ESAA Remediation Technologies Symposium

The Development of Innovative Technologies For the Remediation of Contaminated Sites

Bill Wong, P.Eng.

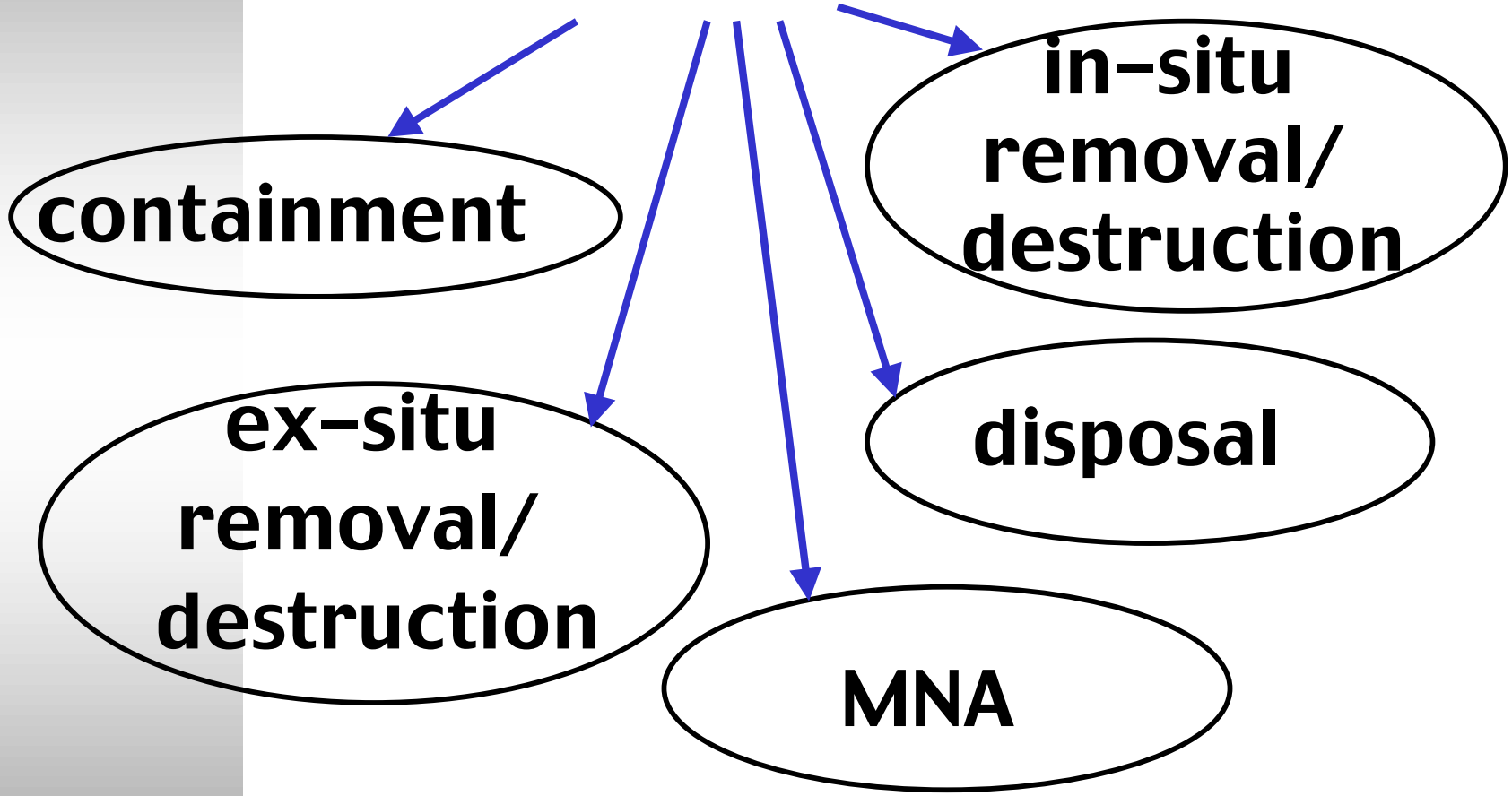
Program Manager
Environmental Technologies Program

Environmental Technology Centre
335 River Road South
Ottawa, Ontario

Environment Canada Environnement Canada

SAIC® An Employee-Owned Company

Remedial Options



Difficult to Treat Sites

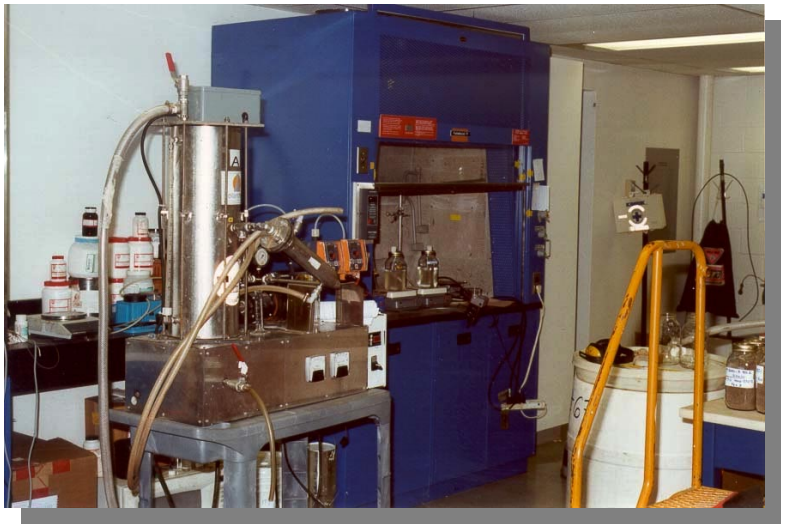
Recalcitrant Substances
Mixed Contaminants
Complex or Difficult Matrices
Wastewater

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

Environment Canada Environnement Canada

SAIC®
An Employee-Owned Company

Example: Contaminated Sediment

Sediment Sample

Environment Canada Environnement Canada

SAIC® An Employee-Owned Company

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

Environment Canada Environnement Canada

SAIC®
An Employee-Owned Company

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

Environment Canada Environnement Canada

SAIC® An Employee-Owned Company

Leachate Treatment - Technology Evaluation

BTEX Destruction

Advanced oxidation process worked very well

Solar-based oxidation test results showed moderate destruction rate

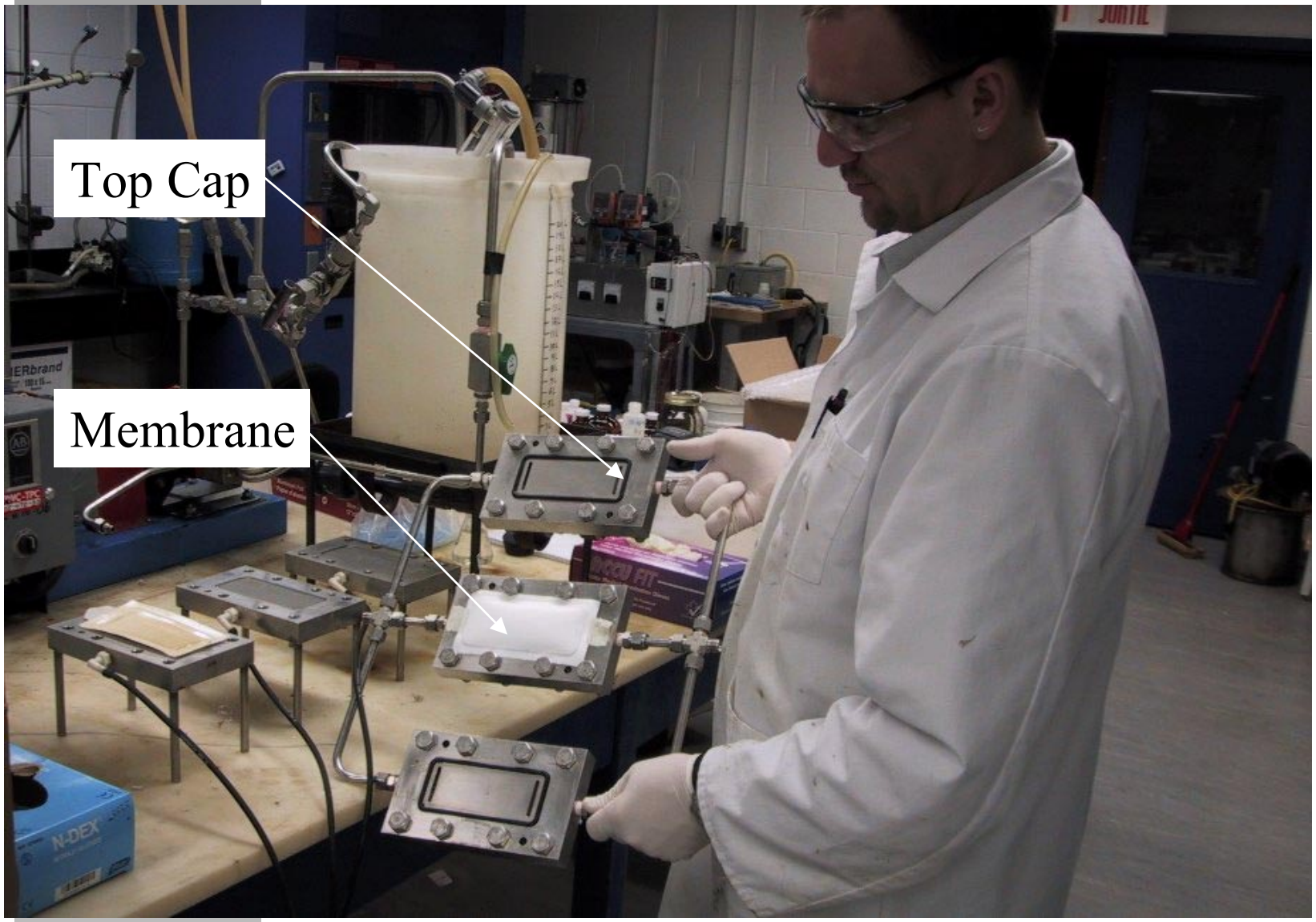
Boron Sequestration

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

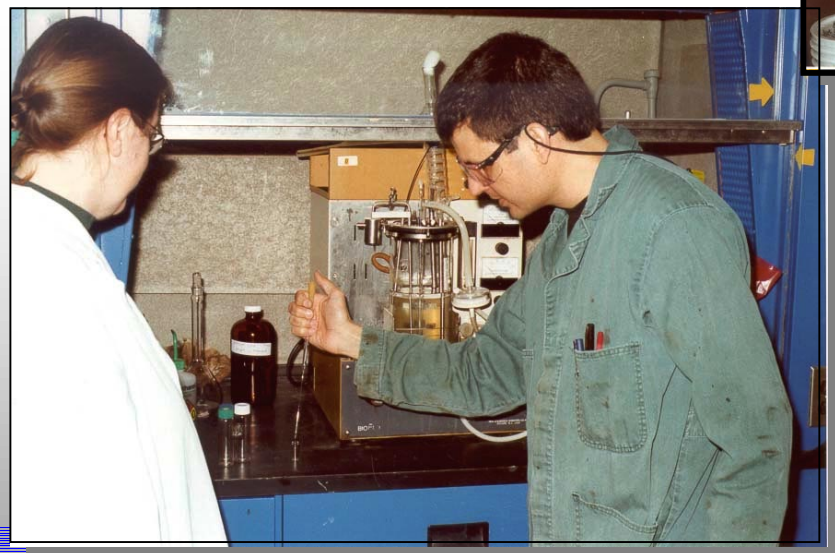
Environment Canada Environnement Canada

SAIC
An Employee-Owned Company

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.

Environment Canada Environnement Canada

SAIC®
An Employee-Owned Company

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

Environment Canada Environnement Canada

SAIC® An Employee-Owned Company

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