

Remediation and Restoration of the Lac Mégantic, Quebec Oil Train Disaster

Todd Schwendeman, CHMM, AECOM Jocelyn Marcotte, PE, AECOM Bruce Noble, PE, AECOM

# Agenda

- Chronology of Lac Mégantic Derailment
- Summary of Environmental Impacts
- Emergency Response Activities and Timeline
- Post-emergency Remediation Activities
- Site Restoration Activities
- CTSB Summary of Disaster Causes
- Path Forward

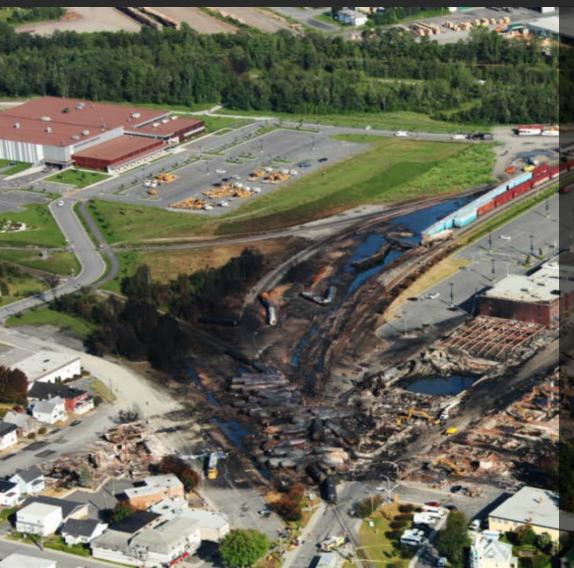








#### **Chronology (July 5 - 6, 2013)**



- 72 Bakken crude oil tankers parked overnight 10 kilometers west of Lac-Mégantic
- Rail crew sets hydraulic and hand brakes, departs approximately 11:25 pm
- Fire reported in the parked train engine at 11:30 p.m.
- Nantes Fire brigade responds, train engine shut down, fire extinguished and depart scene at 12:00 a.m.
- Train begins rolling downhill towards Lac-Mégantic
- At 1:15 a.m. train derails in Lac-Mégantic
- 67 rail cars spill contents with subsequent explosions and fire
- ~150 responders from Quebec and US
- 47 fatalities

# **Summary Table on Bakken Crude Oil Characteristics**

Characteristic	Reported Values	Hazmat Transportation Regulatory
		Implications
Flashpoint	Range: -59°C to 50°C	Bakken crude oils meet the criteria for Packing Group I, II, or III flammable liquids or as combustible liquids <sup>3</sup>
Initial Boiling Point	Range: 2.2°C to 66.9°C	Bakken crude oils with an initial boiling point of 35 °C or less meet criteria for Packing Group I flammable liquids; others for Packing Group II or III flammable liquids or combustible liquids according to flashpoint
Vapor Pressure at 50°C	Maximum: 16.72 psia	All Bakken crude oils have a vapor pressure below 43 psia at 50°C and must be transported as liquids
Reid Vapor Pressure at 38°C	Maximum:15.4 psia	Not used by the regulations; confirm the vapor pressure at 50°C is well below the above 43psia limit and Bakken crude oils must be transported as liquids.
Rail tank car pressures on delivery	Maximum:11.3 psig	Demonstrates that Bakken crude may be safely transported in DOT specification 111 tank cars <sup>4</sup>
Flammable gas content	Maximum:12.0 liquid volume %	None; with the vapor pressures of all Bakken crudes oils examined not exceeding a vapor pressure of 43 psia at 50°C, all Bakken crude oils examined must be transported as liquids
Hydrogen sulfide content in the vapor space	Most reported H <sub>2</sub> S concentrations were below the OSHA STEL; one reported a maximum level of 23000 ppm	None when low values are experienced; additional hazard communication to warn of the presence of H <sub>2</sub> S when inhalation hazard levels are encountered <sup>5</sup>
Corrosivity	NACE B+ or B++	Data and experience indicate that Bakken crude oil does not corrode steel at a rate of ¼ inch per year or more so that Bakken crude oil is not a corrosive liquid

Survey of Bakken Crude Oil Characteristics Assembled For the U.S. Department of Transportation, American Fuel & Petrochemical Manufacturers, May 14, 2014

#### **Summary of Environmental Impacts**

- > 6,000,000 L spilled
- Rail corridor
- Zone Incendiée
  - Soils @ 0-3m over ~1 acre
  - TPH combustion residuals
  - LNAPL great than C20
  - Non-combustible building foundations and structural steel
  - Groundwater impacts
- Lac Mégantic
  - LNAPL impacts to northern shoreline rip rap
  - Wharf at Municipal Marina destroyed
- Rivière Chaudière
  - LNAPL impacts to embankments and floodplain areas





"Zone Incendiée" immediately post disaster

# Village of Lac Mégantic



- Multiple commercial and residential foundation/ basement impacts
- Pont Agnès footers/foundation
- Storm sewer conveyances

### **Emergency Response: July – December 2013**



- About 6,000,000 L petroleum crude oil was quickly released
- On-scene command ~150 firefighters were called to the scene
- Residents evacuated
- Storm sewers plugged/fires extinguished
- City downtown secured/power disconnected
- Groundwater recovery trenches/wells installed
- 136,000 MT impacted soil and other material, removed to soil storage area in 2013
- Debris stockpiled
- Interim commercial center constructed
- Subsurface impacts delineation
- Rail line re-established

# **Subsurface Impact Distribution**



### Clean up Standard

- Soil (Petroleum Hydrocarbons C10-C50)
  - Level A: Background Levels (300 ppm)
  - Level B: Maximum acceptable limit for residential site (700 ppm)
  - Level C: Maximum acceptable limit for commercial site (3,500 ppm)
  - Level D: Maximum acceptable for disposal (10,000 ppm)
  - Site Remediation Objective: Level A for residential area and level B for the railroad zone
- Water (Petroleum Hydrocarbons C10-C50)
  - Surface water criteria: 3,500 ppb
  - Site Remediation Objective: 50% of 3,500 ppb and no free product

Québec's Soil Protection and Rehabilitation of Contaminated Sites Policy

- Impacted soil removal 135,000 MT
  - Zone Incendiée
  - Pont Agnès
  - Storm Sewers conveyances
  - Building foundations (pending)
- Activities of AECOM
  - Prime contractor
  - Program Manager role:
    - Bid specs/Contractor evaluation
    - Field work oversight
    - Reporting
  - Health and Safety
  - Supervision and coordination
  - Soil, Water, Air and Noise monitoring



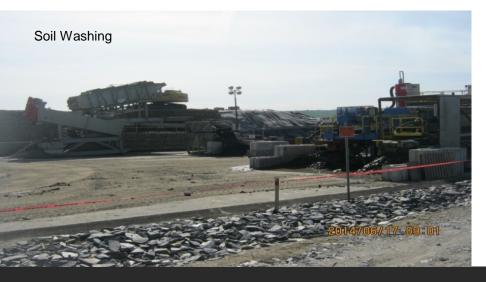
Impacted soil being loaded for treatment/disposal; Lac Mégantic visible in background

#### Impacted soil stockpiles

- Emergency 136 000 MT
- Post emergency 135 000 MT (ongoing)

#### Impacted soil treatment – Phase 2

- Soil Washing (not successful)
- Biological 10,000 MT already treated on site, remain 199,000 MT to treat (contract ended in 2017)
- Landfill 10,000 MT send to cover a former mine





#### **Groundwater/oil recovery and treatment**

- Oil/water separator
- Carbon filtration
- 50,000,000 L treated water 2014 YTD





#### **Storm Sewer Conveyances**

- Rue des Veterans (Phases 1 and 2)
- Rue Frontenac
- Clean fill re-used on site





- Rivière Chaudière sediment removal (pending)
- Building demolition and foundation impacted soil removal (pending)
- Marina wharf replacement (pending)
- Innovative real-time perimeter air monitoring (first time implemented in Quebec)





#### **Site Restoration**



#### Réinventer la ville

#### Le nouveau centre-ville de Lac-Mégantic > chantiers 2014



REHABILITATION DES SOLS
Responsabilité: Ville et gouvernement du Québec
béout avril 2014 Flat: décembre 2014

OMPLEXE FUNÉRAIRE JACQUES & FILS Responsabilité: privé Début: mars 2014. Fin: juillet 2014



PARCOURS D'ANIMATION
Responsabilité: Commission des arts, de la culture et du patrimoine
Début: Juliet 2014



O CONDOS COMMERCIAS Responsabilité: Ville Estraplateuros 2014



LA BERGE GLACÉE Responsabilité: privé Début: mars 2014 Fin: mai 2014



Micis-CAFE
Responsabilité: privé
Début: mars 2014. Piet: juillet 201-



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NOUVEAU PONT RIVIÈRE CHAUDIÈRE Responsabilité: Ville et goux: du Québec Début: mars 2014 : Fin: octobre 2014 MARCHE METRO PLUS
Responsabilité: privé
Début: mars 2014. Fin: octobre 2014

SOCIÉTÉ DES ALCOOLS DU QUÉBEC (SAQ) Responsabilité: privé et SAQ



BANQUE NATIONALE Responsabilité: privé Début: juillet 2014 Fils: novembre 2014



PHARMACIE JEAN COUTU

Responsabilité: privé Début: juillet 2014 Fin; novembre 201



RÉFECTION RUES LÉVIS/SALABERRY Responsabilité: Ville



HOME (12 LOGEMENTS)
Responsebilité: privé
Début: mai 2014 fin; août 2014



MMEUBLE À BUREAUX Responsabilité: privé Début: août 2014 Fin: automne 2014



IMMEUBLE MEXTE (COMMONCE CYLOSOMENYS)
 Responsabilité: privé



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#### **CTSB Summary of Disaster Causes**

- Fire in the locomotive
- Leaving trains unattended
- Braking force
  - Air brakes
  - Hand brakes
- Class 111 tank cars: Damage and construction
  - All 72 tanks cars were Class 111, lacked enhancements such as a jacket, a full head shield, and thermal protection
- Single-person crews
- Dangerous goods: Inadequate testing, monitoring, and transport

#### **Path Forward**

- 127,000 hours safe work 2 incidents
- 135,000 MT impacted soil removed:
  - 23,000 MT of <A and A-B soil stockpile for reuse
  - 32,000 MT of >B soil disposed to a treatment facility
  - 75,000 MT soil >B send to the treatment site
     (10 000 tm already treated)
  - 5,000 MT debris disposed
- 61,000 MT backfill
- 50,000,000 L impacted groundwater treated 2014 YTD



# **AECOM**



Todd Schwendeman, CHMM
Sr. Vice President – Remediation Services
AECOM
Todd.Schwendeman@aecom.com
518-951-2227