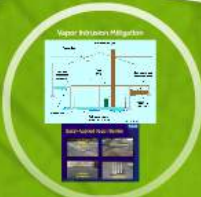


Closing the Case

- Apply for Case Closure
- Demonstrate that the goals have been met
- Address any Continuing Obligations

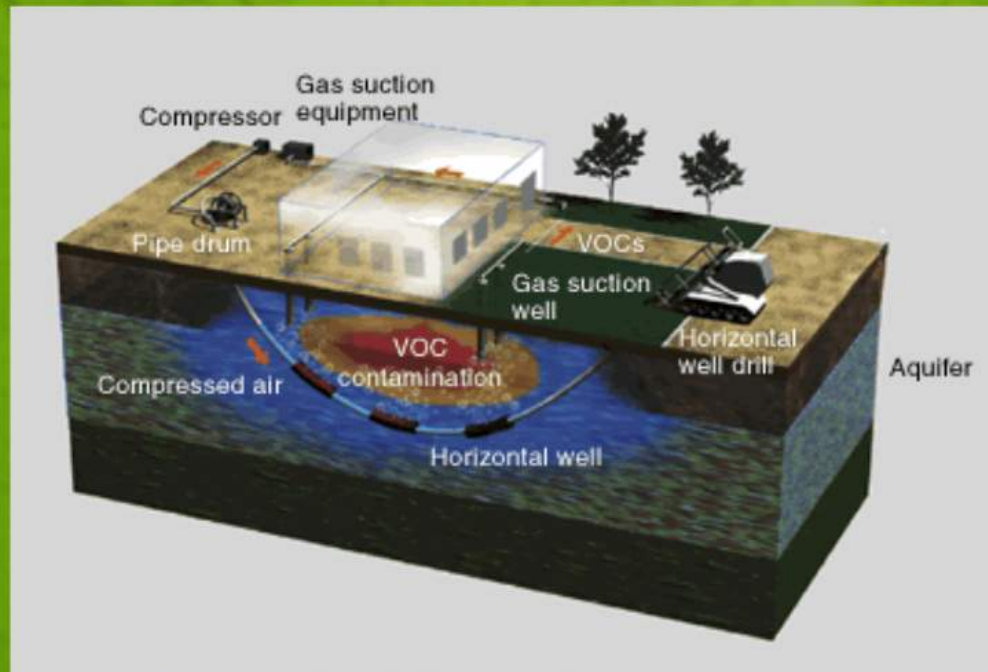


TECHNOLOGIES



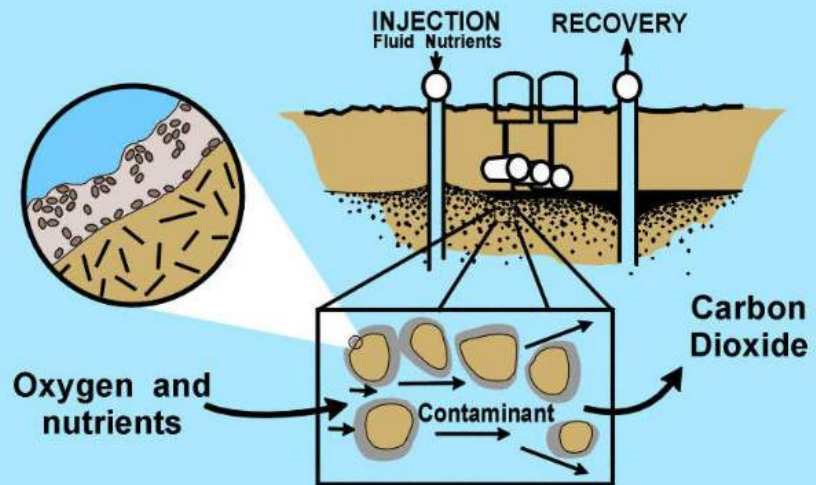


Bioractor Landfills



Air Sparging

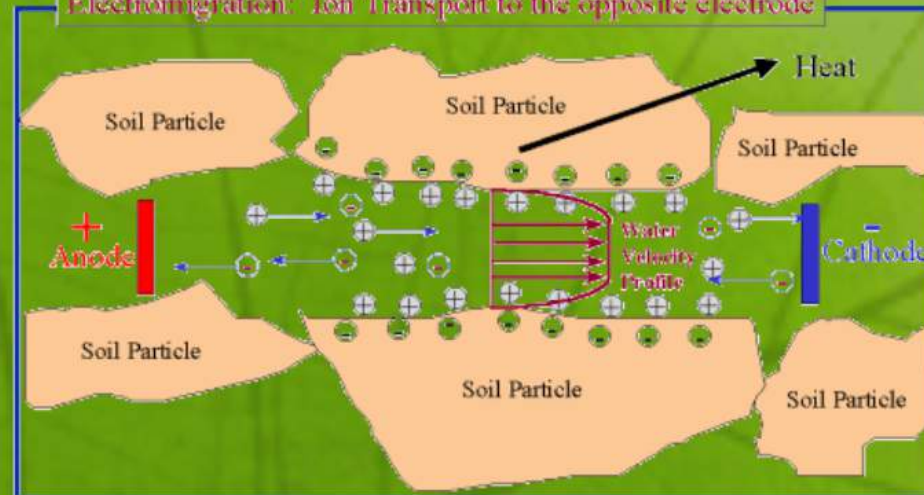
Bioremediation

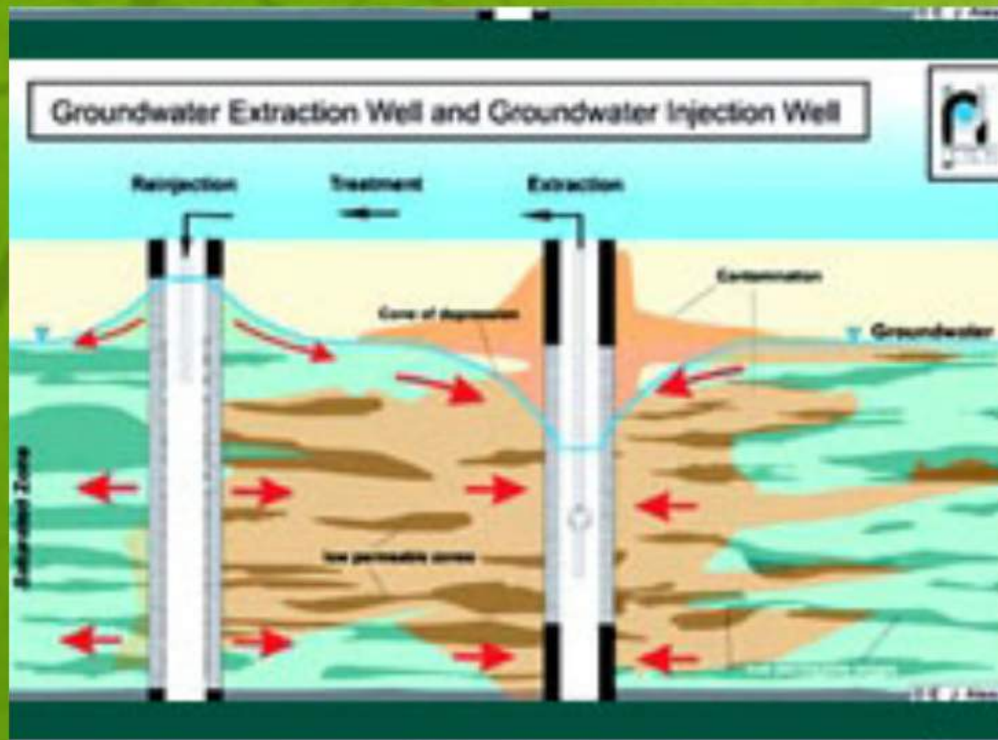


Principles of Electrokinetics

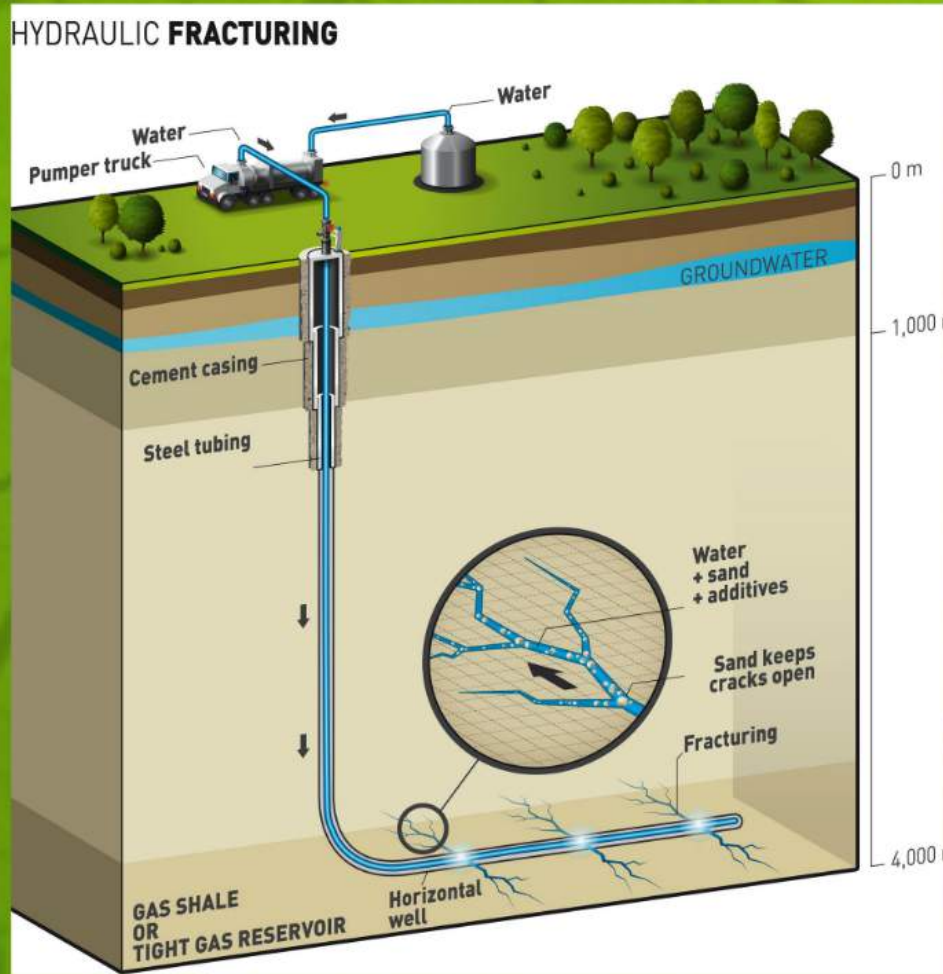
Electroosmosis: Water Transport from anode to cathode

Electromigration: Ion Transport to the opposite electrode

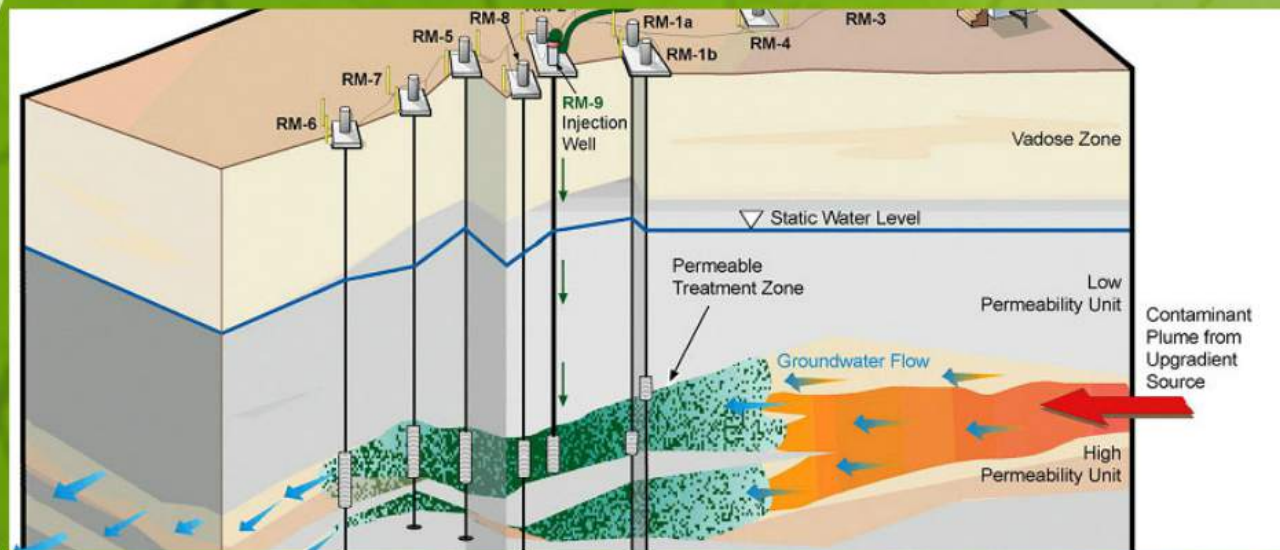




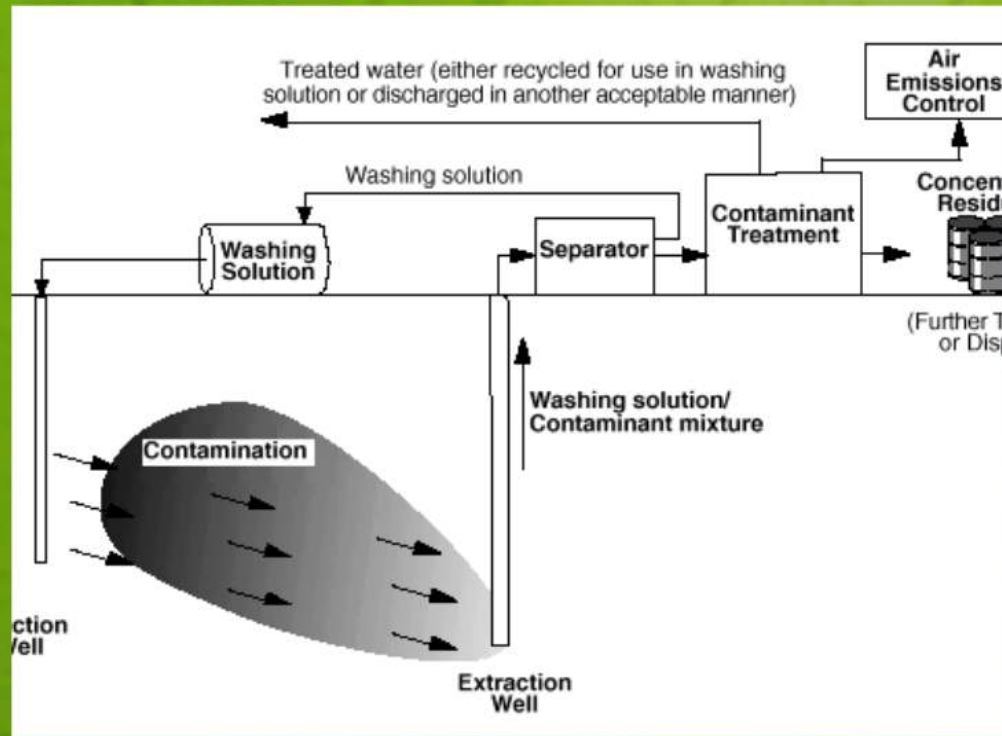
Groundwater Recirculating Wells



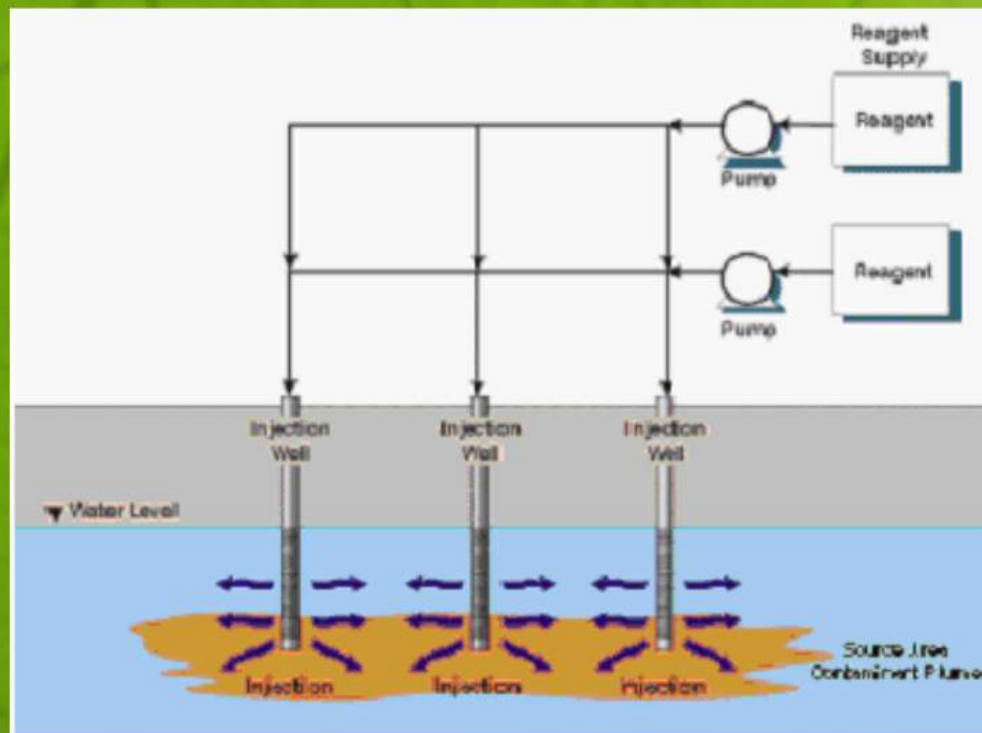
Environmental Fracturing



Insitu Chemical Reduction



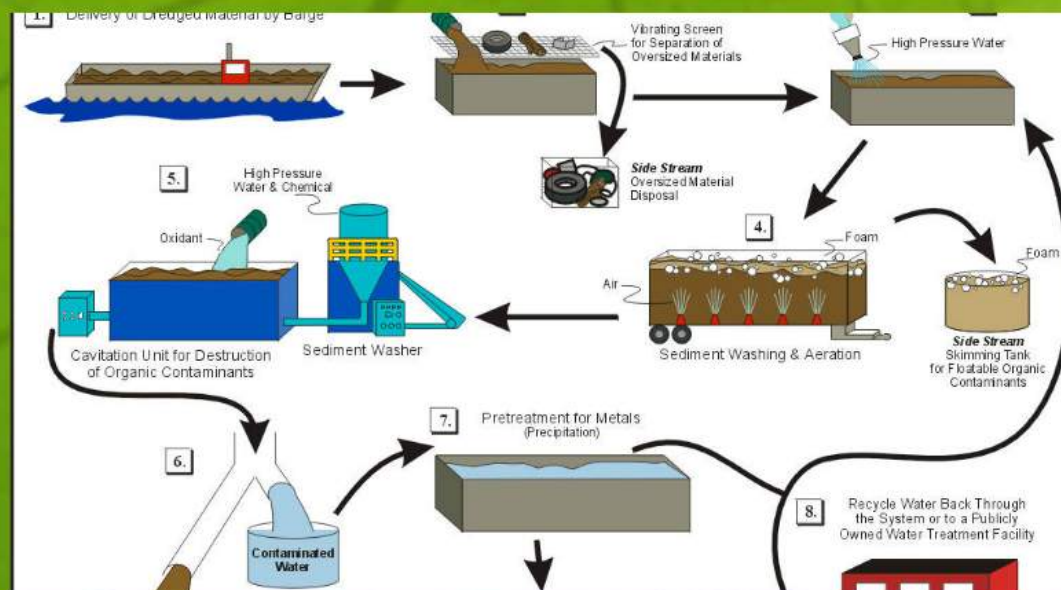
Insitu Flushing



Insitu Chemical Oxidation



Solidification



Soil Washing

Types of plants used



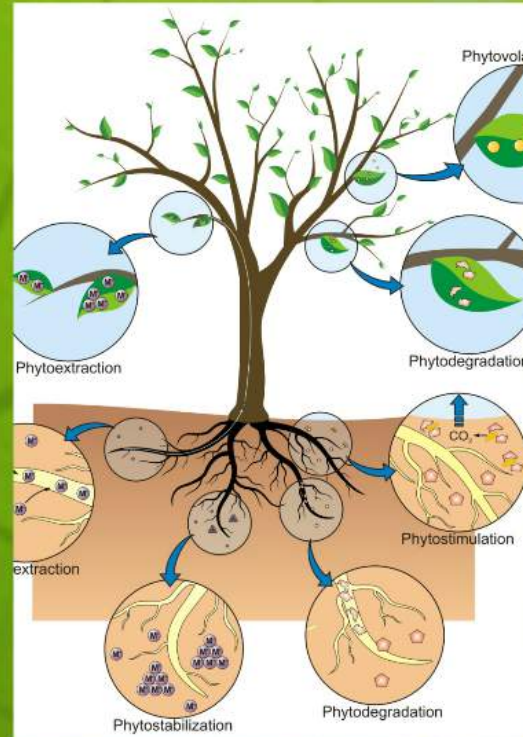
Hydrangeas are popular ornamental plants grown for their large clumps of flowers. Their other speciality is that they are responsible for drawing aluminium out of the soil.



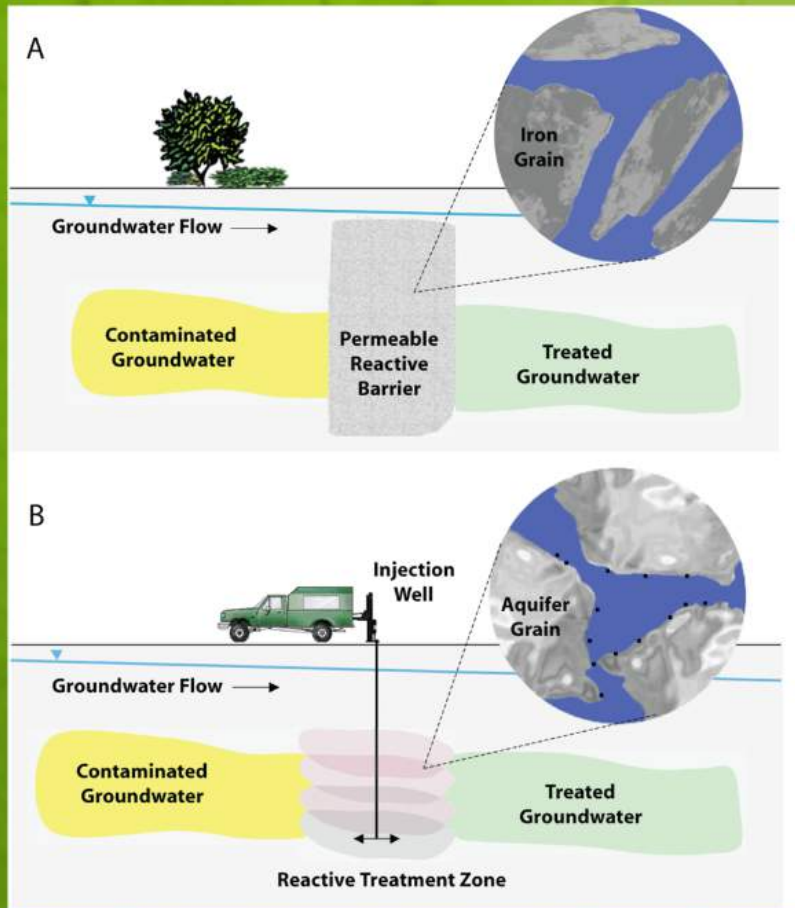
Water Hyssop (*Bacopa monnieri*) removes lead, mercury, cadmium and chromium from bogs and wetland.



Willow trees absorb cadmium, zinc and copper



Phytotechnologies



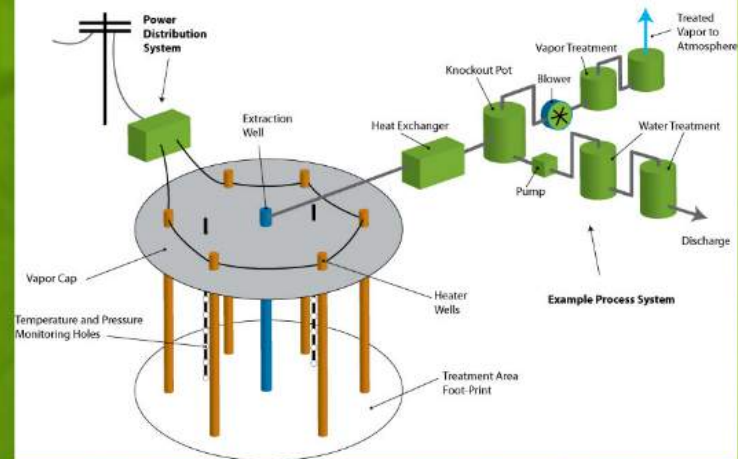
Nanotechnology

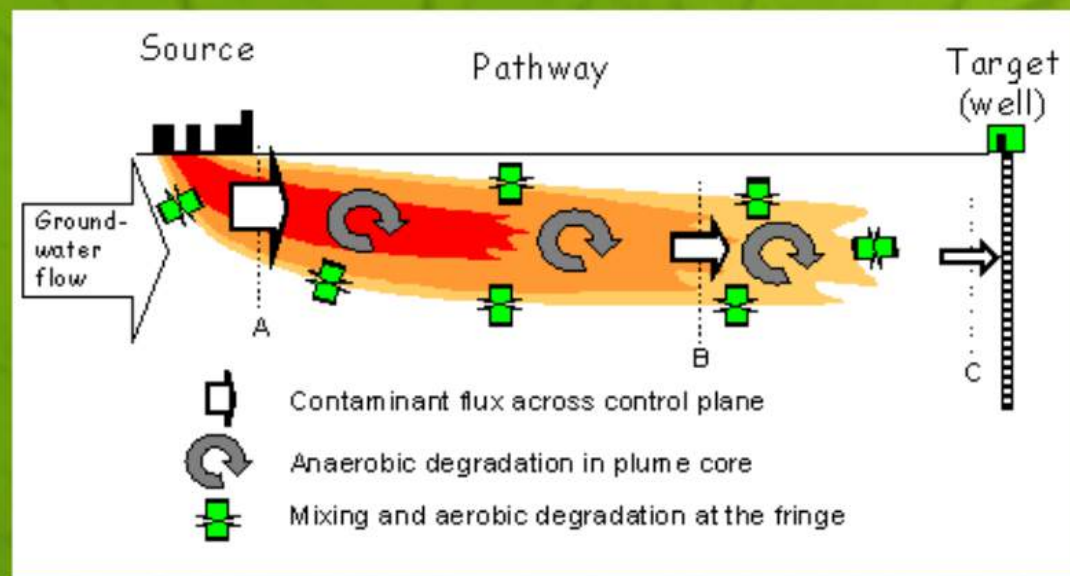
Thermal Treatment



ISTD

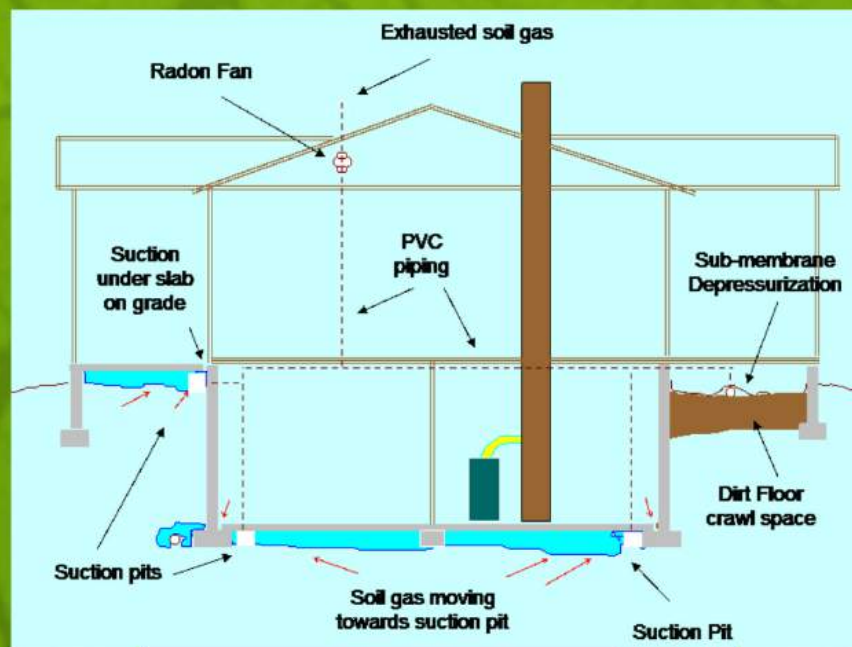
In Situ Thermal Desorption - Utilizing Thermal Conduction Heating





Natural Attenuation

Vapor Intrusion Mitigation



Spray-Applied Vapor Barrier

ROUX





Pump and Treat Systems

Dig and Disposal

Mechanical Mixing



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