



Soil and Materials Engineering  
Environmental Engineering  
Building Science  
Supply Chain Quality



# How to Minimize Cost for a Remote Clean-up and be Sustainable?

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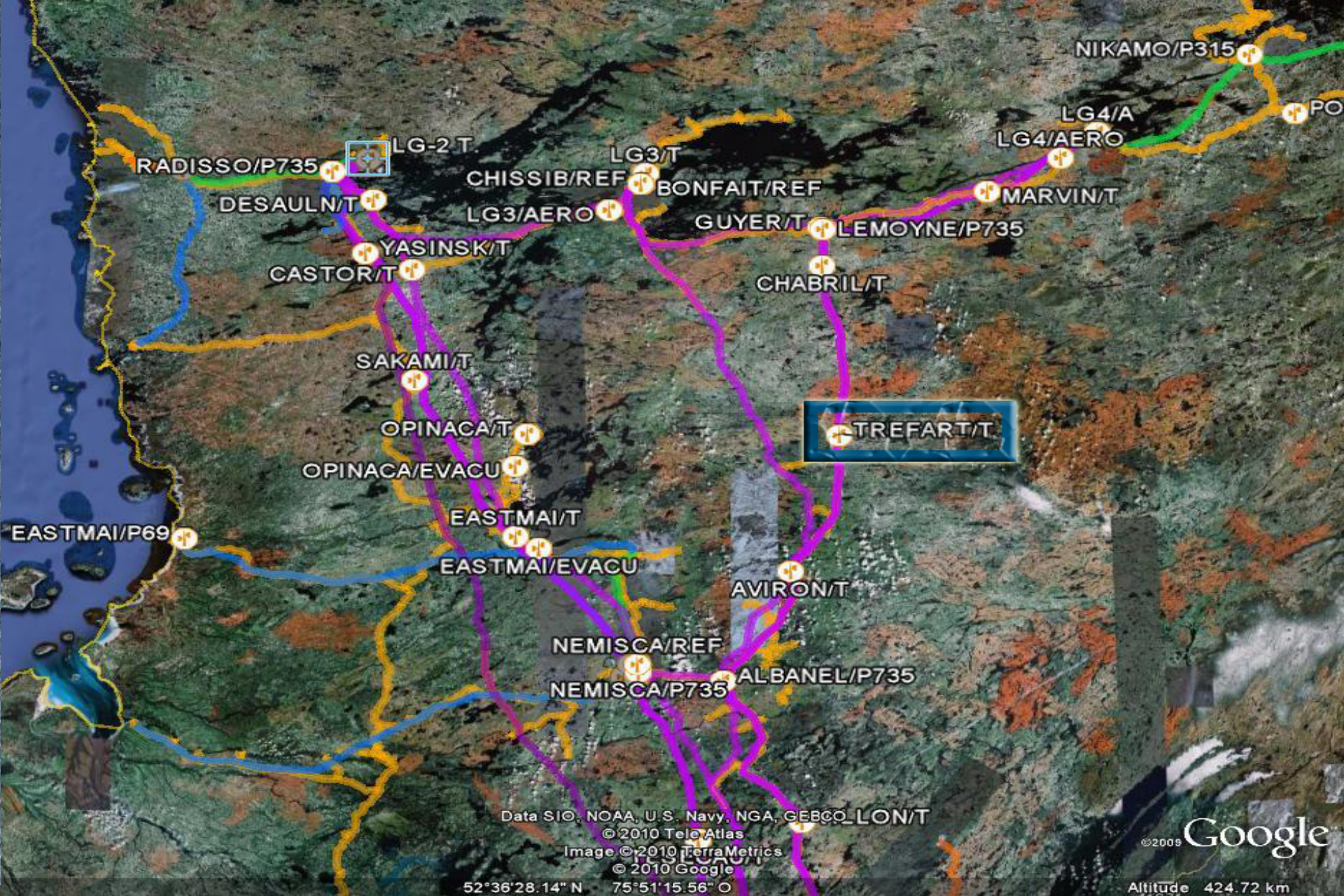
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## Site Description

- Located in northern Quebec, in the James Bay area
- Telecommunication tower
- Site operation since the 1980s
- Site only accessible by helicopter













## 2 Applicable Legislation

MDDEP's Soil Protection and Contaminated Sites Rehabilitation Policy - Level B of the generic criteria

### Soil Remediation Guidelines

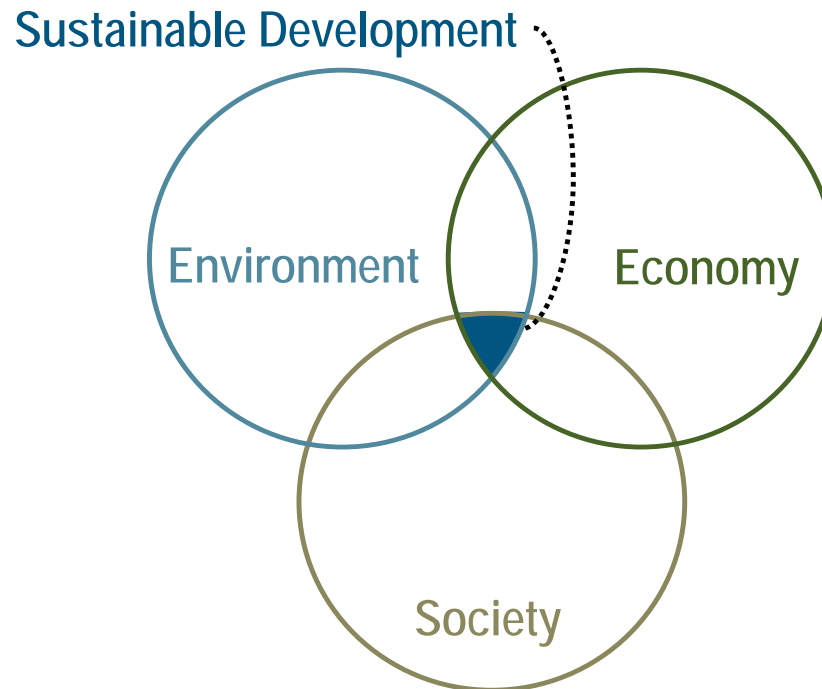
Paramètres	Units	MDDEP Generic Criteria			Alberta Tier I Guidelines (Coarse)		
		A (Residential)	B (Commercial)	C (Industrial)	Residential	Commercial	Industrial
HP C <sub>10</sub> - C <sub>50</sub>	mg/kg	300	700	3,500	-	-	-
F1	mg/kg	-	-	-	24	270	270
F2	mg/kg	-	-	-	130	260	260
F3	mg/kg	-	-	-	300	1700	1700
F4	mg/kg	-	-	-	2800	3300	3300
Benzene	mg/kg	0.1	0.5	5	0.073	0.078	0.078
Toluene	mg/kg	0.2	3	30	0.49	0.49	0.49
Ethylbenzene	mg/kg	0.2	5	50	0.21	0.21	0.21
Xylenes	mg/kg	0.2	5	50	12	28	28

### 3 Site Environmental Background

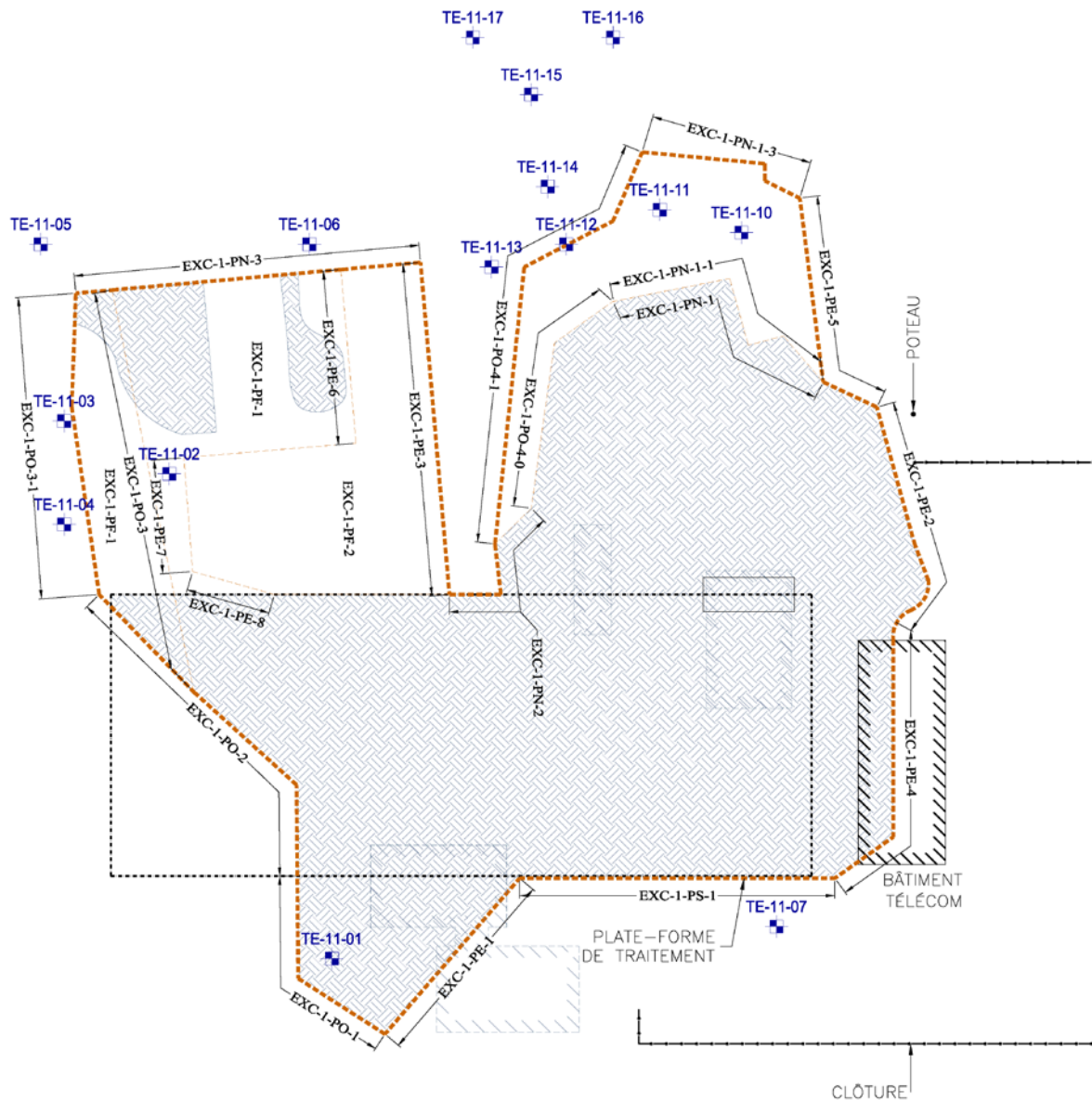
- Removal of a diesel AST and associated piping network in 2002
- Installation of a passive treatment system (7 years)
- Additional characterization were completed in 2009
- Estimated between 400 and 500 m<sup>3</sup> of impacted soil
- Selection of a remediation technology that would be more aggressive (2 years timeframe)

### 3 Site Environmental Background (cont'd)

- and had to comply with all aspects of sustainability









## 4 Challenges

- Site only accessible by helicopter
- Design of a low energy consumption treatment system - 20kW
- Full completion in 2 years
- Optimization of the system according to site characteristics such as northern climate, topography, limited presence of site personnel
- Initial concentrations required a treatment efficiency of 85% for hydrocarbons















## 5 Selection of Remediation Technology

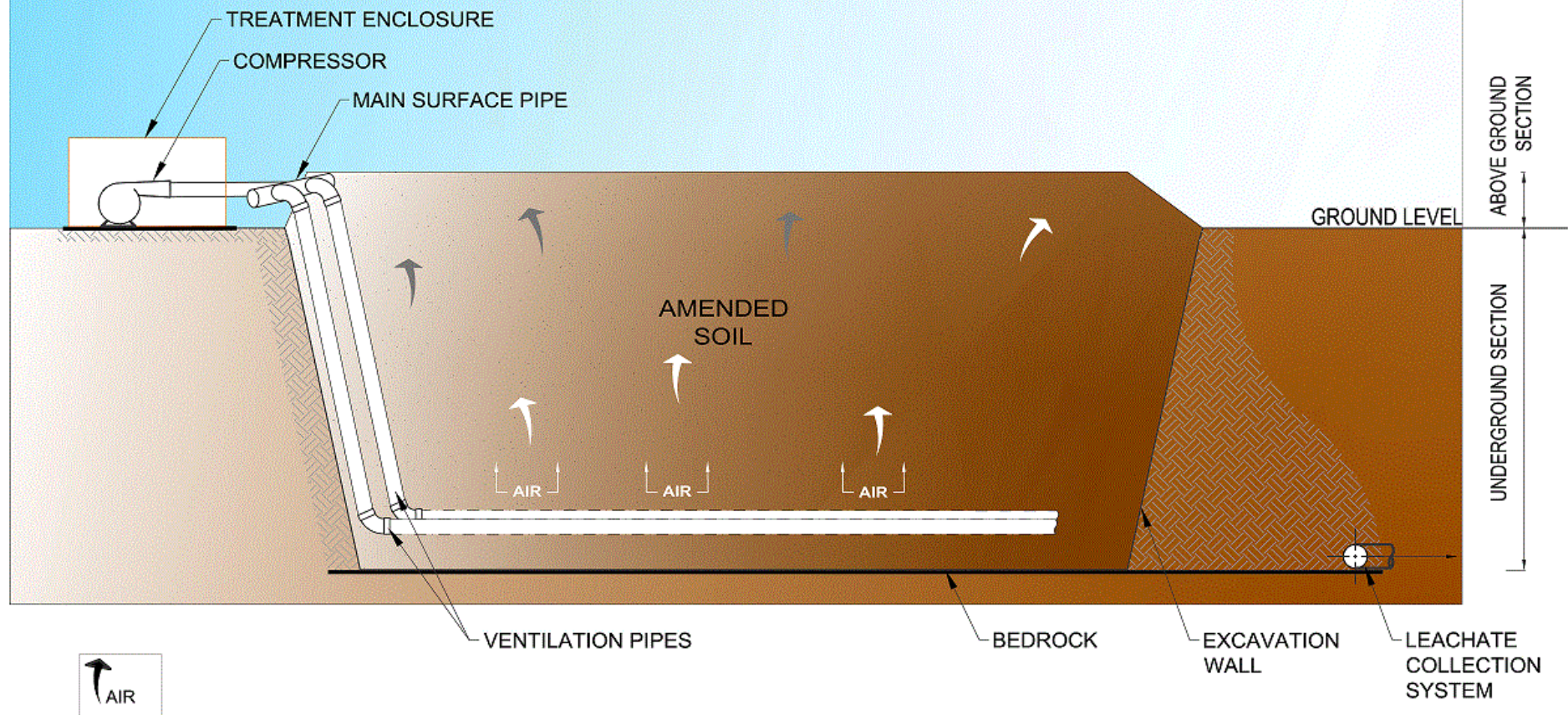
- Selection was done following assessment of different options
  - off-site disposal by helicopter
  - chemical oxidation
- On-site biotreatment was the most appropriate solution
- Design had to be adapted to site conditions and transportation limits

## 5 Selection of Remediation Technology

- Advantages of the selected technology
  - Reduce green-house gas by preventing the use of the helicopter to dispose soil off-site
  - A section of biopile was located underground, which prevented excess loss of heat during treatment
  - Can be implemented directly on bedrock of clean impermeable soil without the use of a liner
  - Flexibility and adaptability

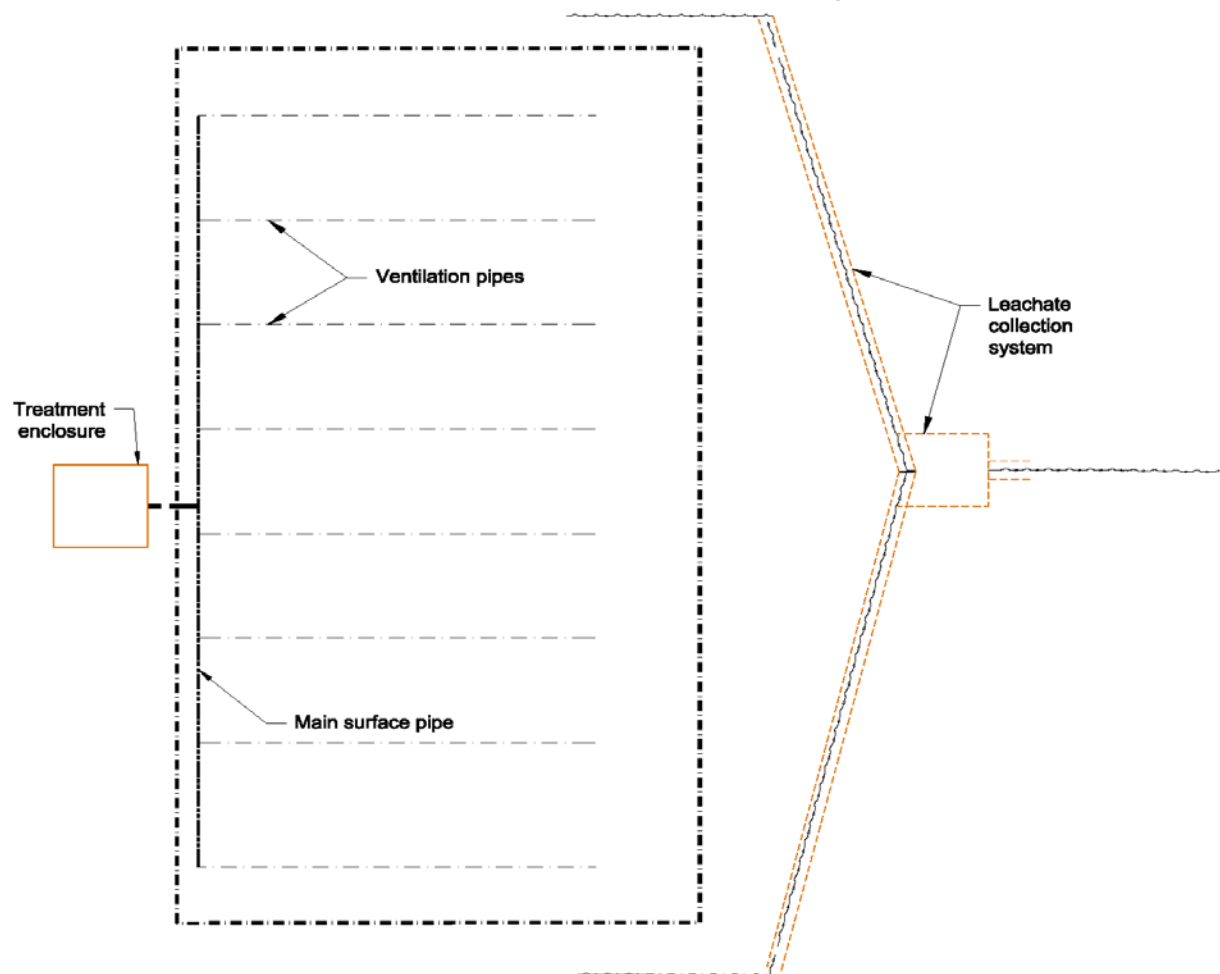


## Cross-Section – Treatment system





## General View – Treatment system

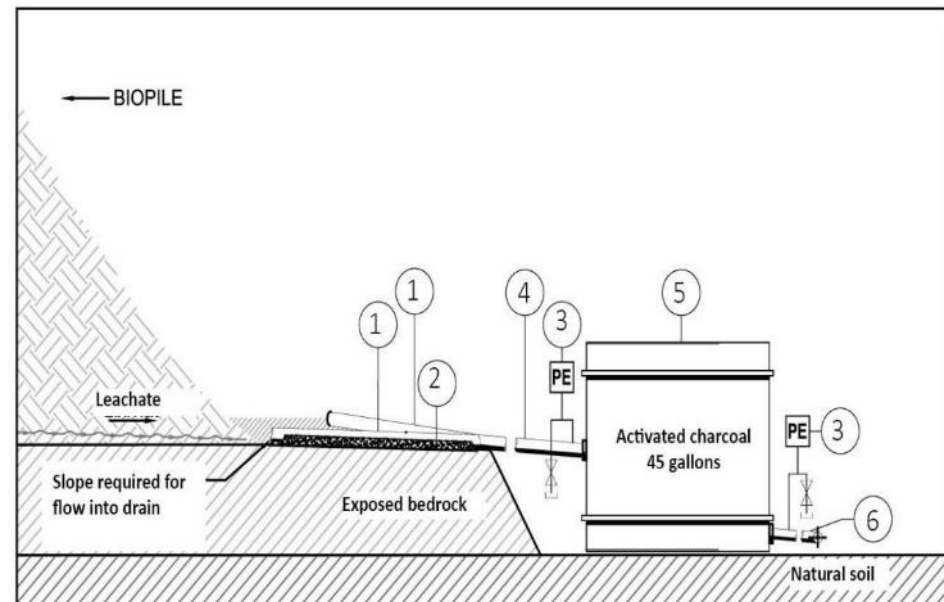




## 5 Selection of Remediation Technology

### ➤ Leachate Recovery System

- No need for pump
- Utilization of the natural slope of the site
- Water treated with activated carbon prior to disposal



## 5 Remediation

- A volume of 550m<sup>3</sup> of impacted soil was stockpiled for treatment
- System had a low energy demand (3.75kW on the allowed 20kW)













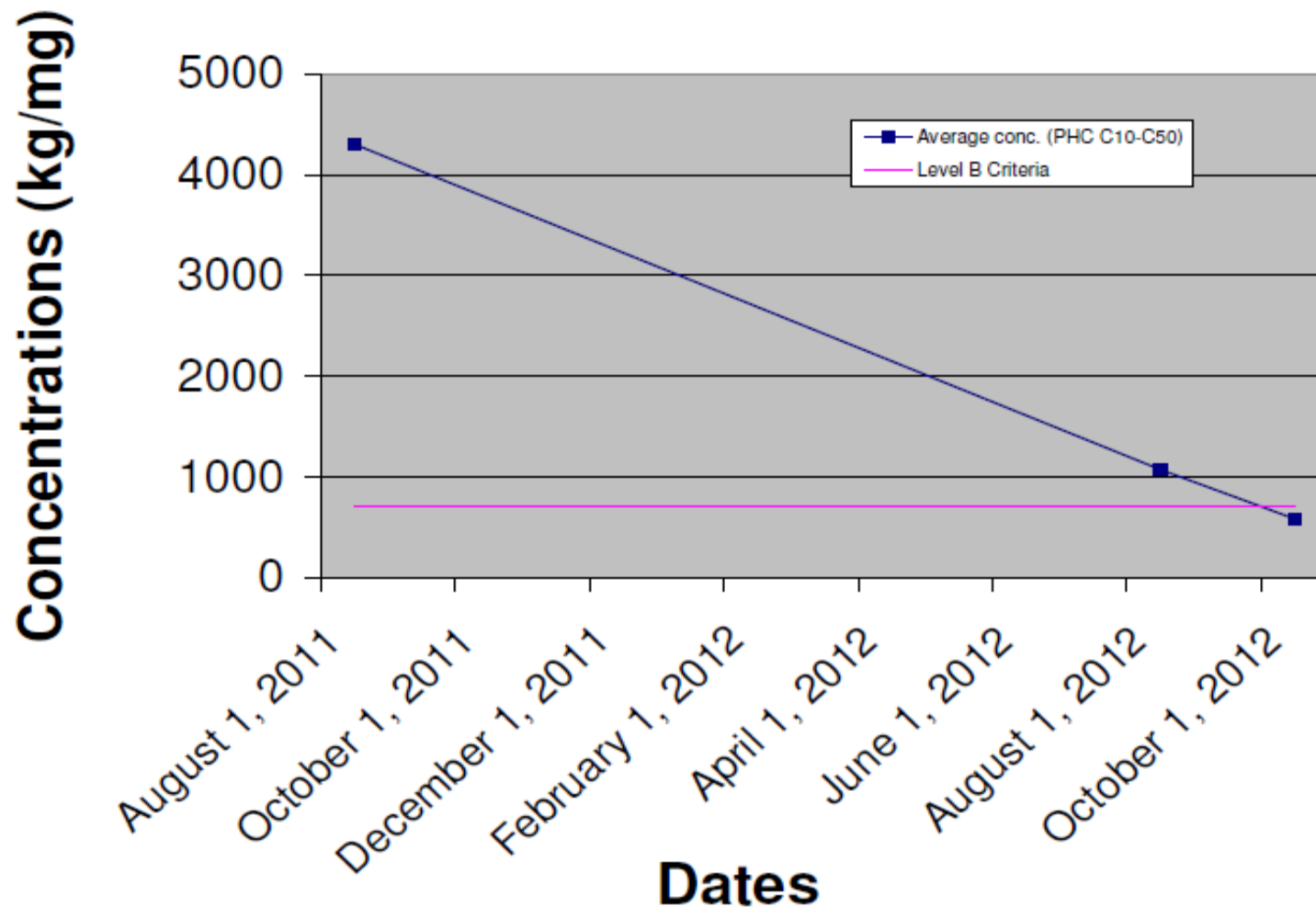








## Treatment Efficiency



## 6 Results

- 100% of soils below Level B of the MDDEP's Policy
- No incident or accident
- 2013 Canadian Consulting Engineering Award
- Inspiring project























THANK YOU



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