CREATING AND DELIVERING BETTER SOLUTIONS
Managing and Mitigating Extensive Subsurface Fuel Product Beneath Two Inner-City Heritage Buildings

Ken Friedrich, P.Eng., The City of Edmonton
Paul R. Morton, P.Geol., EBA Engineering
• **Part I, Description and Planning** – location, buildings, stakeholders, integration with other activity.

• **Part II, Scope and Risk** – hydrocarbon impacts, remediation ranking, remediation modes, field trial.

• **Part III, Design** - remediation components.

• **Part IV, Implementation** - HDD and well construction, difficulties and problems, commissioning, remediation progress to-date, community benefits.
Part I, Description and Planning - Location
Part I, Description and Planning - Buildings

Knox Church

Transalta Arts Barns
(Fringe Theatre Building)

Strathcona Library
Part I, Description and Planning - Stakeholders

- Knox Church
- The City of Edmonton:
  - Community Services, Drainage Services, Library Board, Planning and Development, Property Management, Transportation and Streets
- Edmonton Radial Railway Society (leasing rail ROW)
- Edmonton International Fringe Theatre Festival
- Heritage Resources Management Branch
- Old Strathcona Foundation
- Regulatory (Alberta Environment)
Part I, Description and Planning – Integration

Library Restoration and Expansion
Part I, Description and Planning – Integration
Part I, Description and Planning – Integration

- Library Restoration and Expansion
- Edmonton Fringe Festival (August)
- 84 Avenue Upgrading
- High Level Streetcar Requirements
• **Part I, Description and Planning** – location, buildings, stakeholders, integration with other activity.

• **Part II, Scope and Risk** – hydrocarbon impacts, remediation ranking, remediation modes, field trial.

• **Part III, Design** - remediation components.

• **Part IV, Implementation** - HDD and well construction, difficulties and problems, commissioning, remediation progress to-date, community benefits.
Part II, Scope and Risk - Hydrocarbon Impacts

Diesel Fuel Product in Monitoring Wells (Red)

Dissolved Hydrocarbons in Monitoring Wells (Orange)
## Part II, Scope and Risk - Remediation Ranking

### Ranking for Groundwater Remediation Difficulty

<table>
<thead>
<tr>
<th>Host Media</th>
<th>Mobile Dissolved (Degraded/Volatilizes)</th>
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<th>Strongly Sorbed, Dissolved (Degraded/Volatilizes)</th>
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<th>Separate Phase LNAPL</th>
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<tbody>
<tr>
<td>Homogeneous Single Layer</td>
<td>1</td>
<td>1 - 2</td>
<td>2</td>
<td>2 - 3</td>
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<td>3</td>
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<td>Homogeneous Multiple Layers</td>
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<td>Heterogeneous Single Layer</td>
<td>2</td>
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<td>3</td>
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<td>4</td>
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<tr>
<td>Fractured Bedrock</td>
<td>3</td>
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Note: 1 = least difficult, 4 = most difficult

National Research Council
• Vertical and inclined wells
  – proven for liquid and vapour phases
    e.g., BV, IAS, SVE, MPE, P & T
  – MPE copes well with WT fluctuation
• Horizontal wells
  – proven for vapour phase
    e.g., BV, SVE
  – proven for fully submerged liquid phase
    e.g., P & T, possibly IAS
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### Vertical Wells Versus Horizontal Wells (for MPE)

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Part II, Scope and Risk - Field Trial
Part III, Design - Remediation Components

• Extraction wells
  – 100 metre long HDD wells (3)
  – Custom slot size
  – End-of-well vacuum sensors
  – Pneumatic well flushing
• Liquids separation and collection
• Water treatment (solids, GAC, MCM)
• Off-gas catalytic oxidation (incineration)
• Sensor data acquisition and PLC system
• Satellite link for Web monitoring and control
• Secure and noise-reducing enclosure
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Part IV, Implementation - Difficulties and Problems
Part IV, Implementation - Commissioning

Treated Water Sampling (COE Sewer Bylaw)

Catalytic Oxidizer (Incinerator) for Off-gas Destruction
## Part IV, Implementation – Remediation Progress

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<tr>
<th>Well ID</th>
<th>In-well Product Thickness (cm)</th>
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<tbody>
<tr>
<td>103</td>
<td>34</td>
</tr>
<tr>
<td>104</td>
<td>51</td>
</tr>
<tr>
<td>107</td>
<td>26</td>
</tr>
<tr>
<td>108</td>
<td>7</td>
</tr>
<tr>
<td>207</td>
<td>17</td>
</tr>
<tr>
<td>BH 4-3</td>
<td>5</td>
</tr>
<tr>
<td>BH 4-4</td>
<td>10</td>
</tr>
</tbody>
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Part IV, Implementation – Remediation Progress

Extracted hydrocarbon mass (approx.):

- Separated phase (oil)  50 kg
- Sorbed phase (GAC)    160 kg
- Sorbed phase (MCM)    1,415 kg
- Vapour phase (oxidized) 8,600 kg

Total (March - September, 2006) ±10,225 kg
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Total (March - September, 2006) ±10,225 kg
(±12,500 litres, or ±2,750 igal.)
Part IV, Implementation - Community Benefits
Acknowledgments – Project Team

ALS

Ground Effects Environmental Services Inc.

HO Hamilton & Olsen Surveys Ltd

Creating and delivering better solutions
Thank You
CREATING AND DELIVERING BETTER SOLUTIONS