Conceptual Site Models and Data Collection: A Case Study
Data Collection /Analysis

Conceptual Site Model
A Case Study
Does the data tell us what we need to know?

How do we know what we need to know?
Waste Cap Sources
Sources

- Gas & Vapours
- Waste
- Leachate
- Cap material?
Receptors

- Flora & Fauna
- Humans
- Groundwater
- Aquatic Ecosystems
<table>
<thead>
<tr>
<th>Exposure Pathway</th>
<th>Current Users</th>
<th>Future Users</th>
<th>Adjacent Users</th>
<th>Groundwater Users</th>
<th>Construction Workers</th>
<th>Flora and Fauna</th>
<th>Aquatic Ecosystems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact with cap</td>
<td>✓ ?</td>
<td>?</td>
<td></td>
<td>√</td>
<td>√</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Contact with waste</td>
<td></td>
<td>?</td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inhalation indoors</td>
<td></td>
<td>?</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inhalation outdoors</td>
<td>✓ ?</td>
<td>?</td>
<td>✓</td>
<td>✓ ?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contact with groundwater</td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumption of groundwater</td>
<td>✓ ?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓ ?</td>
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<tr>
<td>Contact with surface water</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓ ?</td>
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</tbody>
</table>
Migration Pathways

- Vapour Migration in Unsaturated Zone
- Preferential Pathways
- Groundwater Transport
- Surface Runoff
Pre-waste ground surface

POSSIBLE SAND AND GRAVEL LAYERS AT DEPTH, THICKNESS AND CONNECTIVITY UNKNOWN
How many zones?
Flow direction and chemistry?
Interaction between zones?
<table>
<thead>
<tr>
<th>Well</th>
<th>Screen Length (m)</th>
<th>Screened Horizon</th>
<th>Water Level?</th>
<th>Chemistry?</th>
<th>Flow Direction?</th>
</tr>
</thead>
<tbody>
<tr>
<td>4A</td>
<td>3</td>
<td>Waste/Till</td>
<td>X</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>1A</td>
<td>3</td>
<td>Sand</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>1B</td>
<td>3</td>
<td>Sand</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>2A</td>
<td>3</td>
<td>Till/Sand</td>
<td>✓ ?</td>
<td>✓ ?</td>
<td></td>
</tr>
<tr>
<td>3A</td>
<td>3</td>
<td>Till/Sand</td>
<td>✓ ?</td>
<td>✓ ?</td>
<td></td>
</tr>
<tr>
<td>5A</td>
<td>4</td>
<td>Sand/Till</td>
<td>✓ ?</td>
<td>✓ ?</td>
<td></td>
</tr>
<tr>
<td>5B</td>
<td>2</td>
<td>Till (Bedrock??)</td>
<td>✓ ?</td>
<td>✓ ?</td>
<td>X</td>
</tr>
<tr>
<td>2B</td>
<td>6</td>
<td>Till</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3B</td>
<td>9</td>
<td>Till</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4B</td>
<td>9</td>
<td>Till</td>
<td>X</td>
<td>X</td>
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</tbody>
</table>
Composition of cap material

Composition of leachate

Vertical and lateral groundwater flow regime

Presence or absence of DUA

Sources

Migration Pathways

Exposure Pathways & Receptors

Direct Contact with Soil

Chemical Quality of cap material unknown

Possible. Rooting depths not confirmed

Vertical Migration through cap

Dispersion in air

Gas Inhalation Outdoors

Possible. Gas and vapours released through cap. Concentrations in breathing zone to be confirmed

Depends on future Land use

Lateral and vertical migration through unsaturated sand

Conduits into buildings and accumulate in buildings

Decomposition of waste

Preferential pathway through utility corridors

Inhalation Indoors

Methane detected through floor cracks in buildings to north-east

Depends on future Land use

Volatilisation

Groundwater abstraction

Consumption of groundwater or DUAs

Possible. Water Usage and hydrogeological regime to be confirmed

Leachate/contaminated shallow groundwater

Lateral and vertical migration through saturated sand and gravel layers

Background sources of contamination

Dissolution in groundwater

Mixing with deeper groundwater

Direct Contact with Groundwater

Possible. Water Usage and hydrogeological regime to be confirmed

Discharge to surface water

Possible. Presence of seasonal ponds and connection to Bow River to be confirmed.
Objectives

Determine composition of cap material

Determine composition of leachate

Characterize Groundwater Flow Regime

Identify potential DUAs
Cap

Gas

Till

Till/Sand

Waste

Confined sand layer

Bedrock Potentiometric Surface

Leachate
Potential human exposure to VOCs

Risk Assessment required
The Conceptual Site Model...
...and data collection.
What is the question?
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(403) 247-0200
Thank You
Merci
Gracias
Danke
Salamat