

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

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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

Downtown Lac Mégantic immediately after disaster

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 ³
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 ⁴
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 ₂ 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 ₂ S when inhalation hazard levels are encountered ⁵
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

Post-Emergency Remediation

- 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*

Post Emergency Remediation

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

Soil Washing



Biological Treatment



Post Emergency Remediation

Groundwater/oil recovery and treatment

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



Post Emergency Remediation

Storm Sewer Conveyances

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



Post Emergency Remediation

- 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



A DESCENTE DE BATEAUX/BAIE DES SABLES
Responsabilité: Ville
Début: juin 2014 Fin: juillet 2014



B RÉFECTION RUE LAVAL
Responsabilité: Ville
Début: mai 2014 Fin: octobre 2014



**Visitez
régulièrement le site
Reinventerlaville.ca**
pour télécharger
la version la plus
récente de cette carte !

1 RÉHABILITATION DES SOLS

Responsabilité: Ville et gouvernement du Québec
Début: avril 2014 Fin: décembre 2014



2 COMPLEXE FUNÉRAIRE JACQUES & FILS

Responsabilité: privé
Début: mars 2014 Fin: juillet 2014



3 PARCOURS D'ANIMATION

Responsabilité: Commission des arts, de la culture et du patrimoine
Début: juillet 2014



4 CONDOS COMMERCIAUX

Responsabilité: Ville
Fin: printemps 2014



5 LA BERGE GLACÉE

Responsabilité: privé
Début: mars 2014 Fin: mai 2014



6 MUSI-CAFÉ

Responsabilité: privé
Début: mars 2014 Fin: juillet 2014



7 PARC DE LA RIVIÈRE CHAUDIÈRE (DENTERS PÉASINES ET CHALABRE)

Responsabilité: Ville
Fin: mai 2014



8 NOUVEAU PONT RIVIÈRE CHAUDIÈRE

Responsabilité: Ville et gouv. du Québec
Début: mars 2014 Fin: octobre 2014



9 MARCHÉ METRO PLUS

Responsabilité: privé
Début: mars 2014 Fin: octobre 2014



10 SOCIÉTÉ DES ALCOOLS DU QUÉBEC (SAQ)

Responsabilité: privé et SAQ
Début: mars 2014 Fin: octobre 2014



11 BANQUE NATIONALE

Responsabilité: privé
Début: juillet 2014 Fin: novembre 2014



12 PHARMACIE JEAN COUÛR

Responsabilité: privé
Début: juillet 2014 Fin: novembre 2014



13 RÉFECTION RUES LÉVIS/SALABERRY

Responsabilité: Ville
Début: mai 2014 Fin: octobre 2014



14 HOME (12 LOGEMENTS)

Responsabilité: privé
Début: mai 2014 Fin: août 2014



15 IMMEUBLE À BUREAUX

Responsabilité: privé
Début: août 2014 Fin: automne 2014



16 IMMEUBLE MIXTE (COMMERCES ET LOGEMENTS)

Responsabilité: privé
Début: juillet 2014 Fin: automne 2014



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



Thank You!

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