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Sandia National Laboratories

Soil Treatability Study

Energy Technology Engineering Center • U.S. Department of Energy

Selecting Technologies for ETEC Soil Treatability Study

STIG Meeting; January 31, 2012

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Repository Performance Department, 6212

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Soil Treatability Study

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Sandia Literature Search

Expert Opinion Survey

Universe of technologies

Technologies for ETEC

Technologies for ETEC

Excavation default

What will the toolbox include?

- Will Recommend
  - Technologies for a given contaminant.
  - Technologies for representative soil types, depths, and conditions.
  - These are the technologies that could be used.
- Will Not Decide
  - DOE and DTSC are the decision makers

Defining the problem

- Developed a set of 14 scenarios
- Scenarios represent the range of soil types, depths, and conditions at the ETEC site
- Scenarios represent a generic picture of the site

Identify tools for the toolbox

- Utilize scenarios to create an “Expert Opinion Survey” as a means of soliciting the opinions of soil remediation experts on possible remediation approaches
- 56 experts were invited to participate in “Expert Opinion Survey”
- 13 experts responded positively to our invitation

What experts did we contact?

- Experts are from:
  - universities (14 contacted, 0 responded),
  - private industry (15 contacted, 3 responded),
  - government agencies (DOE, EPA, NMED, USAC, USDA, USAF) (16 contacted, 0 responded) and
  - Sandia National Laboratories (11 contacted, 10 responded)

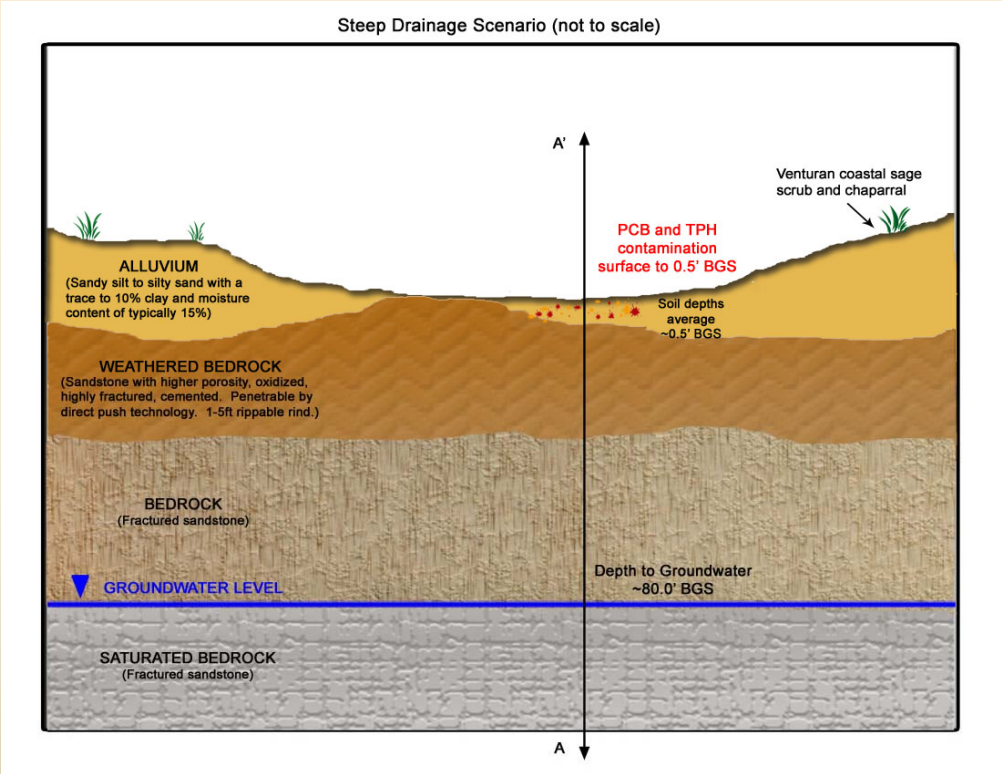
What experts responded?

- Experts have varied backgrounds, including:
  - Chemical and Environmental Engineering (7)
  - Hydrogeology (3)
  - Geochemistry (2)
  - Biology (1)

What did we ask the experts?

- Experts were asked to provide the following information for each scenario:
  - Select a technology or technology treatment train
  - Rate the effectiveness, reliability/durability and treatment duration
  - Describe why the technology or technologies were selected
  - Describe characteristics of the scenario that limited or restricted the technology choices
  - Describe limitations of implementing the technology
  - Describe potential impacts of implementing the technology

Scenario 1 – Steep Drainage, 2 Contaminants



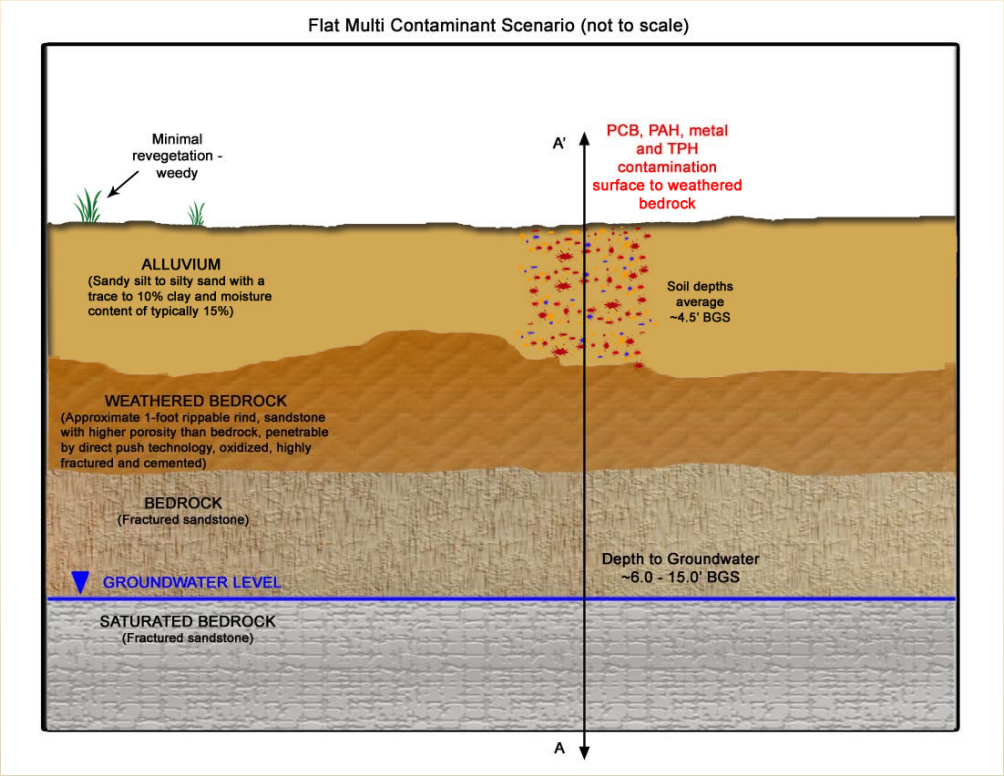
Top technologies selected by the experts:

- Incineration (3)
- Rhizodegradation (2)

PCB = Polychlorinated Biphenyl
TPH = Total Petroleum Hydrocarbon

BGS = Below Ground Surface

Scenario 2 – Flat Multi Contaminant

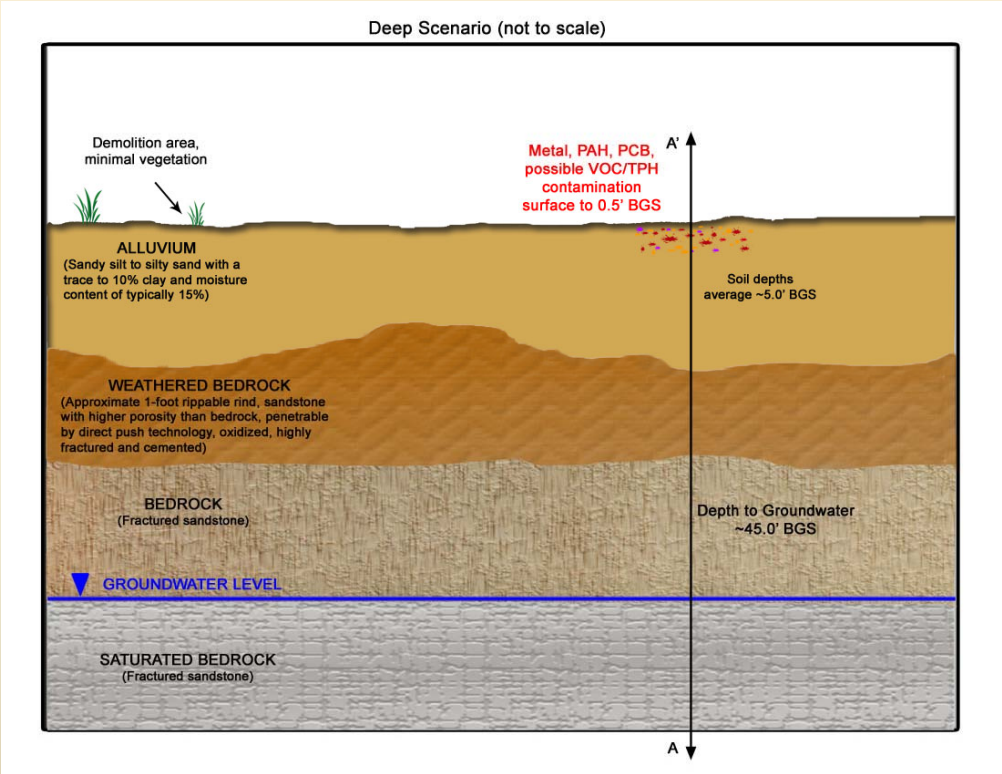


Top technologies selected by the experts:

- In-situ soil flushing (4)
- Phytoaccumulator/ chelator (2)
- Bioaugmentation (2)
- Biostimulation (2)

PCB = Polychlorinated Biphenyl
PAH = Polycyclic Aromatic Hydrocarbons
TPH = Total Petroleum Hydrocarbon

Scenario 3 – Deep



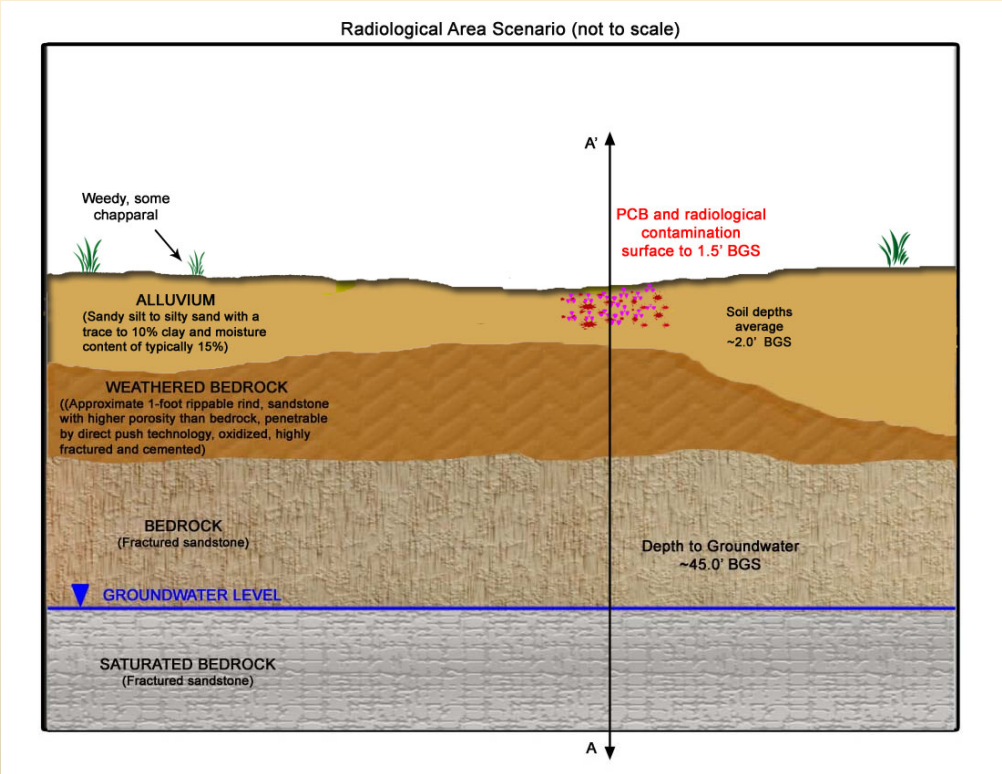
Top technologies selected by the experts:

- Thermal desorption (3)
- Rhizodegradation (2)
- Soil washing (2)

PCB = Polychlorinated Biphenyl
PAH = Polycyclic Aromatic Hydrocarbons
TPH = Total Petroleum Hydrocarbon
VOC = Volatile Organic Compound

BGS = Below Ground Surface

Scenario 4 – Radiological Area



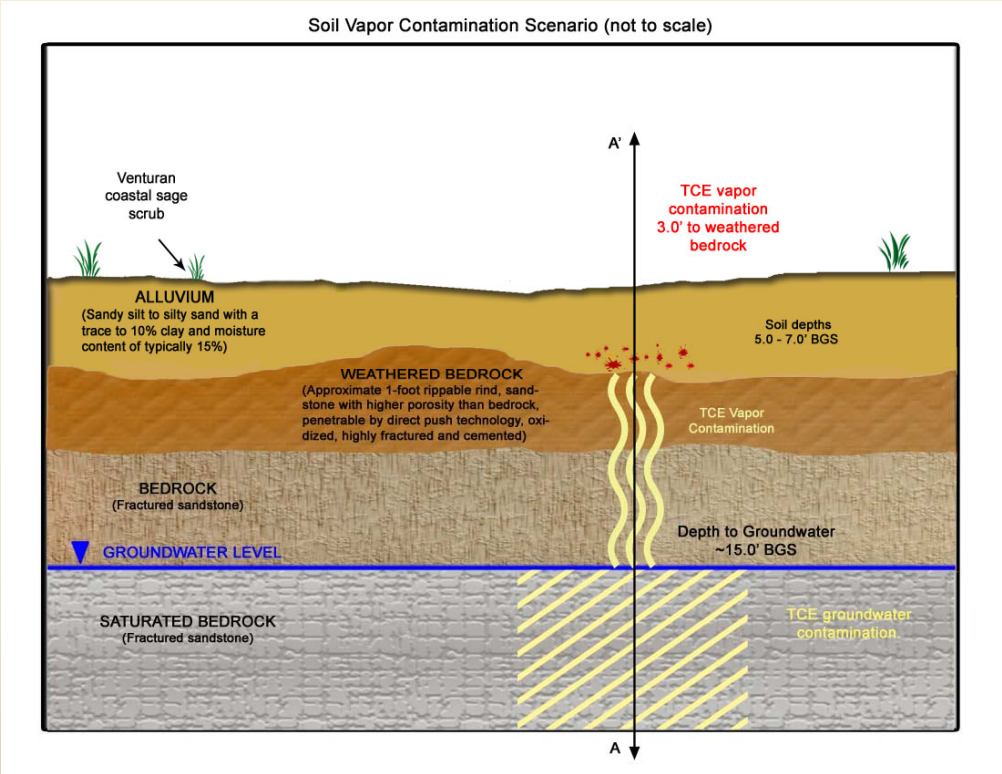
Top technologies selected by the experts:

- In-situ flushing (4)
- Soil washing (2)

PCB = Polychlorinated Biphenyl

BGS = Below Ground Surface

Scenario 5 – Soil Vapor

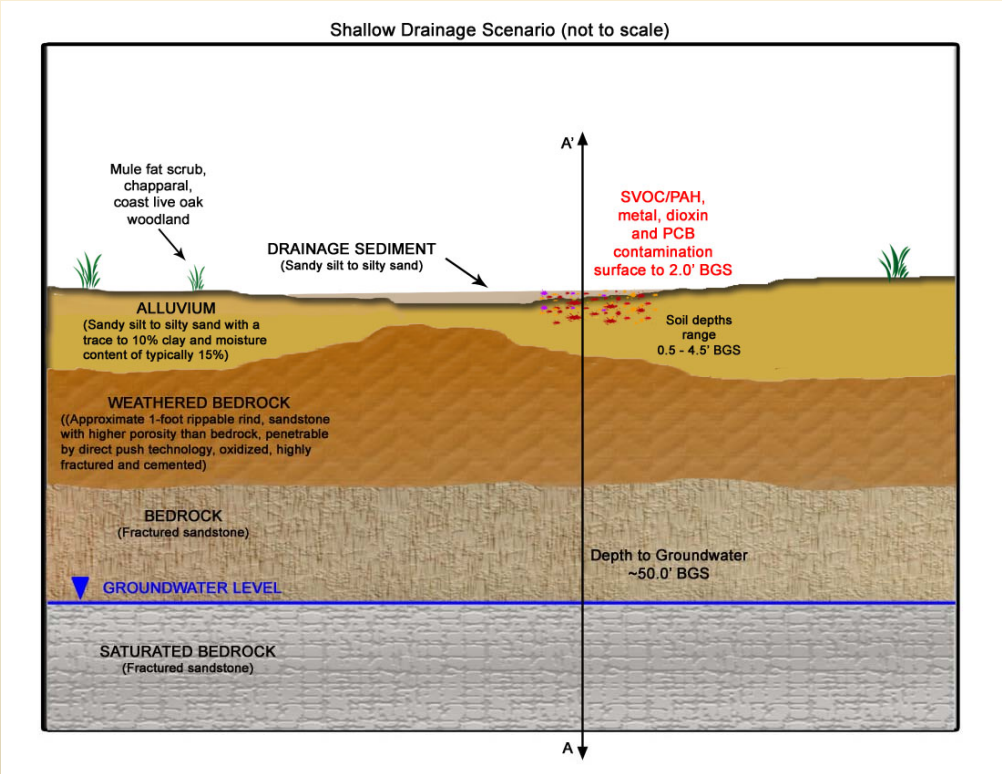


Top technologies selected by the experts:

- Soil Vapor Extraction (SVE) (8)
- Air sparging (2)
- In-well vapor stripping (2)
- Permeable reactive barrier (2)

TCE = Trichloroethylene

Scenario 6 – Shallow Drainage



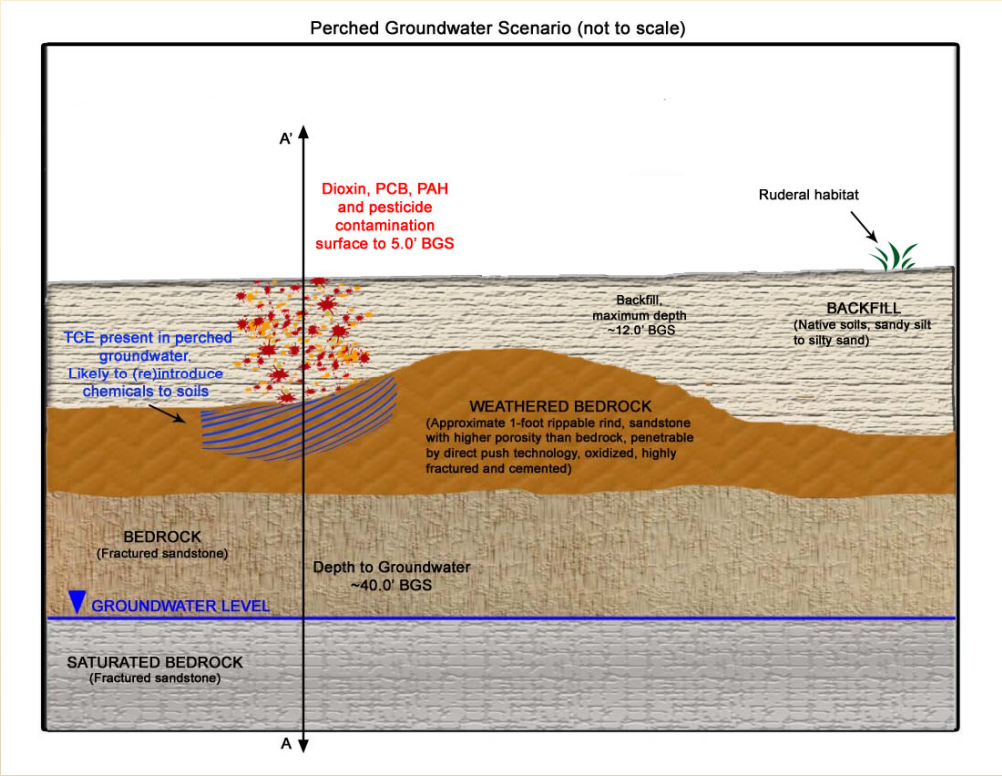
Top technologies selected by the experts:

- Biostimulation (2)
- Soil washing (2)
- Solvent extraction (2)
- Incineration (2)

PCB = Polychlorinated Biphenyl
PAH = Polycyclic Aromatic Hydrocarbons
SVOC = Semivolatile Organic Compounds

BGS = Below Ground Surface

Scenario 7 – Perched Groundwater



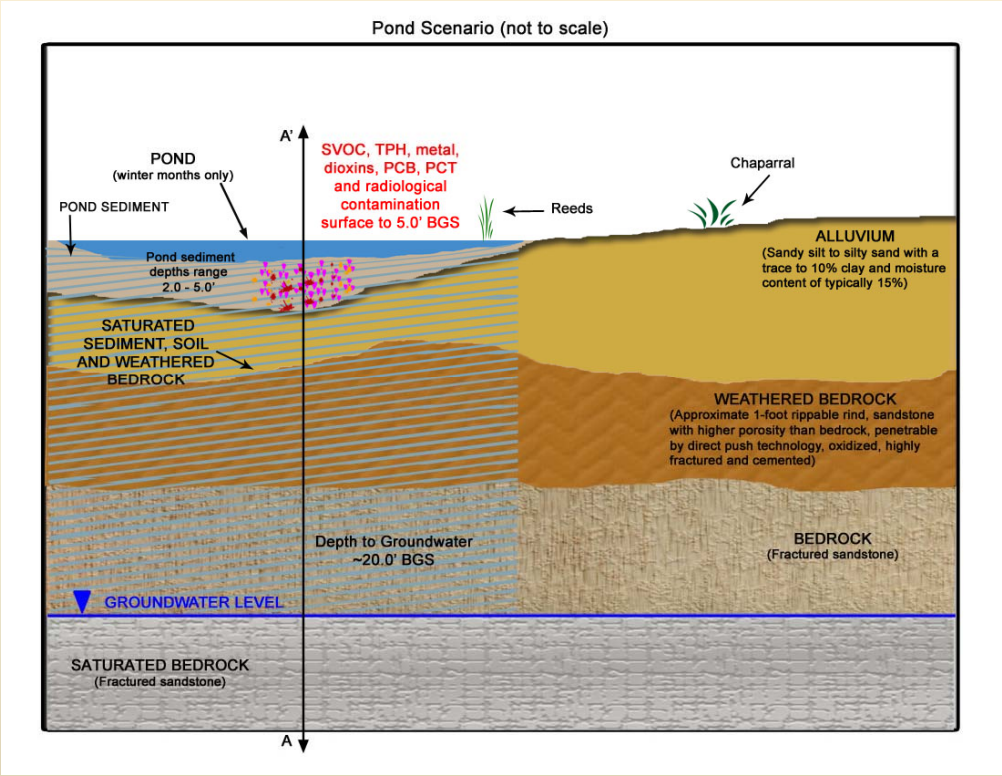
Top technologies selected by the experts:

- Soil vapor extraction (SVE) (3)
- Incineration (3)
- Biostimulation (2)

PCB = Polychlorinated Biphenyl
PAH = Polycyclic Aromatic Hydrocarbons

BGS = Below Ground Surface

Scenario 8 – Pond



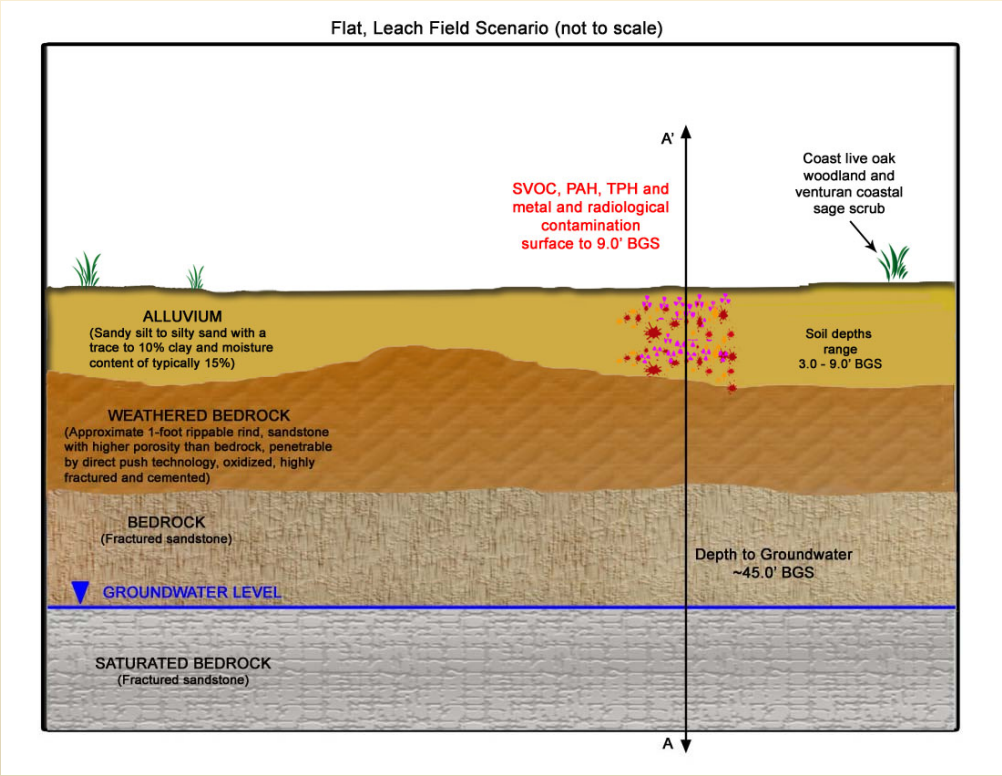
Top technologies selected by the experts:

- Phytoaccumulator/ chelator (2)
- Biostimulation (2)
- In-situ flushing (2)
- Permeable reactive barrier (2)
- Incineration (2)

PCB = Polychlorinated Biphenyl
PCT = Polychlorinated Terphenyls
TPH = Total Petroleum Hydrocarbon
SVOC = Semivolatile Organic Compound

BGS = Below Ground Surface

Scenario 9 – Flat Leach Field



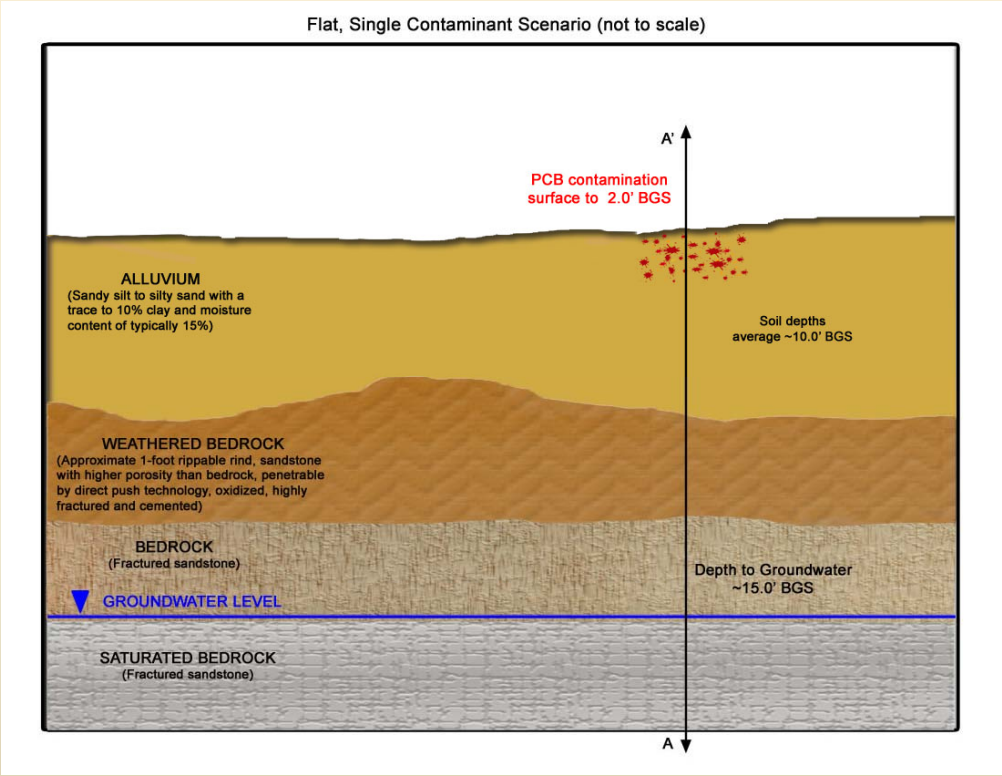
Top technologies selected by the experts:

- Phytodegradation (2)
- Biostimulation (2)
- In-situ flushing (2)
- Incineration (2)

PAH = Polycyclic Aromatic Hydrocarbons
TPH = Total Petroleum Hydrocarbon
SVOC = Semivolatile Organic Compound

BGS = Below Ground Surface

Scenario 10 – Flat Single Contaminant Class



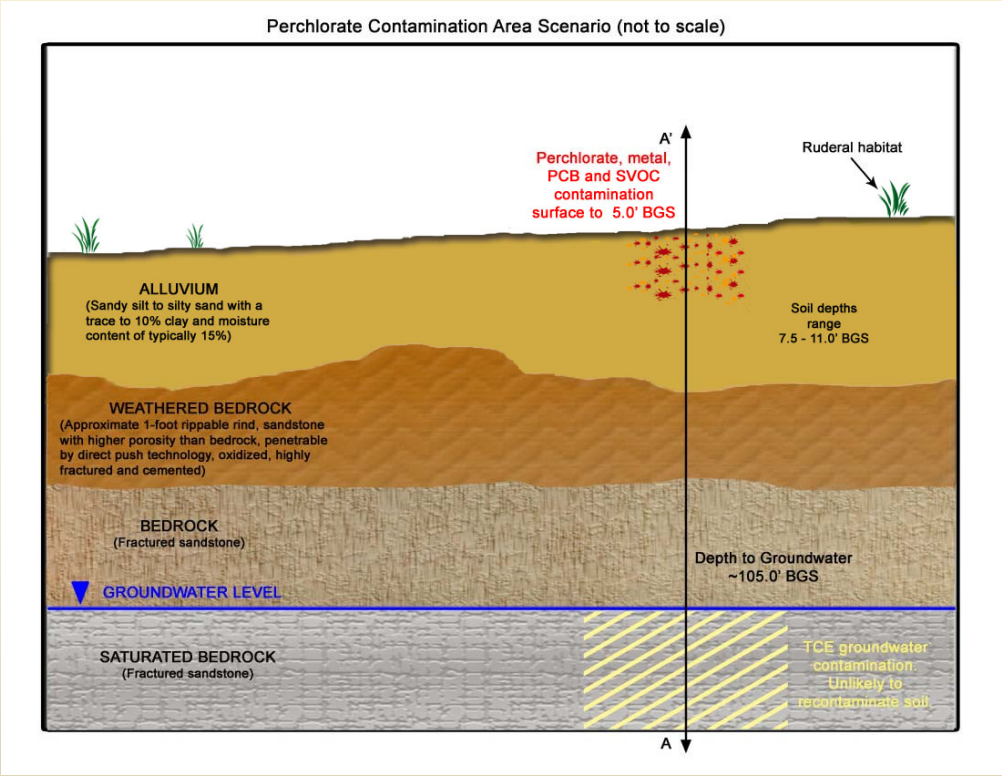
Top technologies selected by the experts:

- Incineration (3)

PCB = Polychlorinated Biphenyl

BGS = Below Ground Surface

Scenario 11 – Perchlorate Contamination



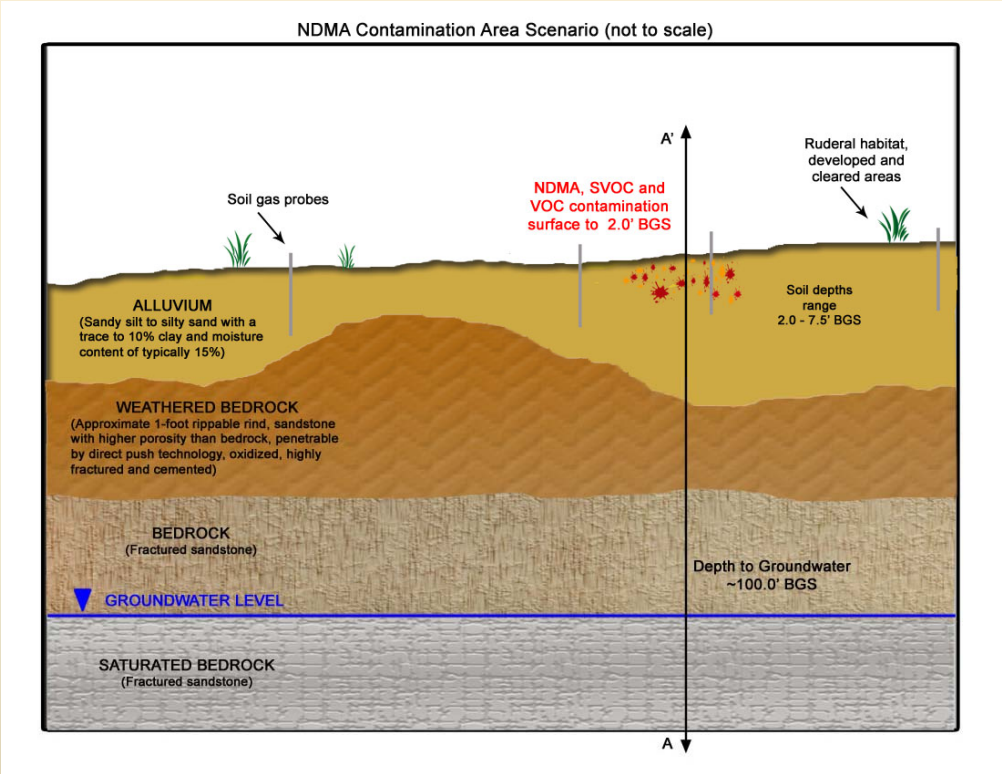
Top technologies selected by the experts:

- Phytodegradation (2)
- In-situ soil flushing (2)
- Soil Vapor Extraction (SVE) (2)

PCB = Polychlorinated Biphenyl Hydrocarbon
SVOC = Semivolatile Organic Compound

BGS = Below Ground Surface

Scenario 12 – NDMA Contamination



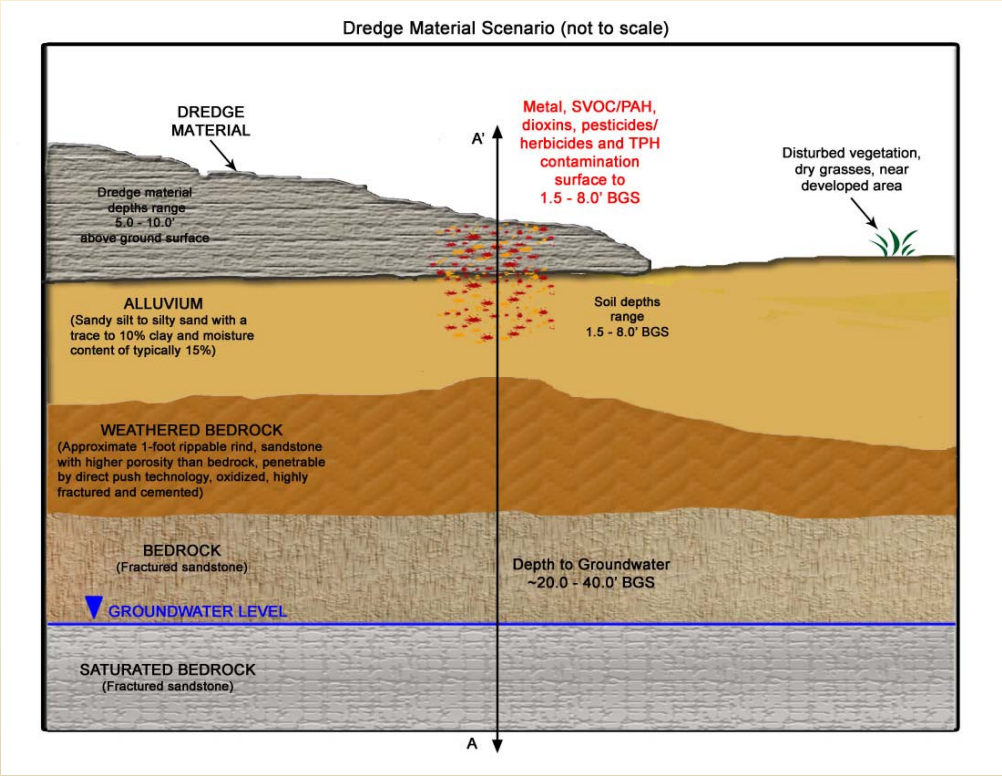
Top technologies selected by the experts:

- Soil Vapor Extraction (SVE) (3)
- Phytodegradation (2)

NDMA = N-Nitrosodimethylamine
VOC = Volatile Organic Compound
SVOC = Semivolatile Organic Compound

BGS = Below Ground Surface

Scenario 13 – Dredge Material



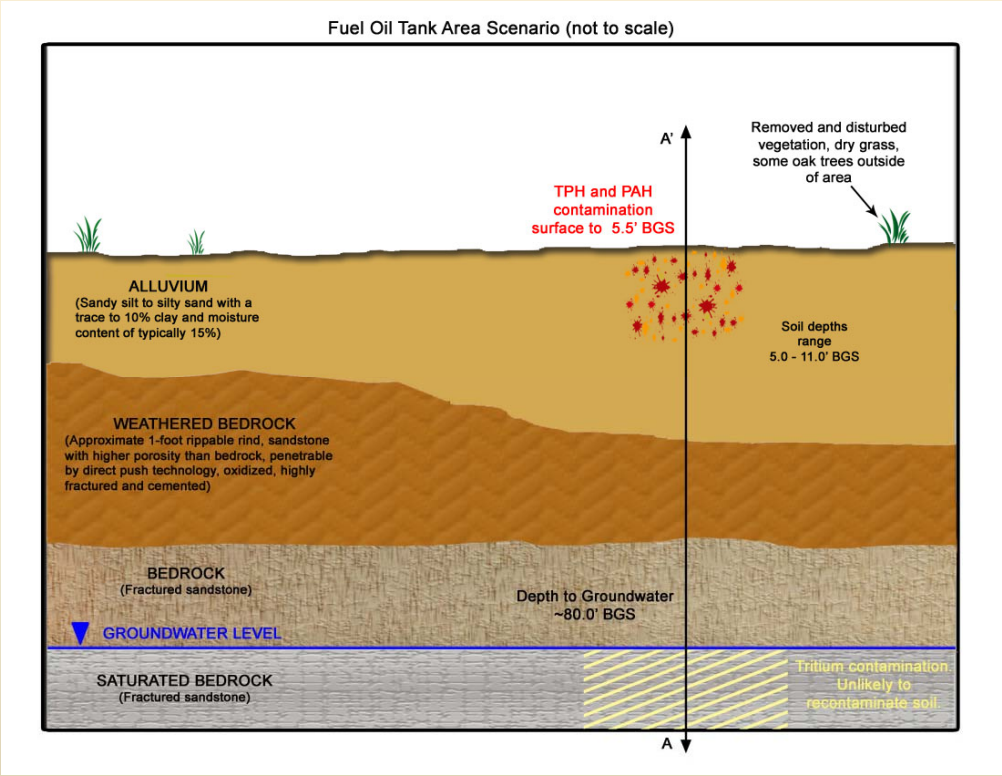
Top technologies selected by the experts:

- In-situ flushing (2)
- Soil washing (2)

PAH = Polycyclic Aromatic Hydrocarbons
TPH = Total Petroleum Hydrocarbon
SVOC = Semivolatile Organic Compound

BGS = Below Ground Surface

Scenario 14 – Fuel Tank Area



Top technologies selected by the experts:

- Phytodegradation (2)
- Biostimulation (2)

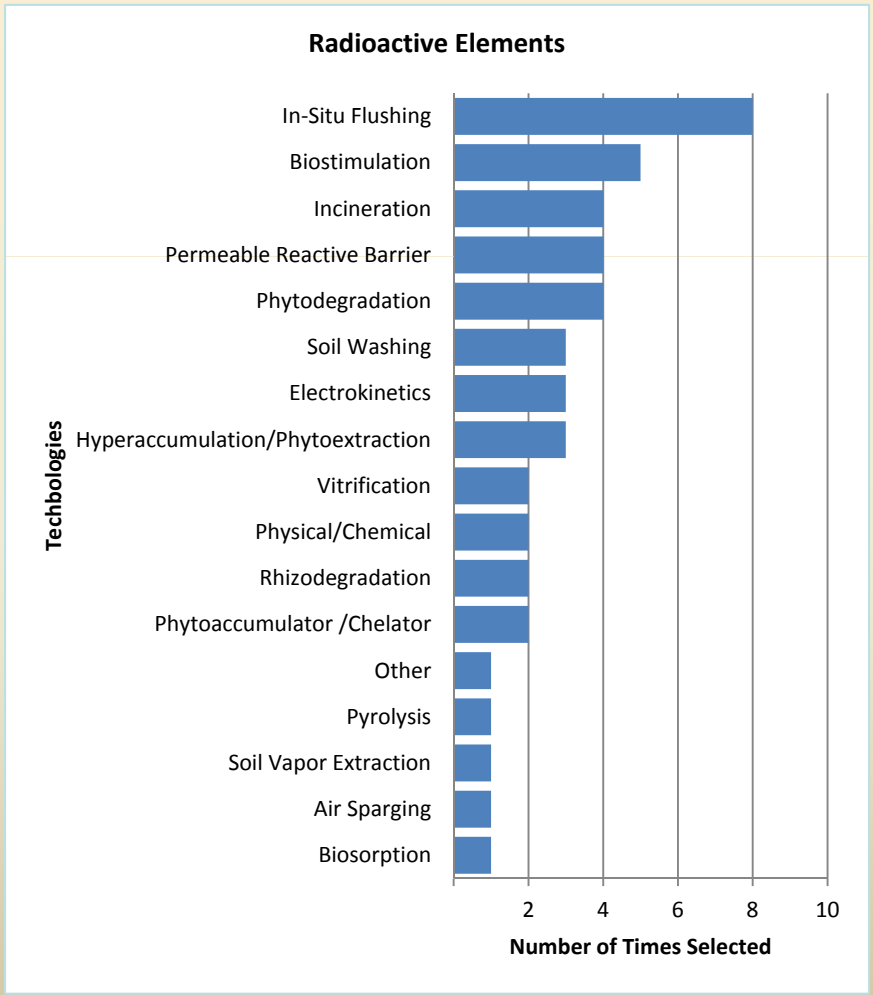
PAH = Polycyclic Aromatic Hydrocarbons
TPH = Total Petroleum Hydrocarbon

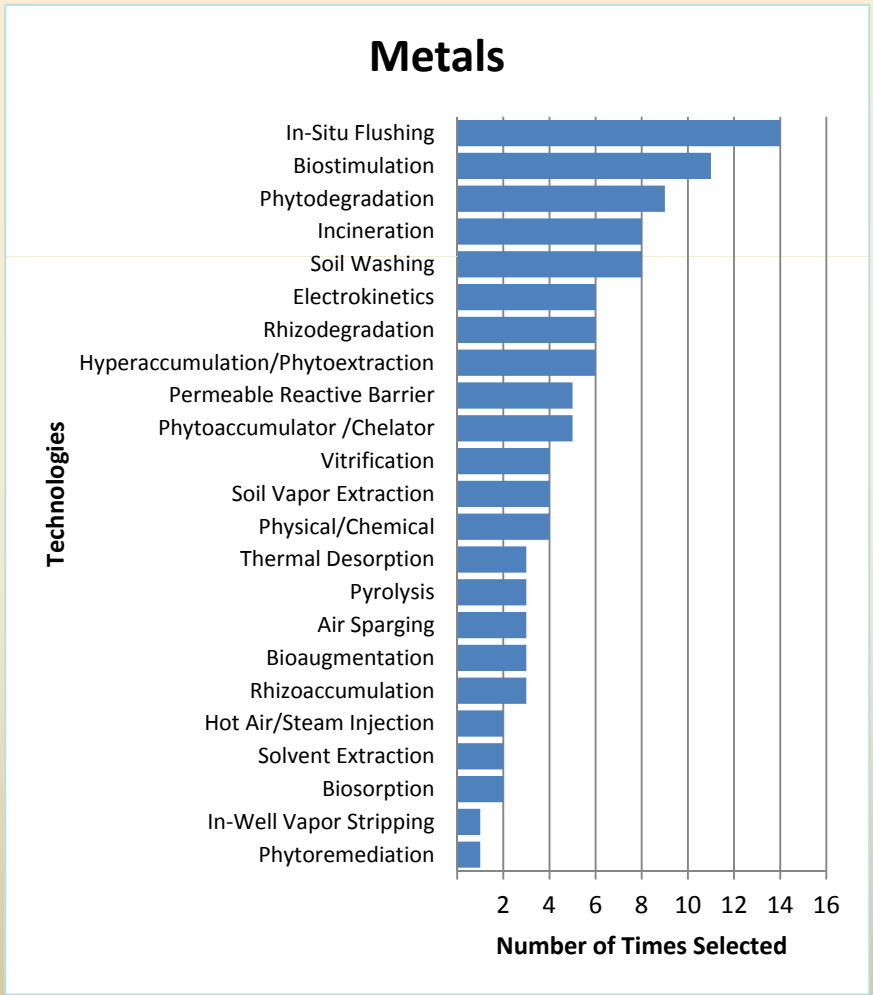
BGS = Below Ground Surface

Technologies selected most often by Experts

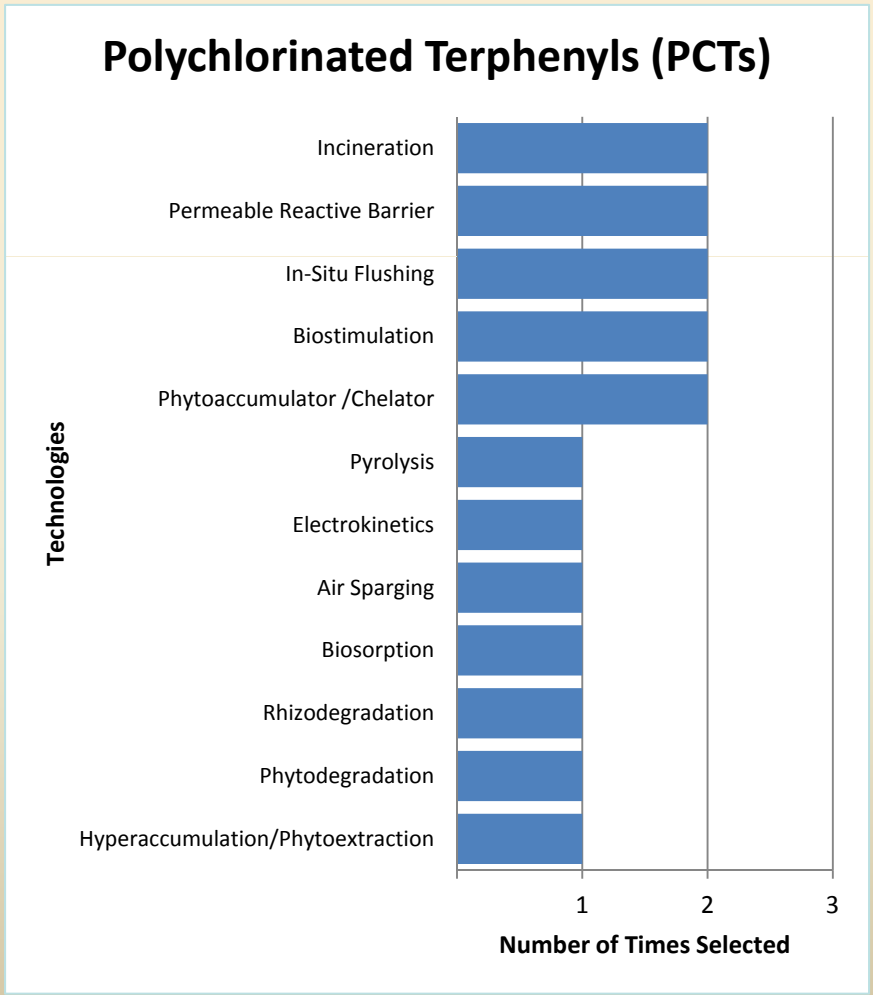
- Soil Vapor Extraction
- In-situ Flushing
- Biostimulation
- Incineration
- Phytodegradation

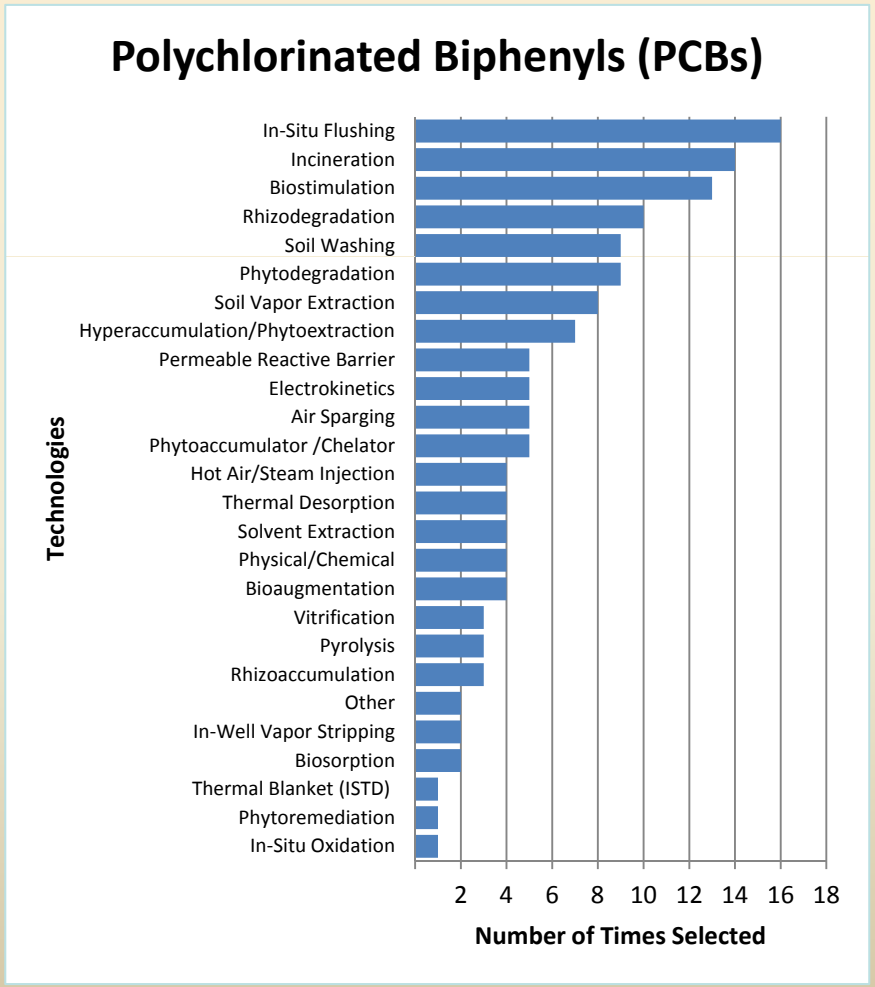
Technologies selected by contaminant



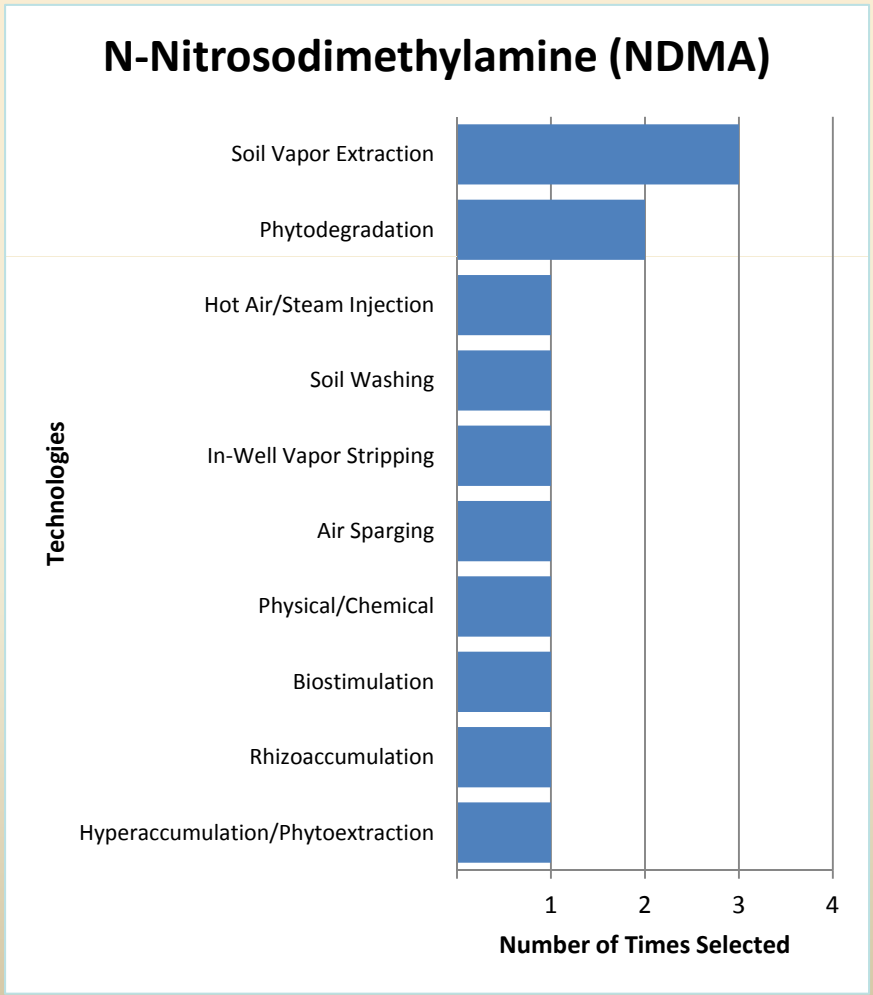


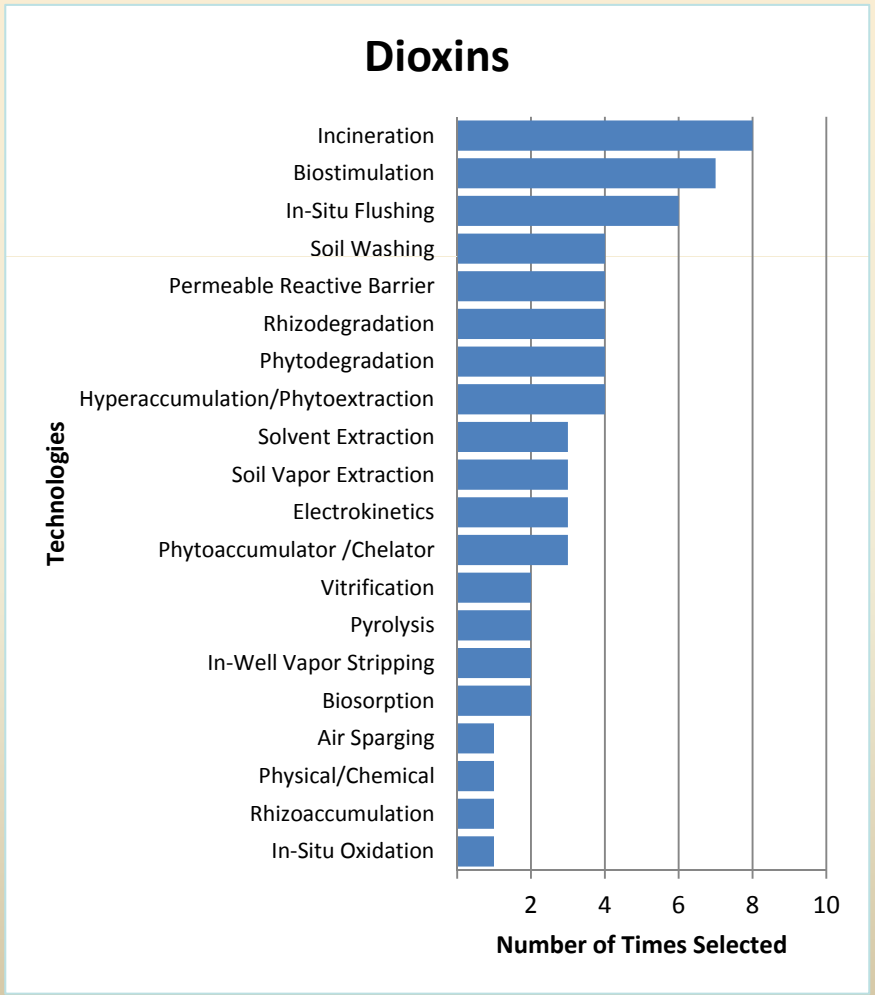
Technologies selected by contaminant



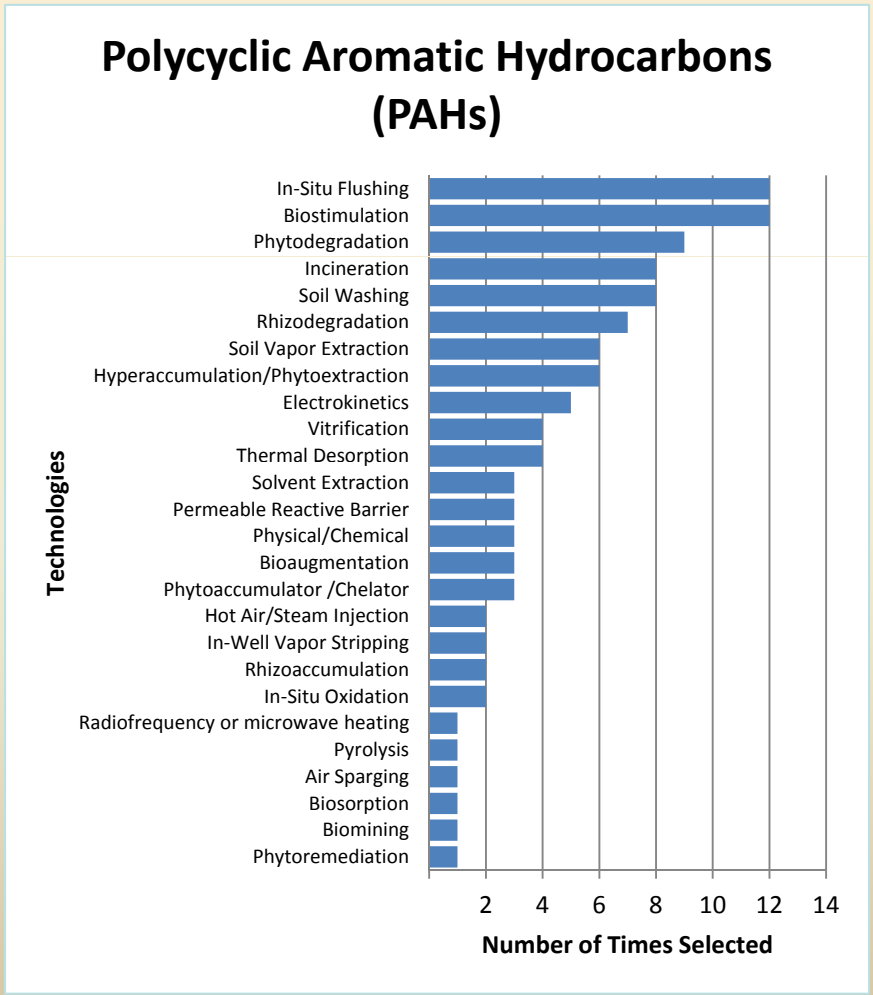


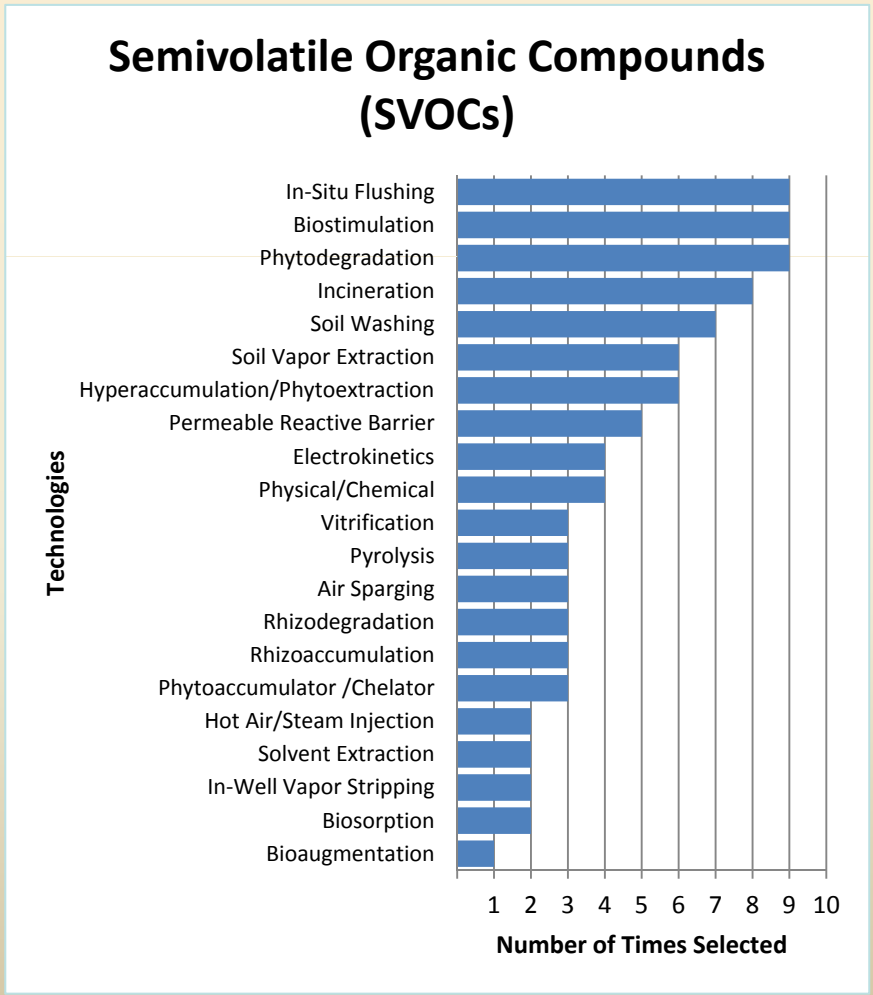
Technologies selected by contaminant



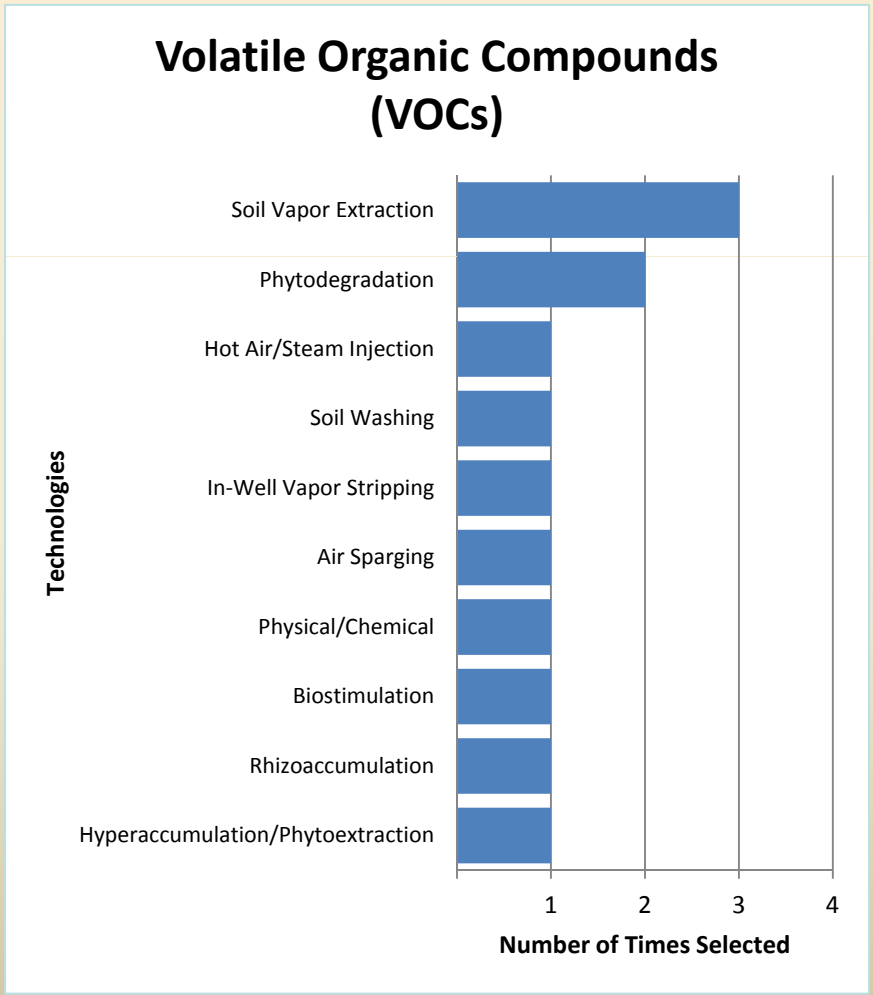


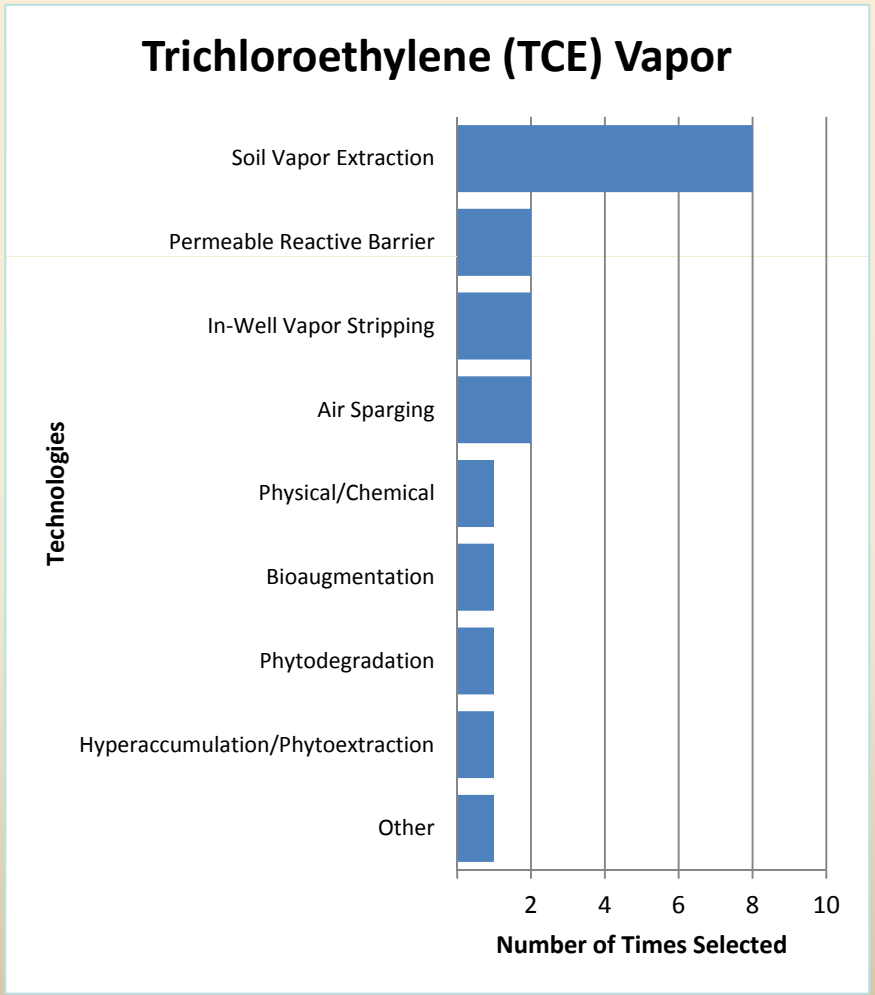
Technologies selected by contaminant



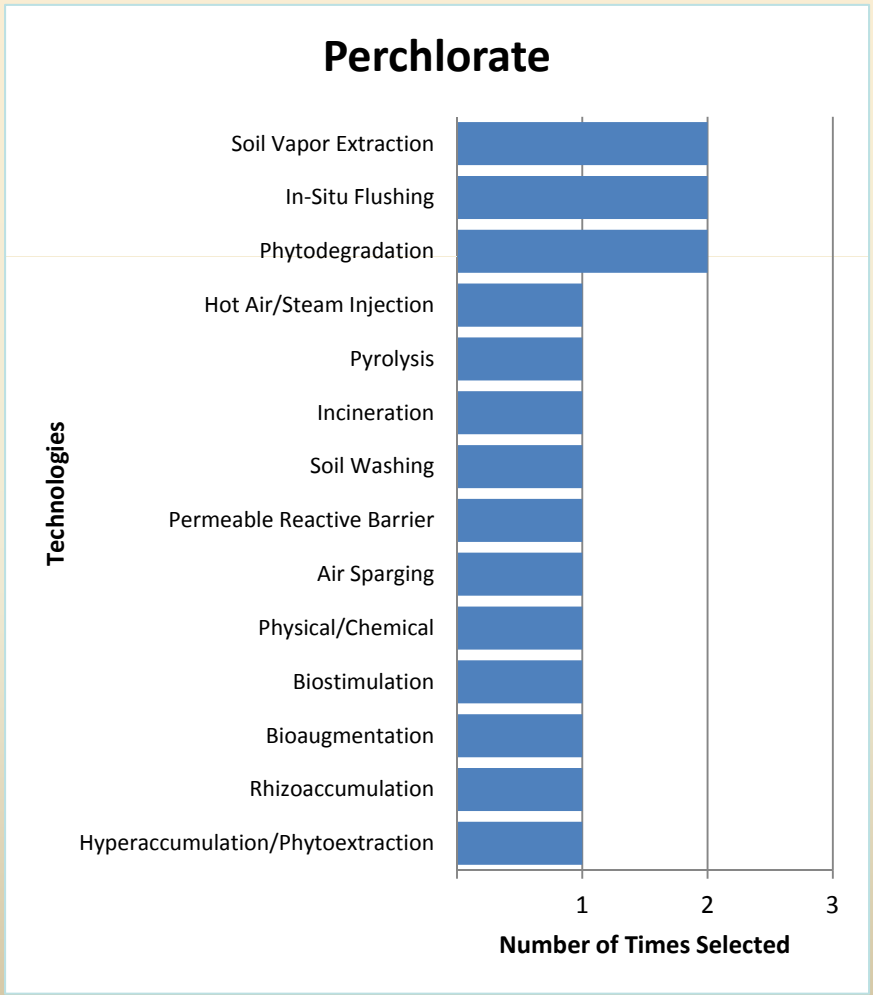


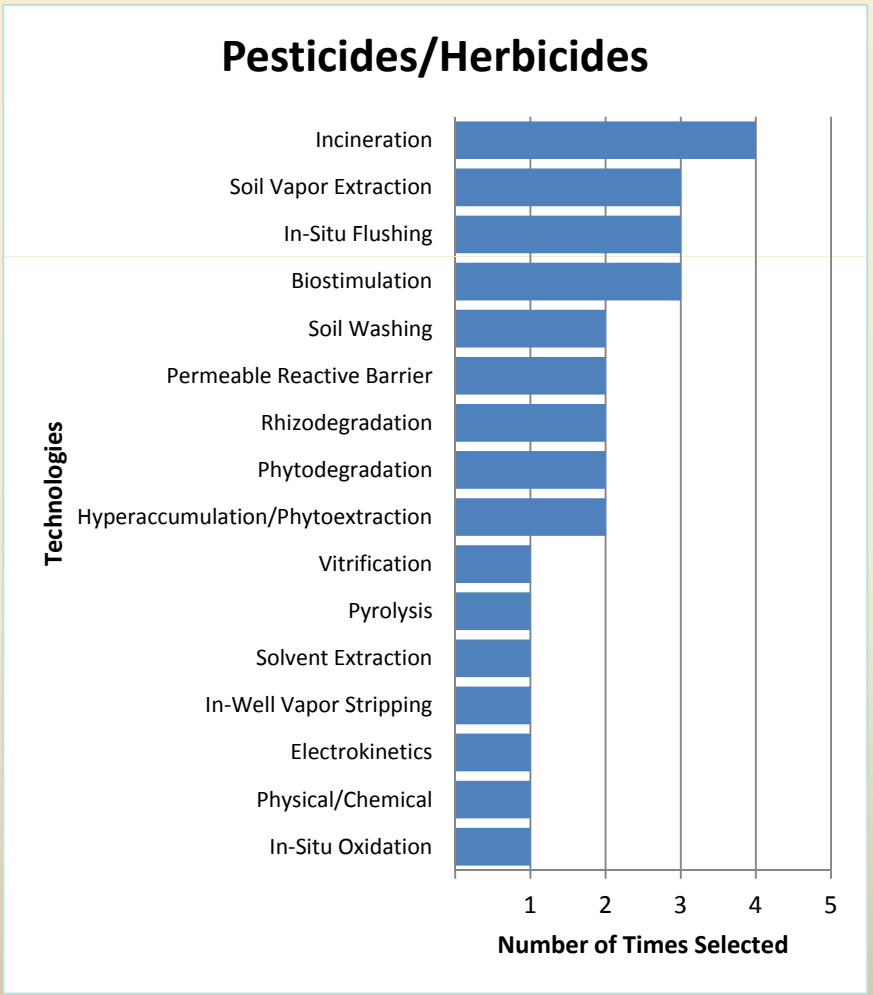
Technologies selected by contaminant





Technologies selected by contaminant





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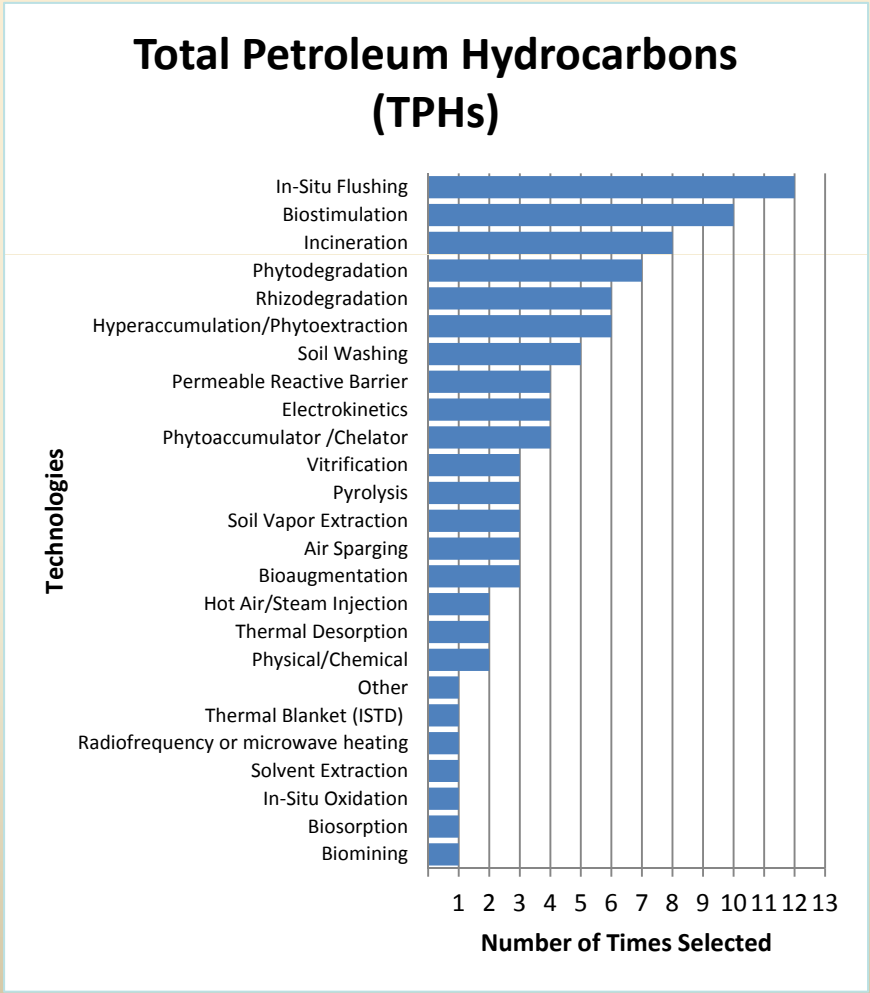
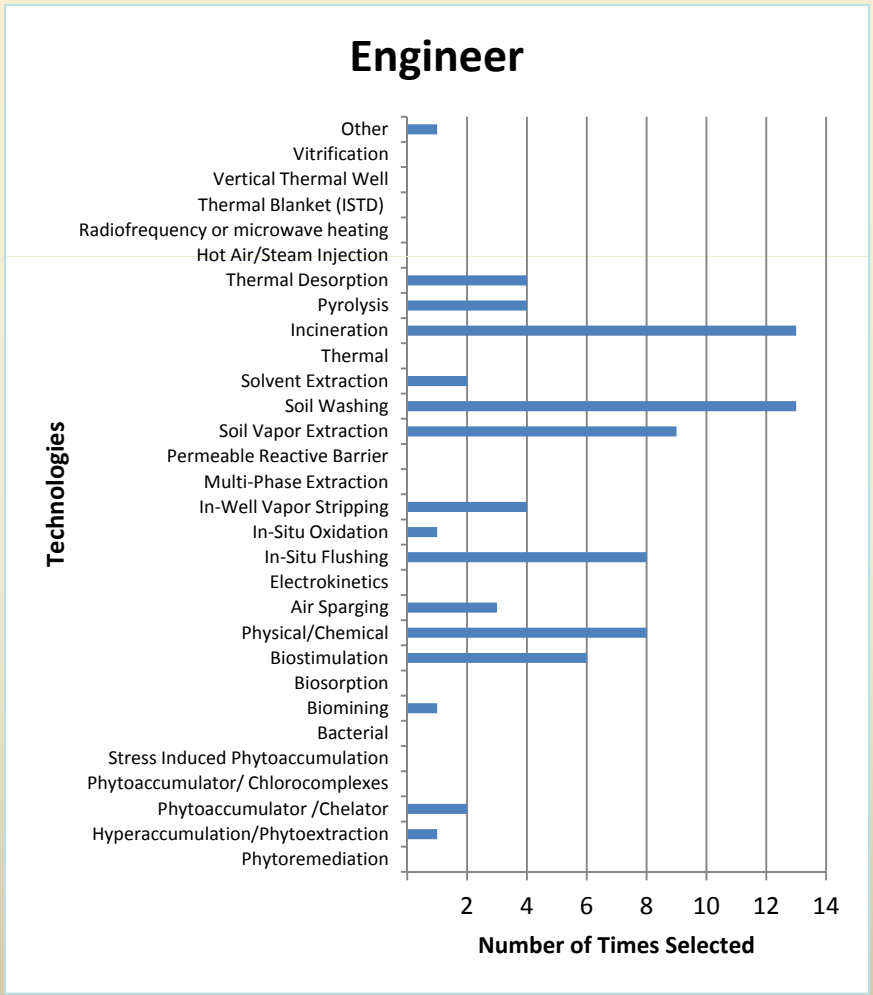
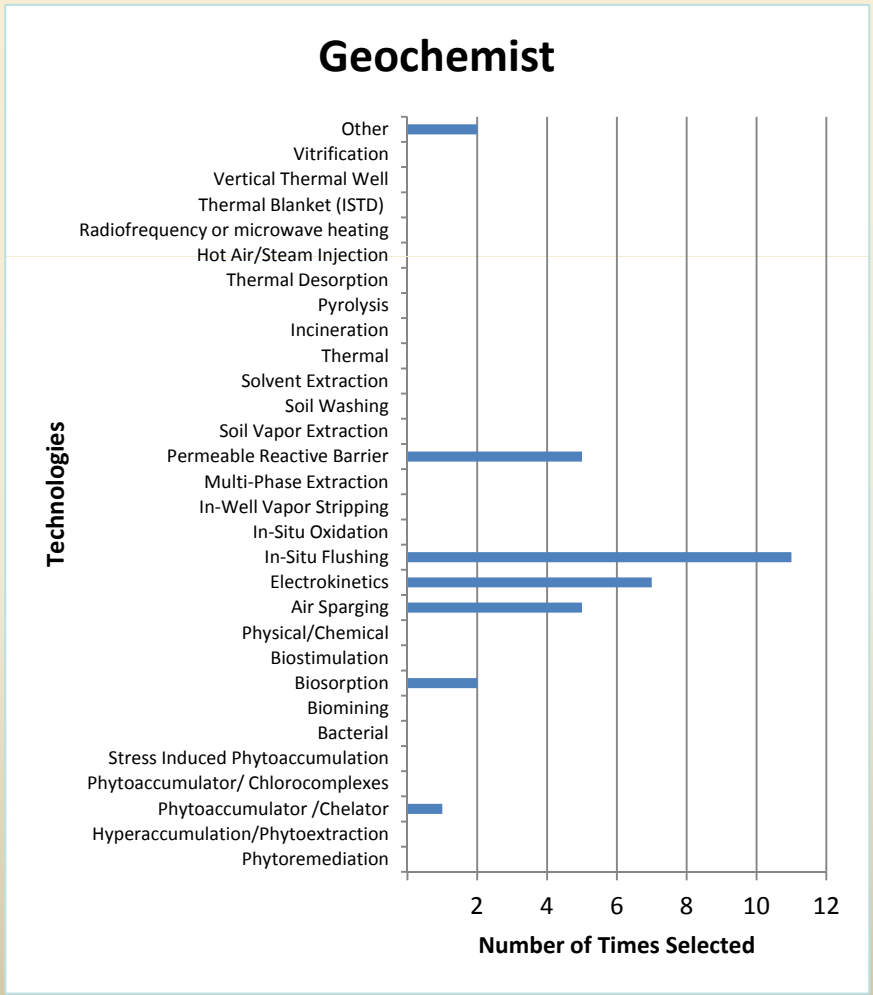


Technologies by expert groups





Technologies by expert groups