Closed Landfill Methane Measurement & Technologies for GHG Reduction

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Objectives

- Discuss four different methods for measuring fugitive methane emissions from closed landfills
  - Handheld Multi Gas Meters
  - Portable Methane Detectors
  - Drone Surveys
  - Flux Chambers
- Look at two different technologies for lowering GHG emissions through reducing methane to carbon dioxide
  - Miniflares
  - Methane Oxidation Biosystems

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Methane Measurement – Handheld Multi Gas Meters

- Commonly used for monitoring LFG at landfill sites
- Typically monitor a handful of relevant gas concentrations, including methane
- Lower end of monitoring range is typically 1% LEL or 500 ppm
- Ideal to monitoring LFG concentrations at property boundaries
  - But not sensitive enough for surface emission monitoring

Methane Measurement – Portable Methane Detectors

- Methane monitoring units that only detect methane gas
- Designed for surface emission monitoring
- Lower end of monitoring range is typically 0.001% LEL or 0.5 ppm
- Includes continuous recording of results with linked GPS data

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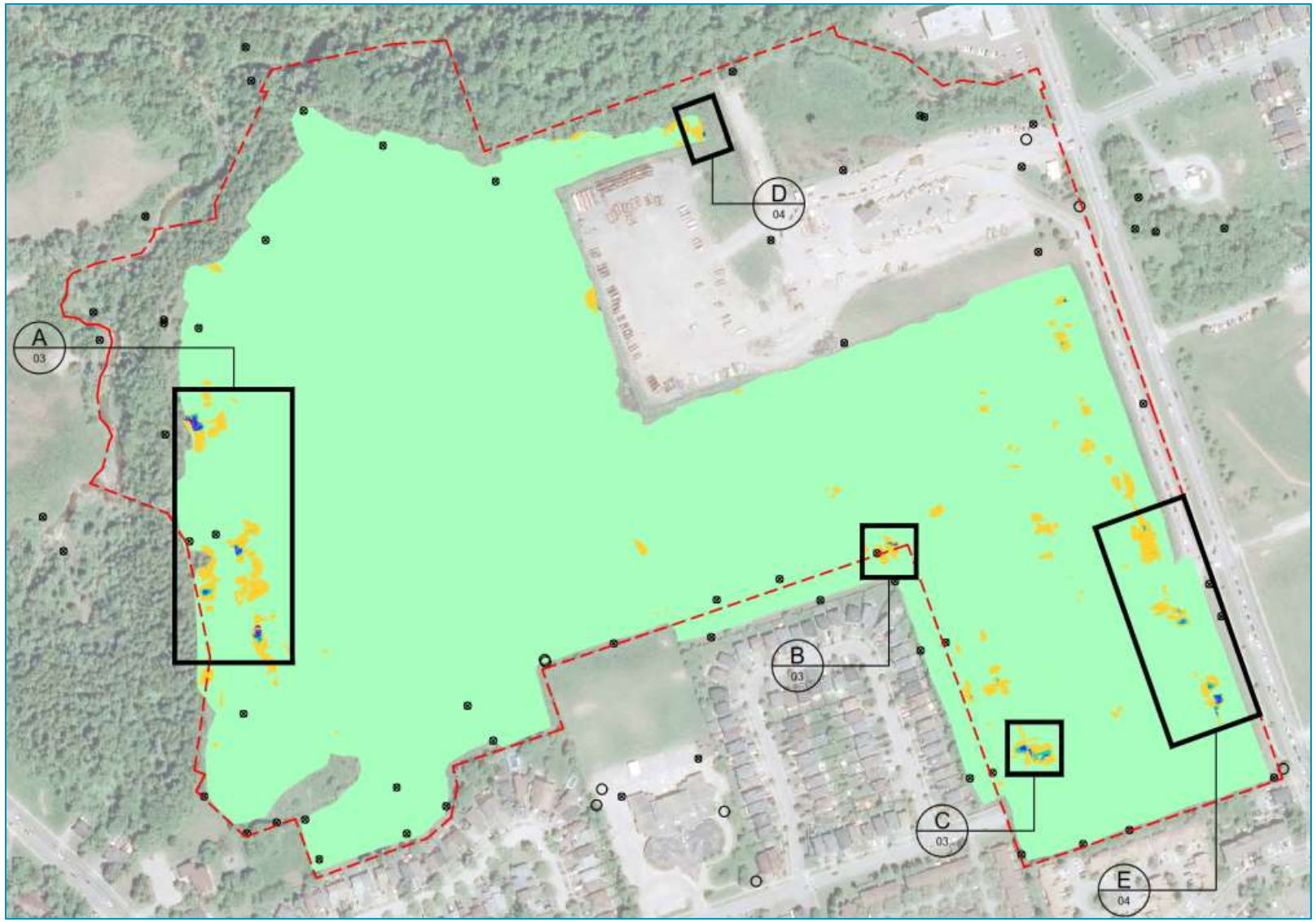
Methane Measurement – Surface Emission Monitoring Results



Gas Value Table

Min. Value (ppm)	Max. Value (ppm)	Colour
0	5	
5	49	
50	99	
100	199	
200	299	
300	399	
400	499	
500	51,509	

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Methane Measurement – Drone Surveys

- Drone surveys are becoming an efficient way of surveying a large, remote area quickly
- Methane measurements are based on the sensor mounted and can be as sensitive as portable methane detectors
- Measures ppm*m, which is not the same as ppm
- Drone surveys pose their own unique challenges with data collection:
  - How high is the methane plume and is the drone above it?
  - Is there anything blocking the unit for detecting to ground level like trees or tall vegetation?
  - Difficult to correlate ppm*m measurements to ppm

Methane Measurement – Flux Chambers

- Do not detect gas concentrations on their own but used in conjunction with a methane monitoring unit
- By recording the rate of methane concentration increase over time you can determine the flow rate of methane at that location
- With this information you can calculate the rate of methane emission in terms of equivalent tonnes of CO_2 over time

So – What Do We Do With This Information?

- Nova Scotia and PEI have banned organics from MSW landfills for decades already, other Provinces are implementing a ban soon or are starting to consider one
- There are thousands of closed MSW landfills in Canada and most are beyond the point of producing sufficient LFG to sustain a utilization technology – but will still be producing methane for many decades to come
- There are innovative systems that can mitigate methane emissions after traditional utilization technologies are no longer viable

Mitigation Technologies – Miniflares

- Designed as a passive landfill gas treatment system
- Solar powered, including ignition system
- Can be equipped with a data logger to record up time and gas flow through the unit
- Can also be equipped with a solar powered fan to create vacuum suction to draw out LFG
- Operating parameters:
  - Flow rates from a few m^3/hr to 200 m^3/hr
  - Methane concentrations from 30% to 90% by volume
- Each unit does need a relatively constant supply of methane

Mitigation Technologies – Methane Oxidation Biosystems

- Methane oxidation biosystems use bacteria (methanotrophs) to reduce methane into carbon dioxide
- Completely passive systems with no mechanical or electrical components required for operation
- Work under a wide range of menthane concentrations, much lower that other technologies
- No maintenance required for operation

Methanotrophic Activity

$$CH_4 + 2O_2 \Rightarrow CO_2 + H_2O + \text{Energy}$$

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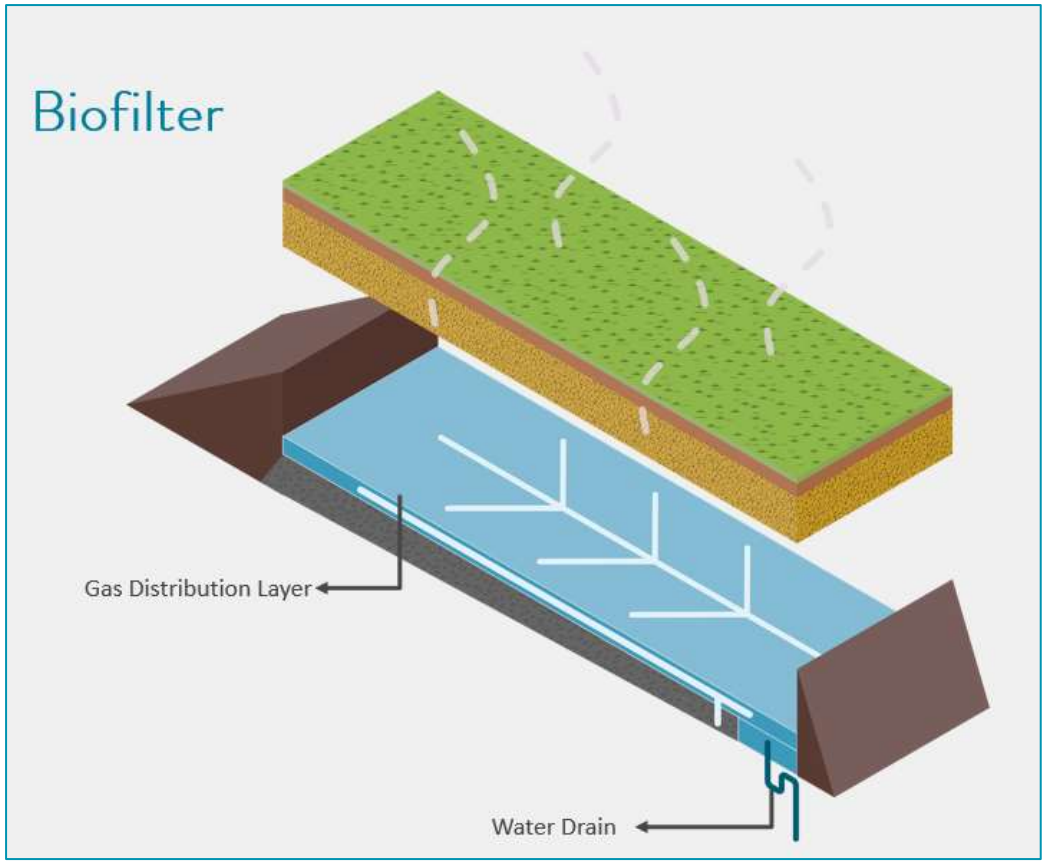
Mitigation Technologies – Methane Oxidation Biofilter



- Collect LFG from a collection network and distribute though the active media
- Operating parameters:
  - Flow rates up to 10 m^3/hr for a single unit
  - Any range of menthane concentration
- Well suited for connecting to an existing LFG collection network or installation of a new LFG extraction network
- Achieving over 90% reduction of methane in the field

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Mitigation Technologies – Methane Oxidation Biofilter

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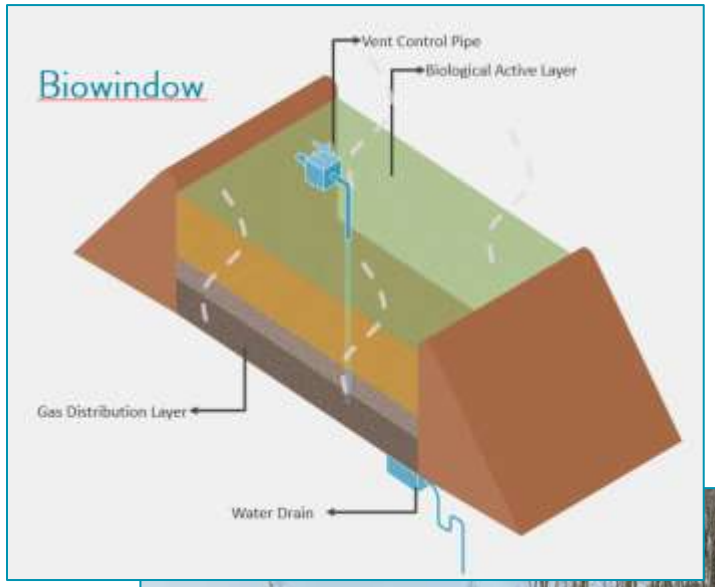
Mitigation Technologies – Methane Oxidation Biowindow



- Well suited for placement over “hot spots” of methane emissions
- Operating parameters:
  - Flow rates up to 5 m^3/hr for a single unit
  - Any range of menthane concentration
- Achieving over 70% reduction of methane in the field

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Thank You For Your Time!

Questions?

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