



Soil and Materials Engineering  
Environmental Engineering  
Building Science  
Supply Chain Quality



**Treatment of Contaminated Soil from the Oil  
Freight Derailment at Lac-Mégantic, QC**  
Remediation Technologies Symposium 2014

**LVM, a division of EnGlobe Corp.**

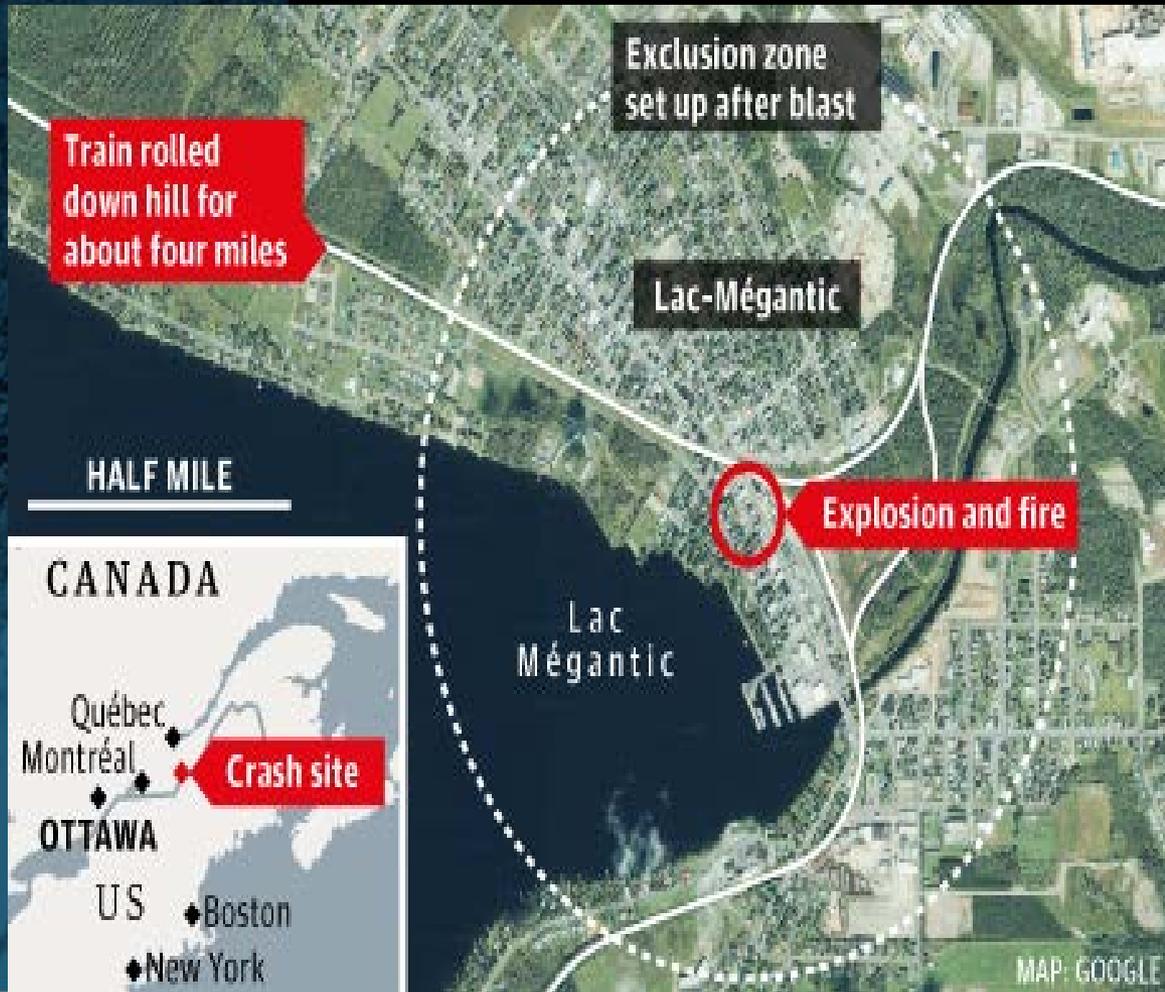
# Lac-Mégantic Derailment, July 6, 2013

- + 72 car freight train carrying Bakken formation crude oil
- + 5,7 million litres of light crude spilled over, under and through Lac-Mégantic
- + A total of 31 ha are affected by the crude oil spill
- + Estimated 558,000 metric tons of impacted soil.



# Lac-Mégantic Derailment, July 6, 2013

- + Lac-Mégantic is located in the Eastern Township of the Canadian province of Quebec
- + Initial reports described a 1 km blast radius
- + It is the fourth deadliest rail accident in Canadian history (killing 47 people)
- + At least 30 buildings were destroyed of which several were historic buildings



# Soil Remediation Targets

- + In accordance with the Environmental Quality Act and Hazardous Materials Regulation:

*" If soils and water are contaminated following an accidental spill the person responsible must take action to restore the site to the quality it had before the incident"*

- + Generic criteria "A" from the Soil Protection and Contaminated Sites Rehabilitation Policy was determined as the remediation target for the Lac-Mégantic city centre area

## **Petroleum Hydrocarbons**

**C<sub>10</sub> to C<sub>50</sub> < 300 mg/kg**

**Benzene < 0.1 mg/kg**

**Toluene < 0.2 mg/kg**

**Ethyl benzene < 0.2 mg/kg**

**Xylenes < 0.2 mg/kg**

**Individual PAHs = 0.1mg/kg**

# Request for Proposals

Call for tenders based only on price following a technical pre-qualification

Only 4 prices were required:

- + Unit rate for treatment of heavy contaminated soil ">B"
- + Unit rate for treatment of light contaminated soil "A-B"
- + Unit rate for backfill "A"
- + Unit rate for landfill (non treatable materials)



# Estimated Soil Quantity to be Treated

- + At the time of the tendering process, approximately 135,000 m.t. of soils were excavated and temporarily stockpiled at various locations either within the city centre or at the soil facility built within the industrial park of Lac-Mégantic owned by the city
- + At the time of the tender process, the volume estimates were:
  - + 228,600 m.t. of >B soils
  - + 329,400 m.t. of A-B soils
  - + 360,000 m.t. of backfill



# Selection of Remediation Methodology

## Contractual Requirements:

- + Soil treatment duration of < 3 years (If at the temporary facility owned by Lac-Mégantic )
- + Technology need to reach a 80% soil treatment efficiency
- + Stringent backfill criteria (<A)
- + 360,000 m.t. of backfill needed at the city centre by December 2014 (< 1 year of treatment);
- + Find an alternative use for remaining treated soil (198,000 m.t.)



# Selection of Remediation Methodology

- + On site treatment at the city soil storage facility built during the emergency response (small foot print, short time frame for large volume)
- + Off site treatment by building a treatment facility on a private industrial property nearby (allowing larger foot print, longer treatment timeframe, potential on site treated soil re-use)
- + Using a combination of treatment methods such as :
  - + Thermal Desorption
  - + Soil Washing
  - + Ex situ Bio-treatment "Biopiles"



# Selection of Remediation Methodology

## *Thermal Desorption*

### Pros

- + Treatment rapidity  
(30-40 m.t. per hour)
- + Smaller foot print
- + Capability to meet stringent treatment end points (<A)
- + Possibility of producing a large amount of backfill before December 2014 reducing backfill import

### Cons

- No natural gas on site, need to import large quantity of fuel
- Very variable hydrocarbons concentration and moisture in soil (very low to very high)
- Difficulty to guarantee unit price since lots of variables
- Cost

# Selection of Remediation Methodology

## Soil Washing

### Pros

- + Treatment rapidity (150 m.t. per hour)
- + Smaller foot print
- + Possibility of producing a large amount of backfill before December 2014 reducing backfill import

### Cons

- Methods not used in Quebec  
Concerns regarding the presence of coal and slags in soil (railroad historical activities)
- Concerns of PAHs treatment in fine soil fraction

# Selection of Remediation Methodology

## *Biopiles*

### Pros

- + LVM has excellent knowledge and has lots of experience with biotreatment
- + Very versatile and less impacted by soil variables (contaminated concentrations, soil moisture, particle size, etc.) easier to evaluate unit cost per ton metric
- + Low cost (guaranteed)

### Cons

- Requires a larger timeframe for treatment (Backfill by Dec.12)
- Concerns regarding the presence of coal and slags in soil (railroad historical activities)
- Requires a larger amount of backfill imports since remedial end points are very stringent, especially for PAHs
- Large amount of treated soil to be re-used on host sites

# Selected Remediation Methodology

- + On site treatment at the existing Lac-Mégantic soil storage facility
- + Biological treatment by "Biopiles" using a design of multiple levels
- + Addition of 1 treatment platform for a total of 4 platforms at the facility:
  - + 1 platform for storage
  - + 2 platforms for treatment of B
  - + 1 platform for treatment of A-B
- + On site treatment capability of 140,000 m.t. per year
- + Possibility of returning 50,000 m.t. of backfill at the city centre by December 2014
- + Re-use of treated soil for the reclamation of nearby old mines



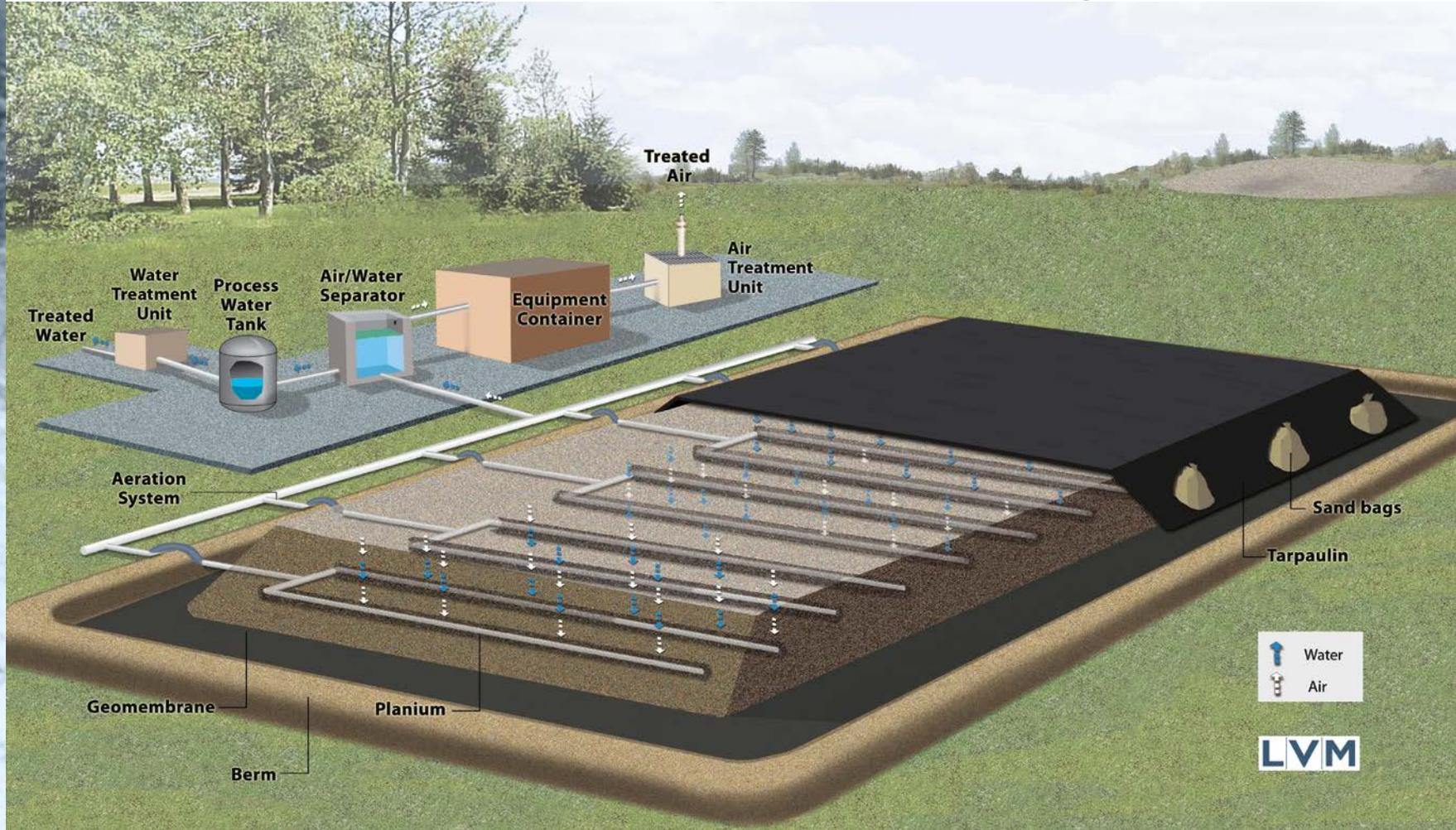
# Impacts on the population of Lac-Mégantic

## Site setting

- + Soil treatment facility is located within the industrial park of Lac-Mégantic
- + The site is owned by the municipality of Lac-Mégantic, which is a supporter of the soil remediation methodologies involving soil re-use
- + The facility was issued a C of A by the Ministry of Environment
- + Platforms previously built by the Ministry of Environment were utilized in addition to new ones built by LVM



# Selected Remediation Methodology



# Selected Remediation Methodology

- + Reception of an average volume of 2,500 m.t. of soil per day (150 truck loads)
- + Management of average volume of 4,000 m.t. of backfill per day (235 truck loads)
- + Re-use of an average volume of 2,000 m.t. of treated soil per day (60 truck loads)



# Selected Remediation Methodology

- + 100% completed in Summer 2016
- + Estimate of 240,000 m.t.
- + 99% Treated /Re-use



# Impacts on the population of Lac-Mégantic

## Social impacts

- + Additionally to LVM employees, 3 people from Lac-Mégantic were hired for the duration of the project
- + Field work also includes the participation of between 5 and 10 people from local subcontractors
- + Use of local suppliers (e.g. tools rental, hardware, electrician, traffic signs, etc.)
- + Other local impacts includes houses rental for employees, hotels, restaurants, groceries, etc.)



# Impacts on the population of Lac-Mégantic

## Environmental Impacts

- + The facility is subject to daily frequent inspections by the regulators
- + Air and water treatment measures are in place to ensure environmental compliance with the municipal and provincial regulations, and by laws. It also prevent the emission of odors in the neighborhood
- + Strict traffic rules and signalisation are in place and enforced
- + Mitigation measures are also in place to reduce dust



# Aknowledgment

## Client

- + Minister of Sustainable Development, Environment and the Fight against Climate Change

## Key personnel from the project team

## Pictures

- +Canadian Press
- +The Gazette

