Market Adoption of Sustainable Development Practices in the Field of Contaminated Site Remediation

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May 31, 2011
Overview

- **4-minute global journey** from:
  - Melbourne, Australia, to
  - Belleville, Ontario, and cross-Canada to
  - Nanaimo, BC

- 1 private sector example and 2 public sector examples

- Brief summary of challenges, obstacles and lessons learned
Sustainable Remediation Drivers

- **Business Drivers**
  - Brand, reputation, competition, ...
  - Risk management, cost reduction, revenue enhancement, ...
  - Business continuity, supply chain protection, ...

- **“Sustainable Communities” Drivers** (from FCM & CMHC)
  - Compact community with balanced mix of activities, housing, & commercial, institutional, recreational and/or industrial land uses
  - Reduces fossil-fuel use from personal vehicle travel and provides opportunities for energy-efficient & healthy alternatives
  - Energy efficient, balancing energy supply and minimizing GHG emissions
  - Minimizes the use and disposal of water and negative impacts on watersheds
  - Resilient and connected – climate, economy, environment & social
  - Efficient use of resources, incl. waste
  - Protects, and enhances /restores the natural environment and cultural heritage
Melbourne, Australia

- Austral Bricks, a brick manufacturer, closed a quarry after 50 years
- Quarry had been far outside the city limits and now was in the city
- High demand for residential housing in the area

Approach used:
- **Environment** – Combine innovative and traditional technical approaches to reduce remediation costs, increase on-site mgmt of impacts, and create sustainable landform ready to redevelop
- **Social** – Sustainable landform meant that the site could easily and quickly be used for residential purposes to house several thousand; strengthened relationships between Austral Bricks, community and regulatory agencies
- **Economic** – Value added to land for Austral Bricks and for community; value added to asset for Austral Bricks; ongoing liabilities eliminated; revitalized local community

*Australia: Austral Bricks Project won several awards*
Belleville, Ontario

- Meyer’s Pier
  - underutilized waterfront property
  - since 1700s, impacted by materials used to create the land through infilling the Bay and by heavy industrial use
- City revitalized the site, now called ‘Jane Forrester Park’

Approach used:
- **Environment** - Innovative technical approach to reduce remediation costs, increase on-site management of impacts, and protect sensitive waterfront ecosystem
- **Social** – Added to waterfront trail system; became location of community-based events and gatherings, incl. concerts, and festivals; re-named for culture/heritage
- **Economic** - Vibrant public park with a revitalized marina inspired private investment for adjacent residential development

Won the 2010 Canadian Urban Institute (CUI) Public Realm Award
Nanaimo, BC

- Conference Center was proposed to become the centerpiece of downtown core revitalization project
- Goal to replace a cluster of derelict buildings with a modern complex
- Part of downtown area was originally underwater, part of an inlet; filled since the late 1800s with natural fill as well as wood and metal debris, blast rock and coal waste; soil and groundwater contamination

Approach used:
- **Environment** – Innovative technical approach (i.e., cutter soil mixing using Dutch technology) reduced remediation costs, increased ability to manage impacts on-site, and improved geotechnical and seismic conditions
- **Social** – Challenge was that city undertook a referendum regarding whether to go ahead – received a 51% majority; went ahead, and ended in success and many awards
- **Economic** – Value added to land; revitalized downtown
Challenges, Obstacles, Lessons ...

- Some challenges and obstacles
  - Technical
    - Technical challenges and obstacles overlain with challenge of increasing comfort level of stakeholders with the concepts and with innovative solutions
  - Financial/Economic
    - Public and private clients had a lot at stake for the success of the project – concerns about cost certainty, process certainty, timeline certainty, ..
  - Social/Political
    - Developing and retaining stakeholder support; reputation

- Some lessons learned
  - Opportunities for transfer of global experience applied locally
  - Stakeholder support and approaching stakeholders
  - Sustainable remediation continues to be essential for communities, government and business
Challenges, Obstacles, Lessons ...

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Some lessons learned
- Continuing opportunities for transfer of global experience applied for local solutions
- Stakeholder support and approaching stakeholders
- SR continues to be essential for communities, government and business

Key issue – By 2050, 70% of the global population will live in cities.
Sustainable Remediation
Case Study

05/ 2011 • Kingston, Ontario
## Case Study - Railyard

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<th>Challenges</th>
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<th>Outcomes and Lessons Learned</th>
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| - Current regulatory guidance  
- Risk perception vs true risk  
- Common understanding of sustainability terms and how these apply to remediation | - Background: Bioslurp operated at the site for 10 years to address diesel product, followed by 2 years of less active recovery  
- Technical arguments demonstrating limited mobility and calculated impacts of continued remediation  
- Dialogue with regulators focused on technical arguments and risk | - Agreement to cease remediation and working towards pathway to closure.  
Lessons learned:  
- focus on technical argument (i.e. common understanding of risk)  
- communicate and engage early in the process  
- Keep looking at sustainability through remediation life cycle |
Sustainability Results Presented

Quarterly Bailing/Skimming

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© Golder Associates
Project: Farnworth Lake, MB

- Challenge: Treat aviation fuel (BTEX) in groundwater

- Conventional technology with innovation: Seasonal air sparging using windmills to operate compressor to supply air to injection wells

- Need for innovation: remote location, subarctic climate, lack of access to electricity

- Benefits: Minimal mobilization and maintenance, savings of $100-$300K
Project: Sikanni, BC

- Challenge addressed: Reduce environmental footprint of all remedial stages for a site where soil and groundwater contaminated by petroleum hydrocarbons and metals in a remote northern location.

- Innovative approach: Development of a green remediation support tool incorporating Green Remediation Indicators (GHG, water, waste, environmental impacts) with on-going assessment of benefits.

- Requirement for innovation: Interest in expanding remedial options analysis to include green remediation factors.

- Benefits: systematic and flexible, considers triple bottom line throughout remediation life cycle, add on to existing tools, expandable database.
Permeable reactive barrier technology

- Innovative in-situ groundwater treatment methods - iron, mulch, compost PRBs for chlorinated solvents, trace metals
- Conservation of water (no pumping)
- No energy inputs
- Use of by-products from industrial (ZVI) and agricultural processes
- In-situ treatment- Preserves use of land above the system (no above-ground structures)
- Acceptance driven by economics, long-term performance
- Extension into injectable materials (e.g. ZVI, EHC) which minimize disturbance to land surface

Upper photo, AFCEE, 2008, lower photo from EnviroMetal Technologies Inc.)
Green Remediation: Artesian Groundwater Capture and Treatment System

- Groundwater impacted with TCE was discharging to an unnamed creek.

- A “green” groundwater remedy was designed and installed that takes advantage of the artesian conditions along the edge of the floodplain, where groundwater naturally discharges to the floodplain and creek.

- Groundwater collected along the toe of the plume, treats the contaminants, and returns clean water to the natural system without any external energy source. The final remedy includes the following components:

  • 5 passive Carbon Artesian Treatment Vessels (CATV), with 4 extraction wells feeding each vessel.
  • 20 extraction wells provide complete capture and treatment at toe of plume prior to discharge.

Naturally upward flowing groundwater is directed into the bottom of the CATV for treatment as it percolates upwards. Treated groundwater exits through piping at the top to the ground surface and subsequently discharges to the floodplain and unnamed creek.
Green Remediation: Artesian Groundwater Capture and Treatment System

The benefits of this sustainable remediation approach include the following:

• Complete plume capture and treatment prior to floodplain/surface water discharge

• Reliance on natural pressure gradients and gravity feed means no external power source is required, reducing the system’s impact on the environment, and providing sensitive riparian protection through:
  ✓ no air emissions
  ✓ no waste products
  ✓ no operational noise
  ✓ limited disturbance to install the system, and
  ✓ limited O&M requirements

• Carbon change outs are not anticipated to be needed for at least 5-7 years.
Lake City Army Ammunition Plant, MO

Performance-based Remediation of 33 Areas of Concern at the LCAAP

- Over-1,000 tree phytoremediation system was installed to manage groundwater hydraulics issues related to an underperforming permeable reactive barrier groundwater remediation system.

- Existing remedial system infrastructure was integrated into final remedies as a “recycling” measure and to reduce the system footprint.

- Extracted groundwater was reused for elements of the final remedy (as a water source for mixing operations, long-term water source for in situ bioremediation injections, etc.)

- Passive, sustainable remediation systems (e.g. phytoremediation and solar-powered mechanical equipment) were integrated with on-going facility operations to lesson the net environmental impact of remediation activities.

- Waste generation was minimized by developing on site treatment methods for impacted soil (17,000 tons) and by using passive sampling devices for groundwater sample collection.

Seven mobile solar-powered systems were deployed to recover hazardous liquids, including DNAPL and LNAPL. This passive energy equipment is low maintenance and low cost, maximizes early mass removal, and requires no external utility power.
Remediation Program – Zone 1

- Excavate and stockpile un-impacted overburden soils.
- Excavate down 8 m into fractured bedrock.
- Crush rock to 3 in. or less and spread on asphalt treatment pad.
- Add pre-measured 50/50 iron powder and mix with soil.
- Add pre-measure bentonite to soil/rock/iron mix.
- Spread mixture back in excavation, misting in lifts.
Excavate and stockpile un-impacted overburden soils.
Excavate down to approximately bedrock interface at 3.5 m.
Mix pre-measured sand and iron in concrete trucks.
Spread sand/iron mix in excavation lifts alternating with impacted soil.