

# MCEBR's approach to innovative treatment technology demonstration projects

Case study:

## Treatment of soil contaminated by PHCs and PAHs leftover from the petroleum industry decommissioning in the east end of Montreal

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# MCEBR's approach

## to innovative treatment technology demonstration projects

### Case study:

Treatment of soil contaminated by PHCs and PAHs leftover from the petroleum industry decommissioning in the east end of Montreal

### Presentation outline

- The MCEBR mission
- The MCEBR approach, role and analytic process
- Case study – Background
- Case study – The Trust's objectives, Goal
- Case study – Characterization
- Case study – Call for expressions of interest
- Case study – Lab tests, pilot tests
- Case study – Assessment and recommendations
- Case study – Rehabilitation works



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# The MCEBR mission

The Montreal Centre of Excellence in Brownfields Rehabilitation (MCEBR) is a non profit organization with a mission **to stimulate innovation** in the field of contaminated sites remediation and **to assist land owners** in finding the right solutions meeting their rehabilitation objectives.

*A neutral and independent* organization



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## The MCEBR: a unique approach

- Provides expertise in the remediation of contaminated soil, sediments and groundwater;
- Provides assistance in the decision-making process of land owners and real estate developers grappling with complex environmental problems;
- Provides networking and collaboration opportunities to developers of treatment technologies.



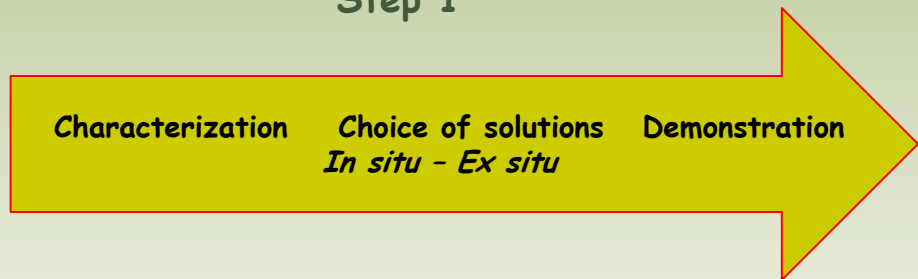
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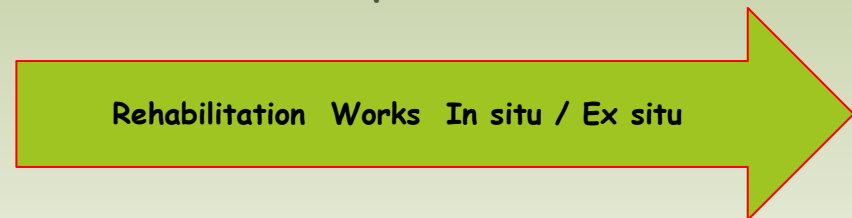
# Finding site specific solutions

## APPROACH TO CONTAMINATED SITES REHABILITATION (2 simple and rigorous steps)

Step 1



Step 2



**MCEBR's involvement with  
real estate developers,  
consultants, technology  
developers and research  
centres**

**Private industry experts  
and companies**

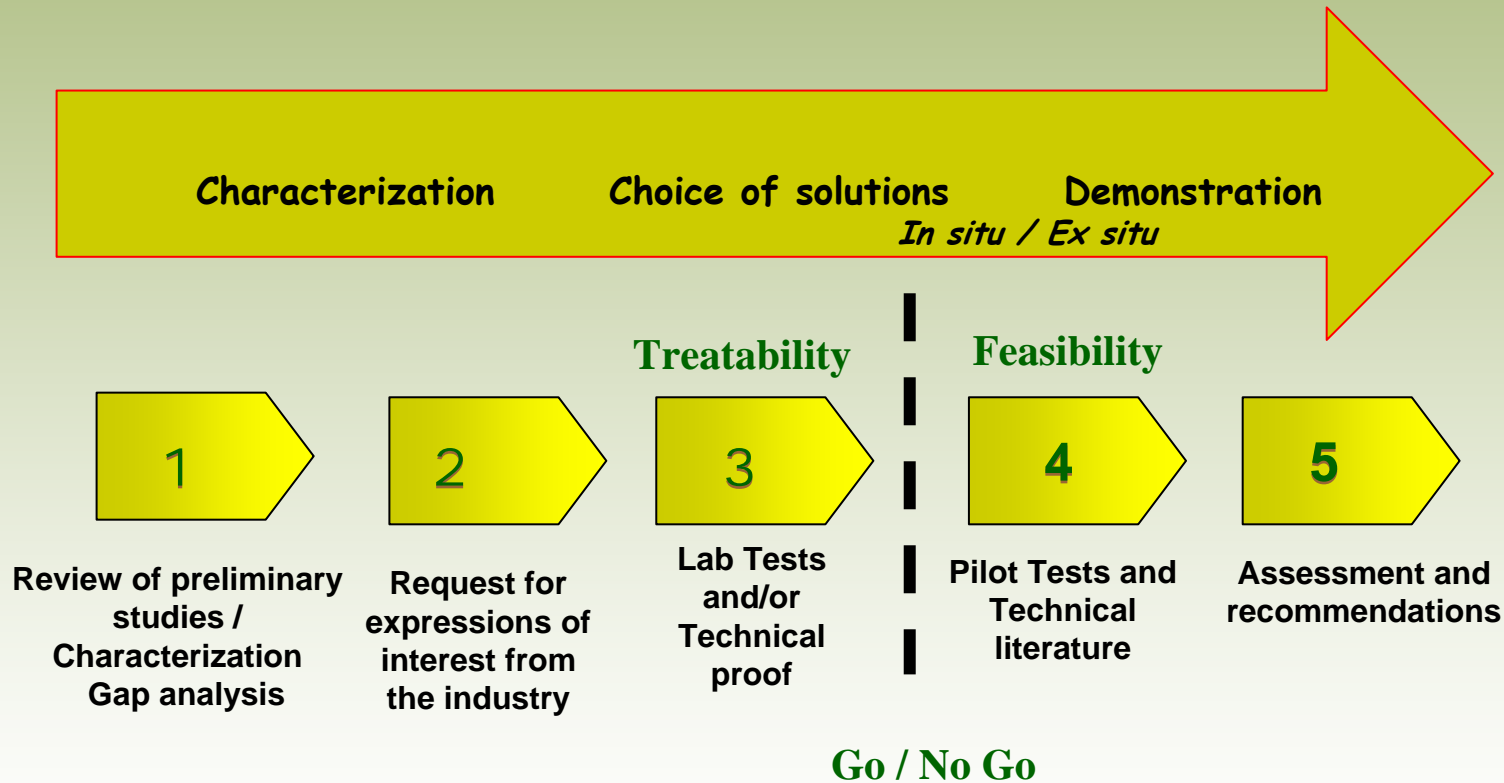


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# The role of MCEBR

*MCEBR's assistance in the decision-making process and in the search for a solution tailored to specific site conditions.*



*A proven approach, tailored to customer needs*



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# Case study - Background

## Petrochemical facilities in Montreal-East



# Case study - Background

## Petrochemical facilities in Montreal-East



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# Case study - Background

## Petrochemical facilities in Montreal-East



1931

1966



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# Case study - Background

## Petrochemical facilities in Montreal-East



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## Case study - Background

Excavation and stockpiling of 20 000 m<sup>3</sup> of contaminated soil



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# Case study: Montreal-East Petrochemical Installations Trust

## The Trust's objectives

- To decontaminate 20 000 m<sup>3</sup> of excavated soil;
- To evaluate and test commercially available technologies and technologies in development;
- To choose the most appropriate technology;
- To give a contract to the appropriate soil remediation company.

MCEBR was retained to accompany and assist the Trust.



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# Case study: Montreal-East Petrochemical Installations Trust

## Objectives and constraints

Time – an important factor but the Trust was ready to take the time required to find the solution allowing to :

- Reduce costs (\$);
- Treat the soil inside of the property limits;
- Reuse and recycle the soil;
- Limit the hauling of the soils, before and after treatment;
- Limit or eliminate the purchase of clean soil from outside sources.



# Case study: Montreal-East Petrochemical Installations Trust

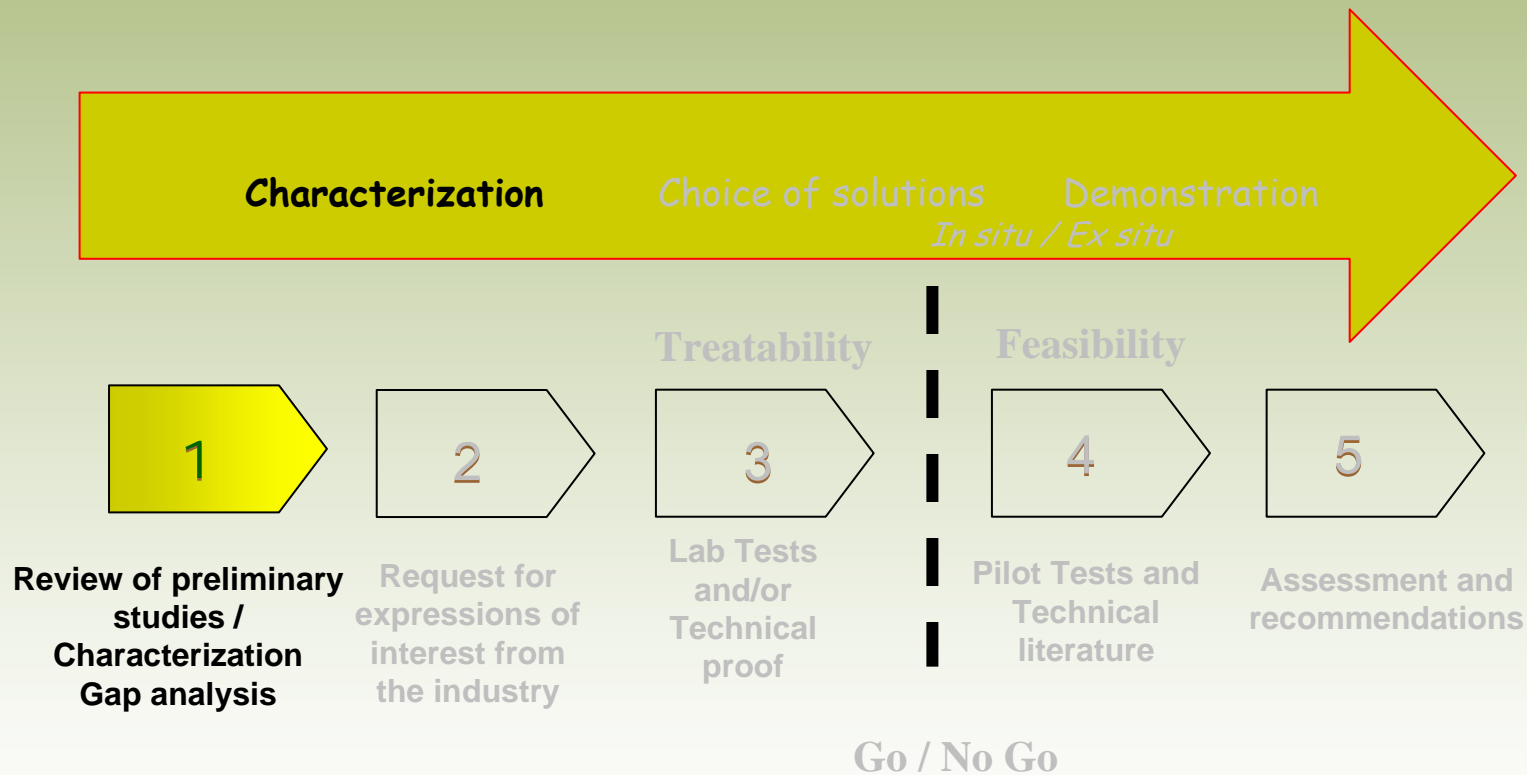
## Goals

- Demonstrate the effectiveness of the treatment methods
  - so that the PHC concentrations and PAH's will be lower than the C criterion and possibly below the B criterion of the Quebec Ministry of the Environment
- Assess the financial impact of the treatment methods.



# Case study: Montreal-East Petrochemical Installations Trust

## The MCEBR approach



Creation of an expert committee

NRC Biotechnology Research Institute  
Environment Canada  
MCEBR



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## Characterization of the contaminated soil



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## Analytical results

Parameters	Soil Criteria MDDEP (mg/kg)				Measured Concentrations (mg/kg)	
	A	B	C	Landfill Criteria	Minimum	Maximum
<b>PHCs</b>						
PHCs (C <sub>10</sub> -C <sub>50</sub> )	300	700	3500	10000	1400	6800
<b>VOCs</b>						
Benzene	<0.1	0.5	5	5	0.56	0.75
Xylene	<0.2	5	50	50	5.3	12
<b>PAHs</b>						
1-Methylnaphthalene	0.1	1	10	56	1.9	42
1,3-Dimethylnaphthalene	0.1	1	10	56	2.4	56
2-Methylnaphthalene	0.1	1	10	56	1.1	28
2,3,5-Trimethylnaphthalene	0.1	1	10	56	1.2	21
Chrysene	0.1	1	10	56	1.1	1.5
Naphthalene	0.1	5	56	56	5.1	7
Phenanthrene	0.1	5	50	150	5.5	14

Desired range



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## Analytical results

Parameters	Soil Criteria MDDEP (mg/kg)				Measured Concentrations (mg/kg)	
	A	B	C	Landfill Criteria	Minimum	Maximum
<b>METALS</b>						
Cadmium (Cd)	1.5	5	20	100	<0.5	-
Chromium (Cr)	85	250	800	4000	10	17
Copper (Cu)	40	100	500	2500	45	81
Lead (Pb)	50	500	1000	5000	13	61
Nickel (Ni)	50	100	500	2500	16	22
Zinc (Zn)	110	500	1500	7500	48	160

Desired range

< B



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## Physico-chemical parameters

Parameters	Results	
	Minimum	Maximum
pH	7.27	8.7
Humidity (%)	6	16
Phosphorus (mg/kg)	890	1200
Nitrogen (mg/kg)	<460	980

Particle size analysis	>5mm	5 – 0.08mm	<0.08mm
	15%	52%	33%
	Silty sand with little of gravel and traces to little of clay		



# Case study: Montreal-East Petrochemical Installations Trust

## Distribution (%) of contaminant levels in stockpiled soils

# Stockpile	Parameters	Number of samples per level of contamination					Total nbre of samples
		<A	A-B	B-C	C-Landfill Criteria	> Landfill Criteria	
313	PHCs / VOCs / PAHs	-	-	6	29	-	35
	PAHs	-	-	-	-	1	1
	Metals	-	10	-	-	-	10
314	PHCs / VOCs / PAHs	-	-	4	20	-	24
	Metals	1	4	-	-	-	5
Distribution (%)		1%	19%	13 %	66%	1%	100%

20%  
< B

80%  
> B

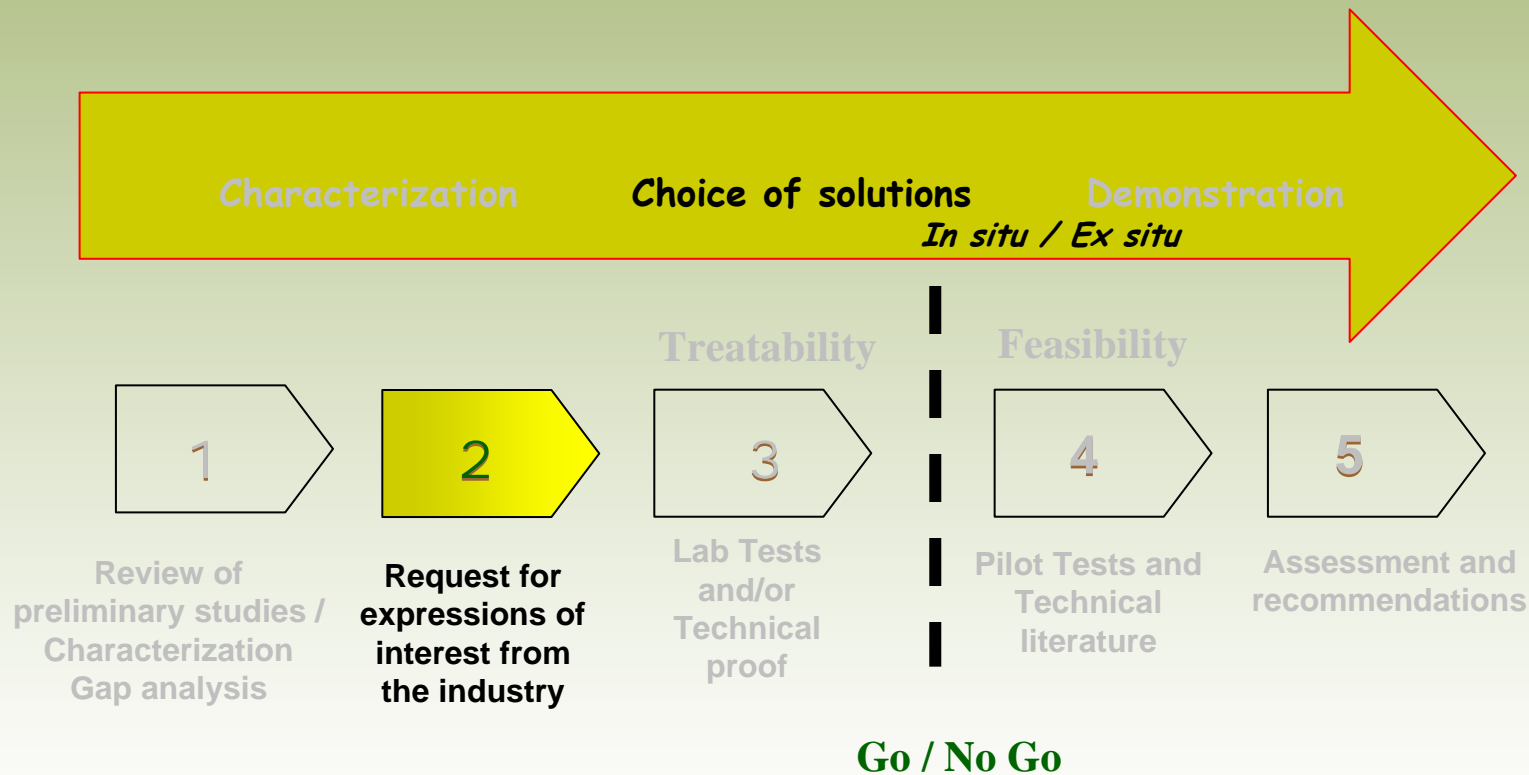


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## The MCEBR approach



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# Case study: Montreal-East Petrochemical Installations Trust

## Call for Expressions of Interest

- CRITERIA - To be eligible, the developers and/or owners of a technology must:
  - Be able to test the technology in Canada;
  - File a proof of insurance with the expression of interest;
  - Demonstrate that they have the rights to use and/or exploit the method or the technology they offer.

The Trust and MCEBR signed confidentiality agreements with the developers or owners of the technologies.



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## Expressions of Interest

11 companies and the following technologies:

- 1- Biotreatment (3)
- 2- Thermal treatment (2)
- 3- Biotreatment and soil screening / soil washing with bacteria
- 4- Biotreatment and chemical oxidation (2)
- 5- Thermal treatment (+ chemical oxidation)
- 6- Thermal desorption
- 7- Chemical oxidation
- 8- Physical treatment with adsorbent
- 9- Biotreatment, thermal treatment and chemical oxidation

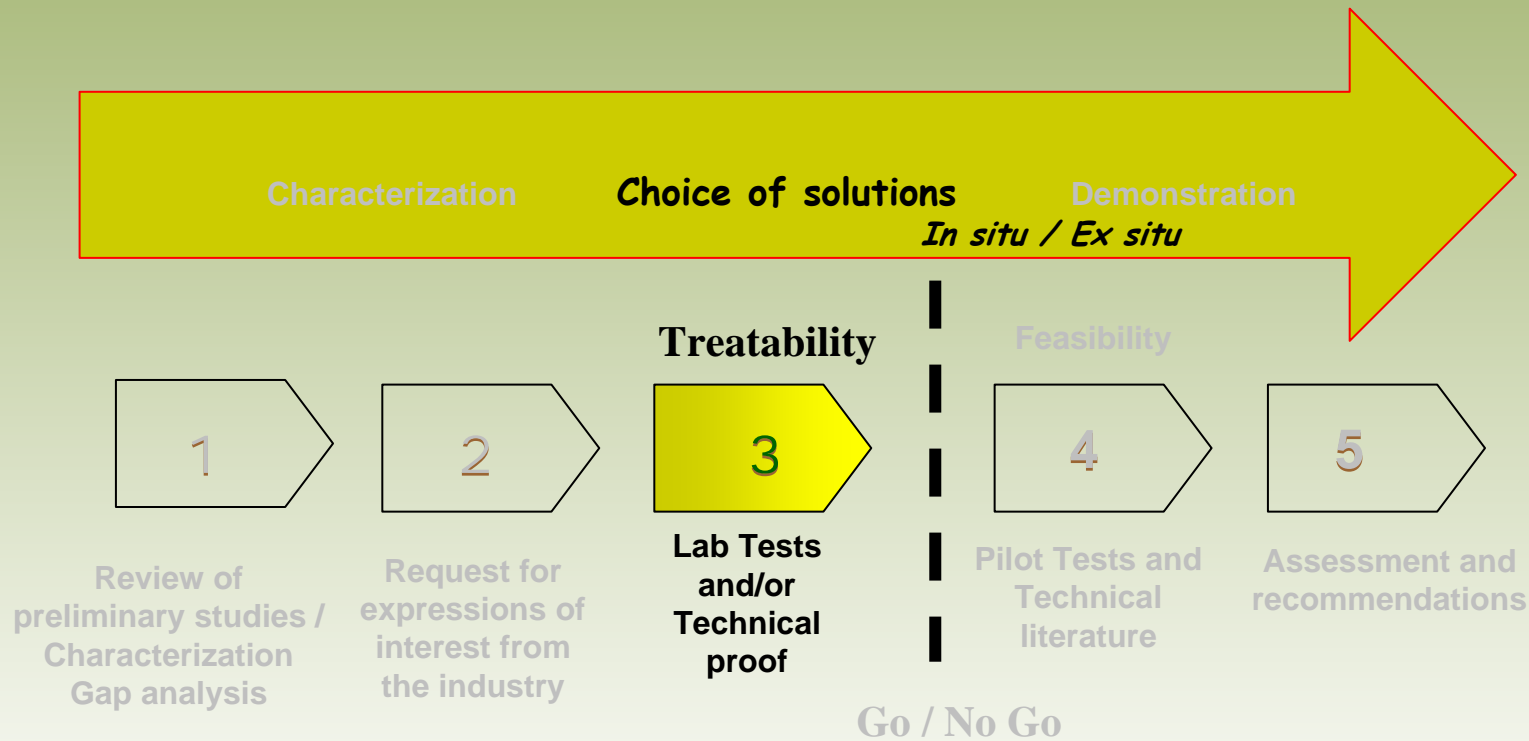
1 company decided not to continue – they thought they had no chance to end up with a contract.

The expressions of interests were evaluated by the expert committee – 14 criteria



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## The MCEBR approach



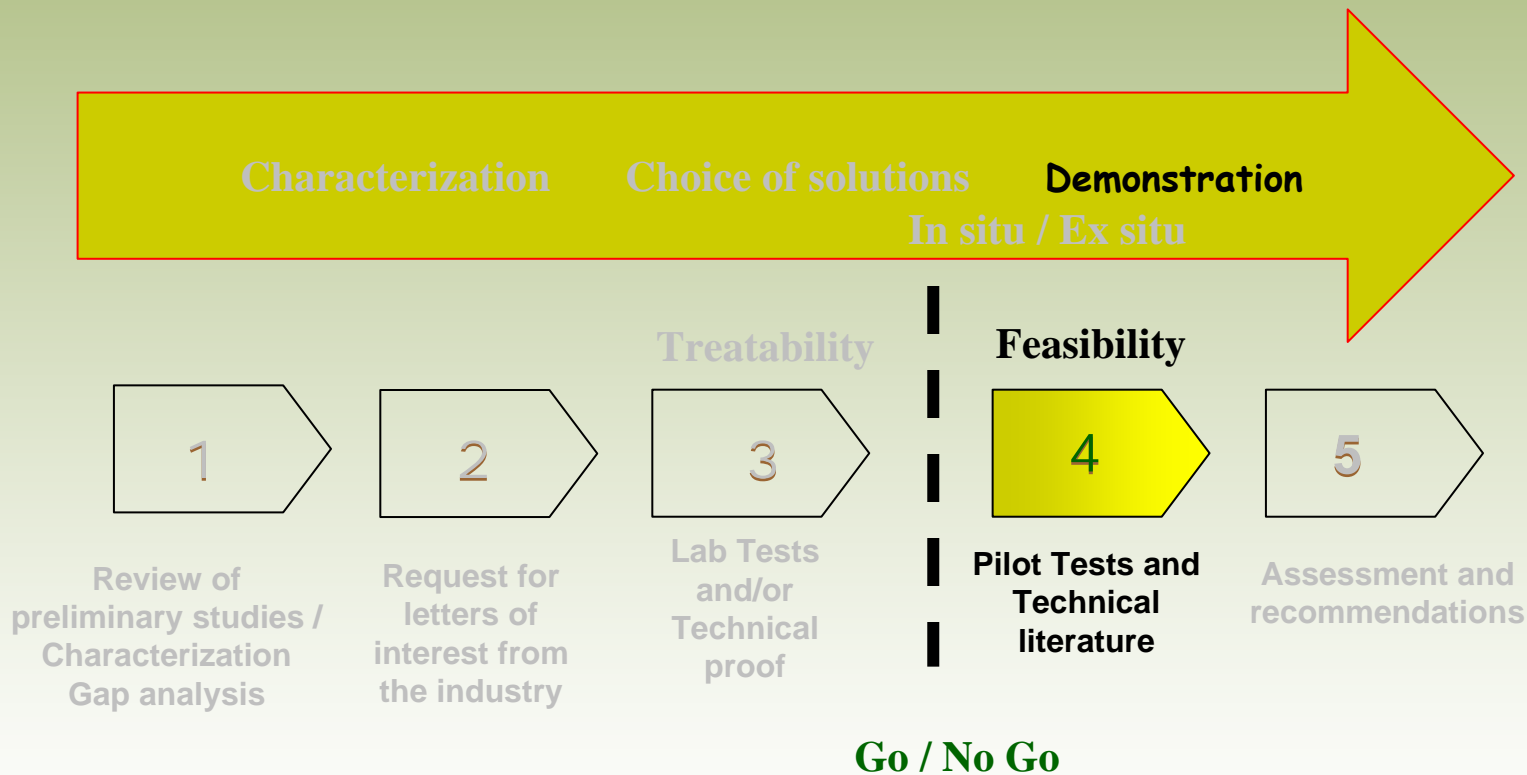
- Biotreatment lab tests;
- Chemical oxidation lab tests;
- Others – The technologies were already commercialized.





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## The MCEBR approach



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## Pilot tests

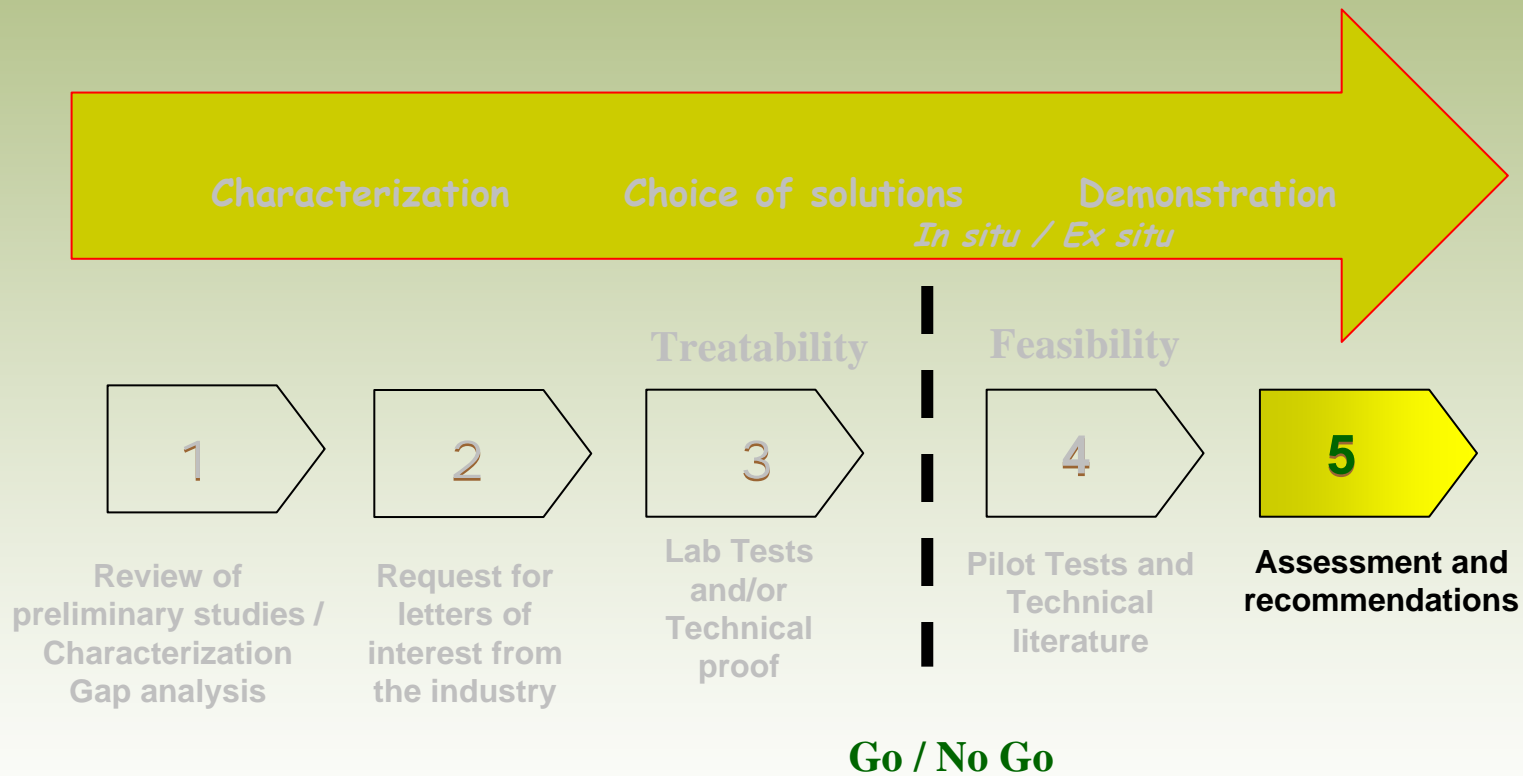
The following technologies were retained for the pilot tests:

- 1- Biotreatment (1 - 144 m<sup>3</sup>) (1 - 30 m<sup>3</sup>) (1 - 15 m<sup>3</sup>)
- 2- Thermal treatment (15 m<sup>3</sup>)
- 3- Biotreatment and soil screening / soil washing with bacteria (10 m<sup>3</sup>)
- 4- Biotreatment and chemical oxidation (2 - 10 m<sup>3</sup>)
- 5- Thermal treatment (+ chemical oxidation) (100 m<sup>3</sup>)
- 6- Thermal desorption (36 m<sup>3</sup>)
- 7- Chemical oxidation (10 m<sup>3</sup>)
- 8- Physical treatment with adsorbent (10 m<sup>3</sup>)



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## The MCEBR approach



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## Assessment and recommendations

### ➤ SELECTION CRITERIA

- Each proposed technology was evaluated with respect to its degree of efficiency to reduce the level of soil contamination under the "B-C" criteria, its processing time, processing costs and reliability, and commercial potential;
- All the information was analyzed and evaluated by the members of the expert committee.



# Case study: Montreal-East Petrochemical Installations Trust

## Assessment and recommendations: Selection criteria

### 3 types of criteria

#### 1- Technological:

- Performance : efficiency;
- Control : Experience, past projects references, technology status;
- Reliability and robustness of the technology: processes, steps, operations clearly defined with tangible results;
- Reproducibility of the results for a full scale treatment;
- Technical assistance Accessibility.

#### 2- Environmental:

- Health and safety: precautions and measures to protect humans and the environment;
- Process/treatment waste: Nature, volume and mode of treatment;
- Physical and chemical characteristics of soils treated.

#### 3- Operational:

- Duration of the operations;
- Treatment activity planning: work distribution and organization;
- Site organization: equipment installation, storage products.



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## Assessment and recommendations

Based on the results of the pilot tests and the evaluation of all the criteria,

the biotreatment technologies were retained and recommended to the Trust.

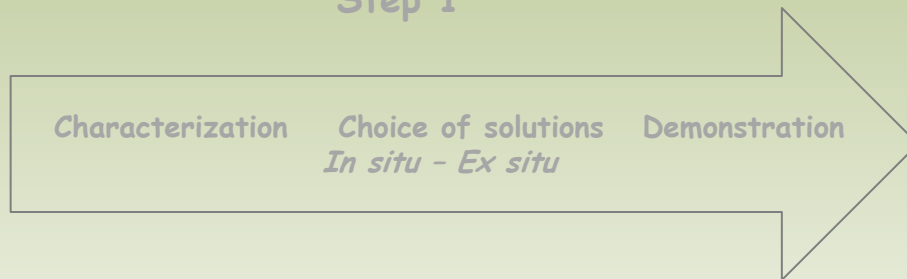


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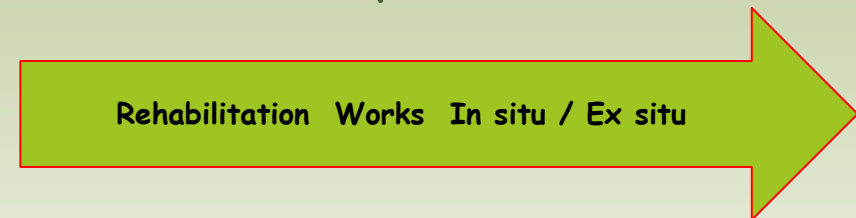
## Rehabilitation works: Private industry

### APPROACH TO CONTAMINATED SITES REHABILITATION (2 simple and rigorous steps)

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MCEBR involvement with  
real estate developers,  
consultants, technology  
developers and research  
centres

Private industry experts  
and companies -  
Soil remediation industry



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# Case study: Montreal-East Petrochemical Installations Trust

## Rehabilitation works – Soil remediation industry

- With biotreatment as the retained technology - 5 biotreatment companies were invited to bid on the job
- Sanexen Environmental Services Inc. was given the contract  
→ offered an effective and viable solution with a lower cost than the initial estimated budget.





# MCEBR's approach to innovative treatment technology demonstration projects

## CONCLUSION

### ➤ Cost (\$) reduction

- Cost initially estimated: **4 000 000 \$**;
- Final cost: **800 000 \$**.

**The MCEBR approach reduced the Trust's costs  
by close to 80 %**

### ➤ Reuse of decontaminated soil on-site

- Berm with trees and shrubs;  
→ Landscape improvement.



# MCEBR's approach to innovative treatment technology demonstration projects CONCLUSION



On-site usage of the decontaminated soil



# THANK YOU

## Montreal Centre of Excellence in Brownfields Rehabilitation

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