Site Work & Installation
Dewatering of site required for excavation of underground structures

Large Scale Pump Test
Fit of Observed and Modelled Water Table at Site during Dewatering Activity.
Hydrogeologic Study of Slurry Wall Installation
Impermeable Slurry Wall
Water Table and Flow Lines

$K=10^{-11}$
Fit of Observed and Modelled Water Table at Site

Impervious Slurry Wall

K = 10^{-11}
‘Z’ Leakage to underlying glacial till deposits

$K_z = 10^{-9}$

Water Table and Flow Lines
'Leaky' Glacial Till

Fit of Observed and Modelled Water Table at Site

Observed heads (m)

BH7 Multilevel
Install Reactor
PLAN OF REACTOR UNIT

- Gravel drainage material around reactor omitted for clarity
- Compacted clay backfill
- Reinforced concrete roofing slab
- Inlet
- Interceptor
- 100mm diameter HDPE pipe extending into gravel trench 2.0m below outlet weir
- 600mm wide gravel filled trench, depth to be confirmed
<table>
<thead>
<tr>
<th>Contaminant (mg/l)</th>
<th>Groundwater Plume</th>
<th>Interceptor</th>
<th>After Aerobic PRB Reactor</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRO</td>
<td>13.3</td>
<td>2.6</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Acenaphthene</td>
<td>4.8</td>
<td>6.4</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Acenaphtlyene</td>
<td>10.2</td>
<td>5.5</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Anthracene</td>
<td>1.0</td>
<td>1.6</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Flouranathene</td>
<td>0.6</td>
<td>0.9</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Flourine</td>
<td>5.7</td>
<td>9.8</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Napthalene</td>
<td>320.8</td>
<td>57.7</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Phenanthrene</td>
<td>3.7</td>
<td>5.4</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Pyrene</td>
<td>0.4</td>
<td>0.4</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Substituted Phenol Isomers</td>
<td>4.3</td>
<td>0.6</td>
<td>&lt;0.01</td>
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<tr>
<td>Benzene</td>
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<td>0.4</td>
<td>&lt;0.01</td>
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<tr>
<td>Toluene</td>
<td>1.7</td>
<td>0.07</td>
<td>&lt;0.01</td>
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<tr>
<td>Xylenes</td>
<td>1.0</td>
<td>0.05</td>
<td>&lt;0.01</td>
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<tr>
<td>TOC</td>
<td>83</td>
<td>20</td>
<td>3</td>
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<tr>
<td>Total Cyanides</td>
<td>10.5</td>
<td>8.9</td>
<td>1.5</td>
</tr>
<tr>
<td>Arsenic</td>
<td>0.06</td>
<td>0.12</td>
<td>0.07</td>
</tr>
<tr>
<td>Nitrate</td>
<td>&lt;0.3</td>
<td>&lt;0.3</td>
<td>6.2</td>
</tr>
<tr>
<td>Ammonia</td>
<td>74</td>
<td>19.4</td>
<td>0.8</td>
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<tr>
<td>Sulphate</td>
<td>450</td>
<td>590</td>
<td>530</td>
</tr>
<tr>
<td>COD</td>
<td>295</td>
<td>NA</td>
<td>15 (?)</td>
</tr>
</tbody>
</table>

The following compounds are not found above detection limits in the groundwater plume at the EPSRC WPM site: Benz(a)anthracene, Benz(a)pyrene, Benz(b)flouranthene, Benz(ghi)perylen, Chrysene, Dibenzo(ah)anthracene, Indeno(123cd)pyrene, Chromium, Cadmium, Copper, Lead, Zinc, Nickel, Mercury.
Bob’s team took it apart Oct 2002 – Why and lessons:

✓ Collect microbiological samples
✓ LDPE Liner ripped during heavy rain event
✓ ‘Cheap construction’ allowed by-pass flow (honourable idea but not sustainable)
✓ How easy is it to clean one of these out? (Pick Your Weather!!!)
✓ Try new hydraulic design internally for controlled flow

✓ We are changing box as Flood ruined the structure
  (1 monthly average rainfall in 1.5 hours saw all streets and site completely flooded!)

✓ Sampling for microbial repopulation
  Using DNA arrays and microtox.

New Box will be shuttered
QUB Strategic Research Infrastructure Grant

Prof. R. Kalin PI
Geo-environmental Engineering Lab
Environmental Tracers Laboratory
Research Offices
Microbial Biotechnology Labs
Mass Spectrometry Labs

SRIF Environmental Engineering Equipment
Analytical & Field

SRIF Microbial Biotechnology Equipment
Complete DNA Array

SRIF = £2,429,750

Technology Development Grant

QUESTOR Tools Staffing
21 new Research Staff

QUESTOR Tools = £2,145,000
QUB Brownfield Development R&D Strategy:

30 Years Source Reduction at active sites
30 Years Boundary Interception at active sites
30 Years MNA Plume in urban environment
New R&D Projects 2003 for Sustainable Urban Brownfield Remediation Design

BBSRC Link – SEREBAR £1.65M
PRB at active industrial site

EPSRC InStep & NERC Impart - £750K
Enhanced in-situ source treatment
at active industrial site

New Installation Methods & Treatment Cells

Review of existing PRB’s with respect to Guidance
Treatment Cell at QUB Science Park

Treatment of TPH Source via in-situ bioremediation over next 10 years
Design of geotechnical systems to protect funnel and simplify the use of trench-and-gate PRB Installations

EcoMESH and Keller Ground Engineering (Hayward Baker)
PRBs in the UK: New Agency Guidance
Old Friends & New Sequential Reactors

Message from UK to USA…
What about decommissioning Iron walls?