ESAA Remediation Technologies Symposium

The Development of Innovative Technologies For the Remediation of Contaminated Sites

Bill Wong, P.Eng.
Program Manager
Environmental Technologies Program
Environmental Technology Centre
335 River Road South
Ottawa, Ontario
Remedial Options

- Containment
- Ex-situ removal/destruction
- In-situ removal/destruction
- Disposal
- MNA
Difficult to Treat Sites

- Recalcitrant Substances
- Mixed Contaminants
- Complex or Difficult Matrices
- Wastewater

NO EASY ANSWER

→ Multiple-Technology Testing Approach
Example Technologies:

- Soil Leaching / Soil Washing
- Membrane Separation
- Steam Stripping / Air Stripping
- Solvent Extraction
- Advanced Oxidation Process

Biological Processes
- Chelation Enhanced Extraction
- Chemically-enhanced Membrane Separation
- In-situ Soil Flushing
Example: Contaminated Sediment

Sediment Sample
Contaminated Sediments - Technology Evaluation

Soil Classification
- almost 95% of sediment at 150 microns or less
- heavy metals are contained in the fines
- “clean” fraction is only 3% of total mass

Enhanced Washing
- did not significantly remove petroleum hydrocarbons
- hydrocarbons in heavier products

Chemical Leaching
- sediments have high iron content
- lower than expected removal efficiency of heavy metals
- metals are strongly adsorbed to soil matrix
Contaminated Sediments - Technology Evaluation

**Microwave Assisted Process - Solvent Extraction**
- for this type of soil, effect of MAP extraction is not significant
- fines physical properties may render MAP ineffective

**Supercritical Fluid Extraction**
- able to removal PAHs
- low PCB removal rate (may need fluid modifiers)

**Microwave Activated Cracking**
- able to destroy organics (best results in PAHs)
- limited destruction of PCBs
Bench-Scale Solvent Extraction System
Contaminated Sediments

Lessons Learned:

• Results of bench-scale testing has demonstrated this sediment is extremely difficult to treat.
• Resistant to a number of proven conventional technologies.
• A couple of new and innovative technologies showed some promise.
• A combination of technologies is probably required to treat the contaminated sediments.
• Screening evaluations such as this multiple technology testing are useful in providing a realistic assessment on remediation prospect.
Example: Landfill Leachate Treatment
Leachate Treatment - Technology Evaluation

BTEX Destruction
Advanced oxidation process worked very well
Solar-based oxidation test results showed moderate destruction rate

Boron Sequestration
Natural polymer sequestration did not show promise
Chemically-enhanced membrane filtration test produced excellent results

Ammonia Removal
Steam stripping was effective in reducing TKN to meet discharge limit
Bench-Scale Membrane Filtration System
Example: PCB Contaminated Soil

Soil Classification
Microbial Degradation
Two-Phase Partitioning Bioreactor (TPPB)

Queen’s University
Memorial University of Newfoundland
Royal Military College
University of British Columbia

Coupled with Solvent Extraction. Destruction of PAHs and PCBs.
Multiple-Technology Approach – Infrastructure Savings

- Project management
- Financial tracking
- Health and safety plan
- Sample collection/site visit
- Sample shipment, receiving and storage
- Project team
- Analytical work
- Data evaluation and reporting
Benefits of the Multiple-Technology Approach

• Comprehensive study
• Rapid assessment of conventional and innovative technologies
• Lower infrastructure cost per technology
• Contribution to technology R&D
• Prioritization of innovative technologies