



Environmental Simulation and Testing to Inform Hazard Assessment and Risk Mitigation

REMTECH EUROPE

**InnoTech Alberta
Environmental Services**
Simone Levy, M.Sc., P.Ag.
Research Scientist
simone.levy@innotechalberta.ca

September 24, 2020



1

InnoTech Alberta's Suite of Services

| | | | |
|--|---|--|--|
|  <p>Technology Research, Development & Deployment</p> <p>Access to diversified range of scientific, engineering, and technological research expertise and experience</p> |  <p>De-Risking & Pilot Demonstration Facilities</p> <p>Industrial-scale research infrastructure, equipment, and demonstration facilities built to support and de-risk technological initiatives</p> |  <p>Analytical, Testing & Monitoring</p> <p>Dedicated in-house testing and monitoring capacity and expertise with data analytics, sharing, standardization/informatics, and interoperability services</p> |  <p>Innovation & Emerging Technologies</p> <p>Focus on cross-sectoral emerging technologies including industrial digital life cycle support and sandbox services</p> |
| Industrial Solutions & Program Execution | | | |



2

2



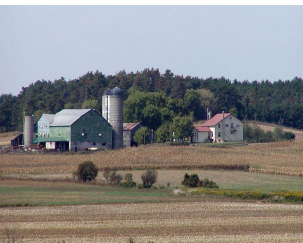
Environmental Services Division

Environmental Impact Risk Evaluation

- Contaminant fate and behavior in the environment – microcosms (anaerobic and aerobic conditions), bench scale columns, above and below ground mesocosms, field investigations
- Water resource investigations and impact assessments using isotopic tracers
- De-risking technologies and processes
- Science based policy recommendations enabled by industry/government facilitated consultation



3

Alberta Environmental Guidelines






Alberta Government

Alberta Tier 1 Soil and Groundwater Remediation Guidelines

<https://open.alberta.ca/dataset/842becf6-dc0c-4cc7-8b29-e3f383133ddc/resource/a5cd84a6-5675-4e5b-94b8-0a36887c588b/download/albertatier1guidelines-jan10-2019.pdf>



InnoTech ALBERTA
A SUBSIDIARY OF ALBERTA INNOVATES

4

Experimental Design Process

- Characterize the product – physical and chemical
- Co-develop release scenarios with client(s) and collaborators
- Identify potential land use and human/environmental receptors
- Determine necessary experimental scale – micro, bench, meso, field
- Design and conduct experiments and testing program
- Analyze results to identify hazard mitigation opportunities
- Gap analysis and additional testing if required



5

Land: Support for remediation, reclamation and land management challenges



Source: <https://www.golder.com/news/federal-funding-accelerating-the-reclamation-of-inactive-wellsites/>



Source: https://www.canadaaction.ca/alberta_oil_sands_reclamation_photos

6

6

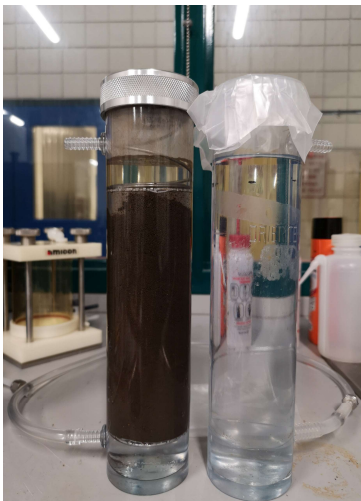
Land: Soil columns with vegetation for root analysis



7

7

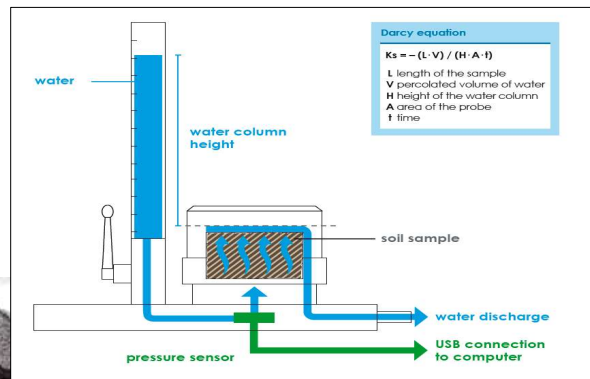
Land: Effective reclamation of hydrophobic soils



8 Assessment of re-wetting potential and retention



Filter cake



Hydraulic conductivity measurement

8

Land: Computed Tomography (CT) Imaging Centre

Industrial CT Scanning



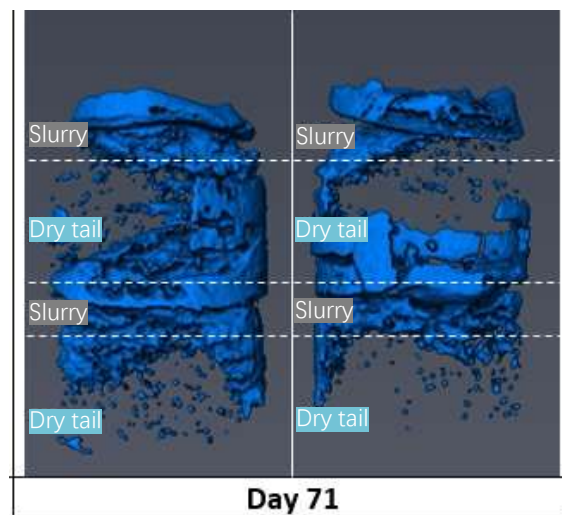
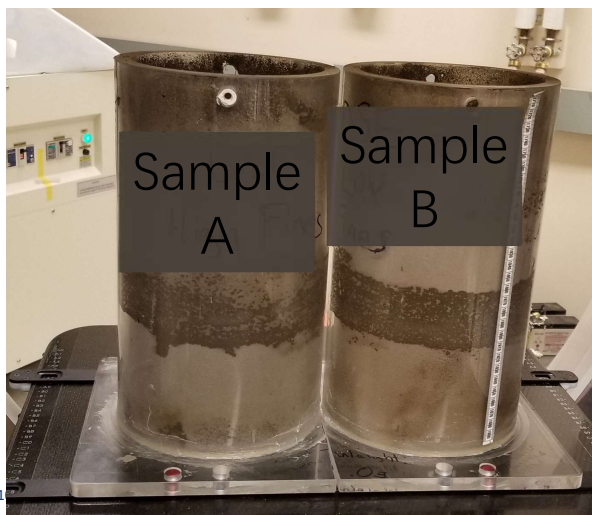
<https://innotechalberta.ca/research-facilities/computed-tomography-imaging-centre>

- *Toshiba Aquilion One X-ray CT scanner – a*
- *3rd generation 320-slice helical scanner capable of imaging up to 1.9m in length with a field of view up to 50cm in diameter.*
- *72kW of power and advanced iterative reconstruction, the scanner can acquire low-noise images in seconds or minutes*
- *72cm bore and 300kg weight limit can accommodate large-scale experiments in a laboratory setting*
- *Nominal voxel sizes down to 1/3mm available*

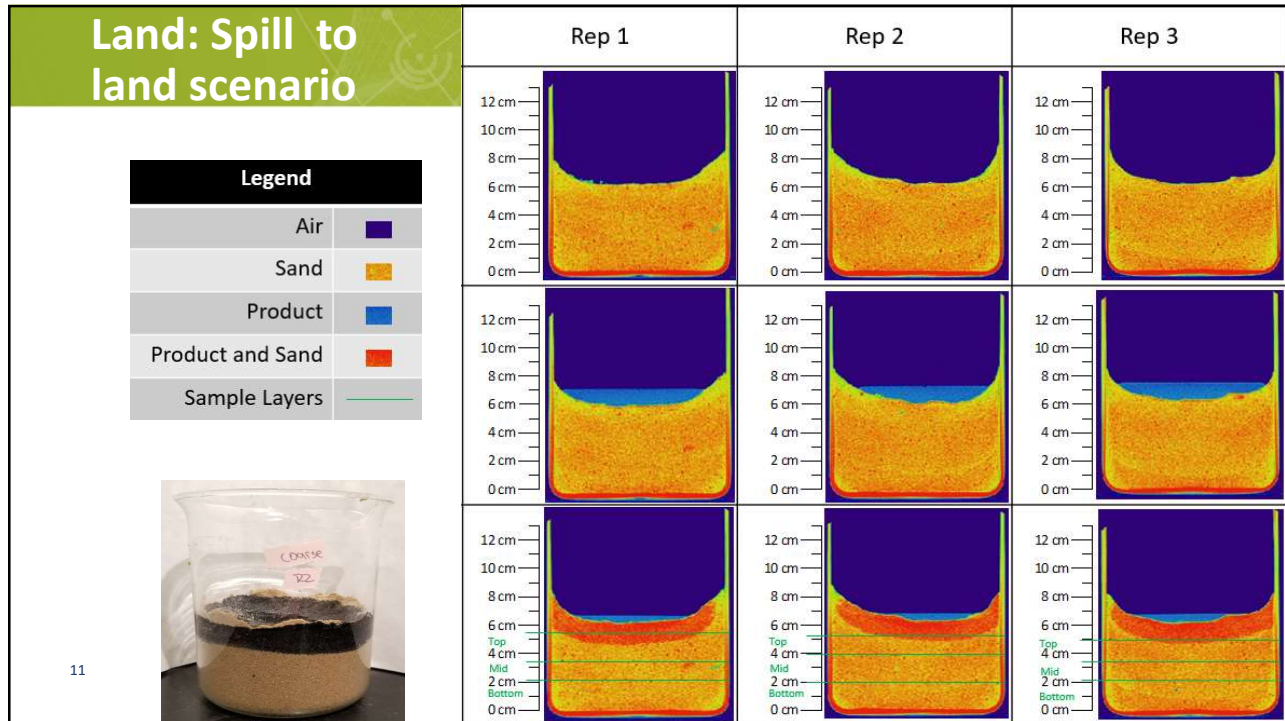


9

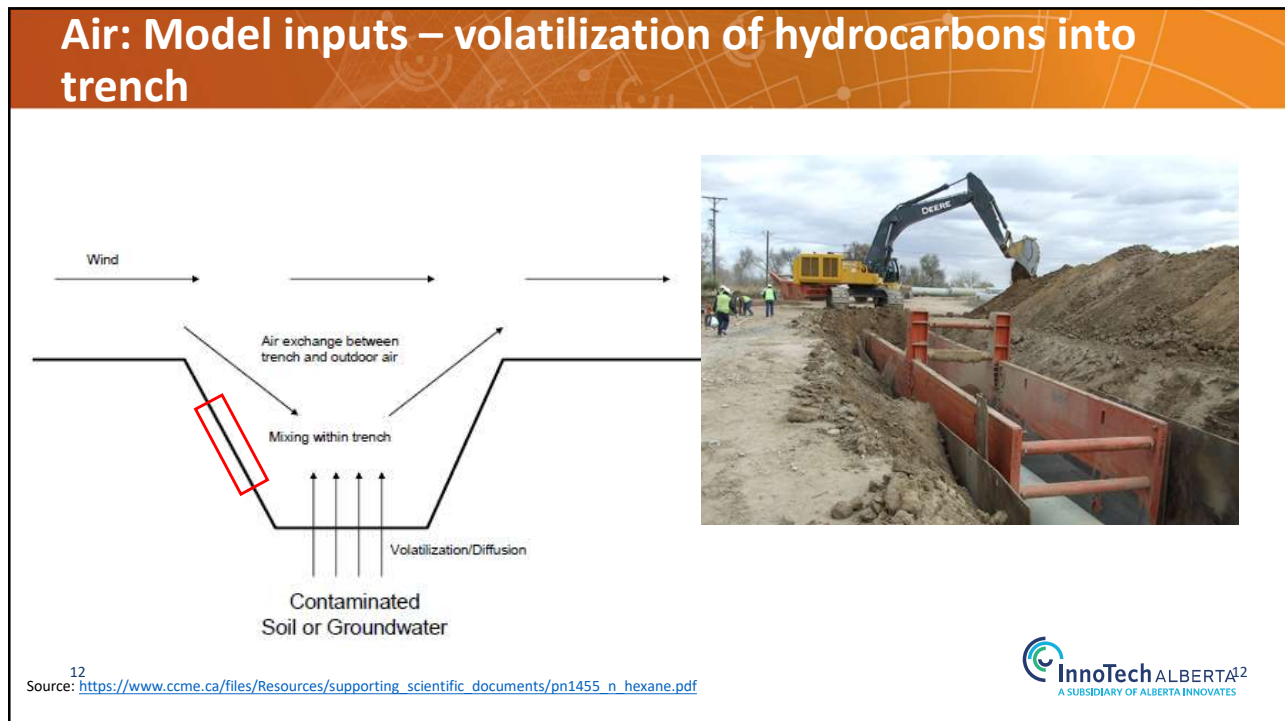
Land: Layering approach – CT Scanning to view 3D moisture distribution



10



11



12

Air: Unique headspace method – atmospheric pressure

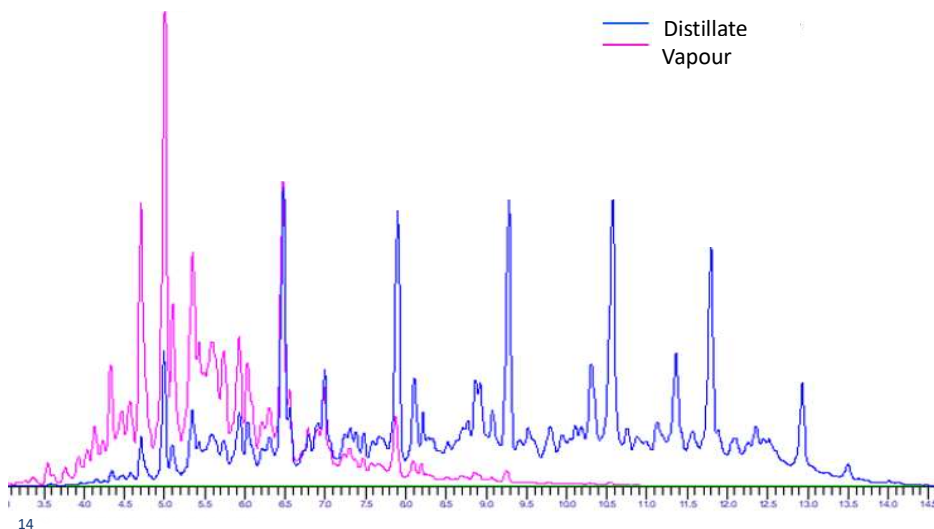


13



13

Air: Volatile vs. distillate fraction analysis



14

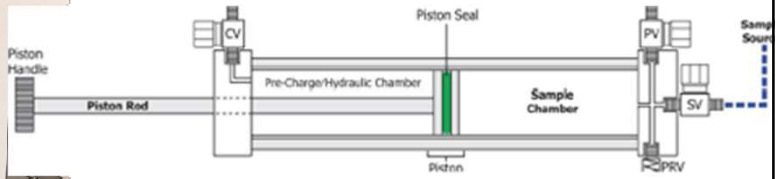


Air: Case-specific headspace analyses



Incubation at elevated temperature
– product in Tedlar bag

15



Manual piston method – V/L ratio of
4:1 (modified ASTM D8236)



Headspace vial – direct
GC analysis (1:1)



15

Water: Hydrocarbon behaviour in water



Hydrocarbon release to water experiments

16

Collaboration with CanmetENERGY (NRCan)

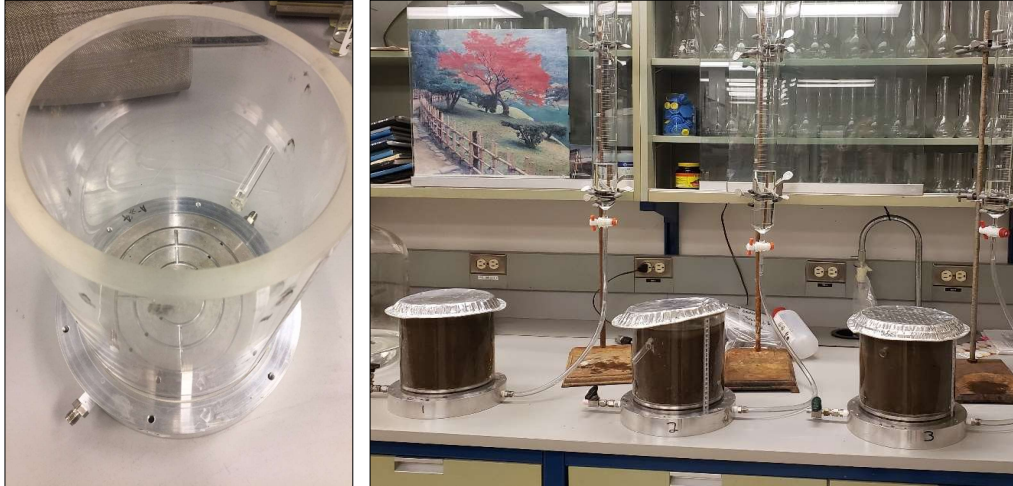


<https://www.nrcan.gc.ca/simply-science/science-dilemma-bitumen-task-1-nrcan/21288>



16

Water: Soil Leaching Columns



InnoTech ALBERTA
A SUBSIDIARY OF ALBERTA INNOVATES

17

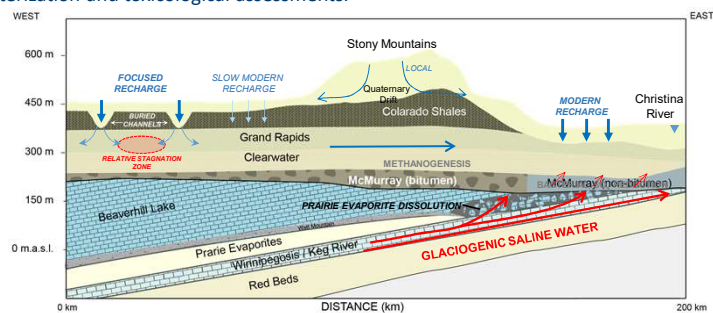
Water: OSPW Characterization and Risk

OSPW Characterization

- Ultra high-resolution MS characterization of OSPW and linking water quality to ecotoxicity.
- Projects with industry and with Alberta Environment and Parks Oil Sands Monitoring and OSPW Science Team to develop criteria for water return.
- Leading OSM Technical Advisory Committee to develop a long-term monitoring plan for groundwater.
- OSPW treatment evaluation combining organic characterization and toxicological assessments.

Conceptual Model Development

- Using geochemical and isotopic tracers to develop conceptual models for groundwater flow to inform water management.
- Hydrocarbon and microbiological characterization of oil sands tailings deposits to help develop conceptual models of pond evolution for closure strategies.



18

(Birks et al., 2019)

InnoTech ALBERTA
A SUBSIDIARY OF ALBERTA INNOVATES

18

Conclusions

- Environmental challenges presented by industry, consultants and government
- Experimental design process key to effective simulation to inform management or mitigation
- Multi-disciplinary capabilities and flexible business model allow collaboration and holistic approach to challenges

19



19

100 YEARS OF HISTORY
[InnoTech was] able to guide us on the path that they believed to be most beneficial. We took their advice and it was spot on. We ended up quadrupling our production and reducing our cost substantially.
 NORM BRIGGS, CANADIAN LASER MARKETING SOLUTIONS

NEW opportunities

100 YEARS OF HISTORY
Creativity Curiosity Can-Do Spirit Collaboration Commitment

BUILDING a better future

20+ LABS, PILOT PROJECTS & KEY FACILITIES IN **4** CITIES

InnoTech Innovation at the speed of business

Alberta
 ABMI SUNCOR
 cosia
 CN TWI

working together

20

Contact Information

Simone Levy, M.Sc., P.Ag.

Research Scientist – InnoTech Alberta

Environmental Services Division

Edmonton, AB, Canada

simone.levy@innotechalberta.ca

(780) 450-5210

21

