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Continuous Monitoring of Methane

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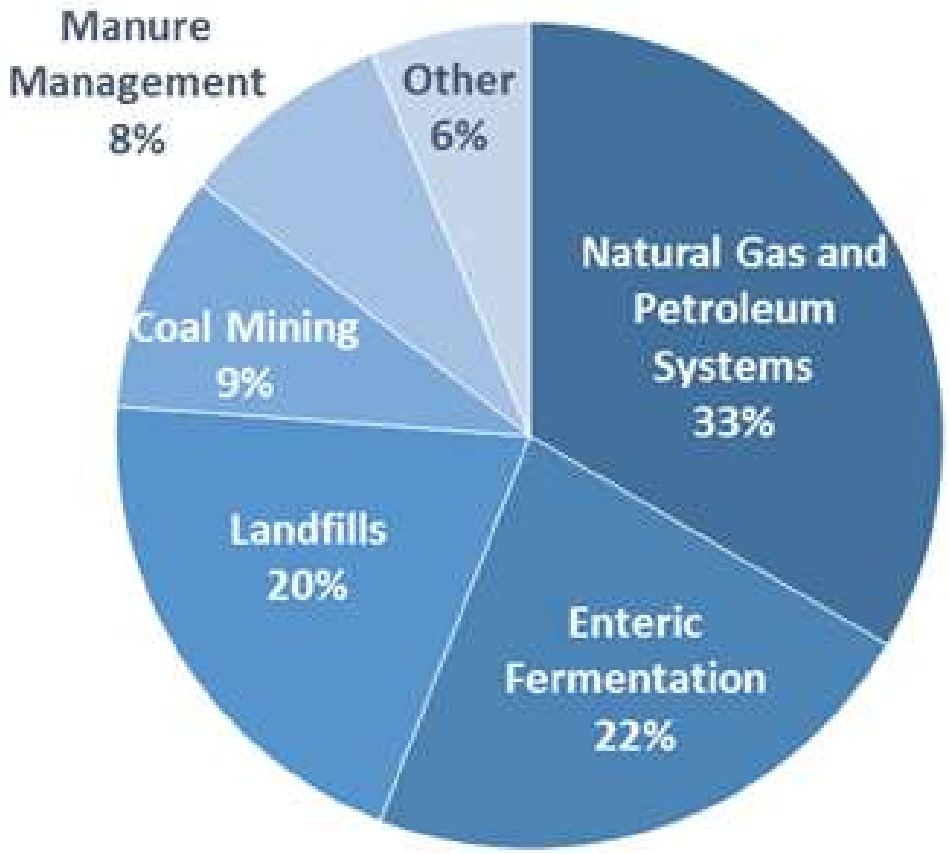
Methane is the second most prevalent greenhouse gas

- Emitted by:
  - Human activity
  - Wetlands
  - livestock

Methane emissions by source

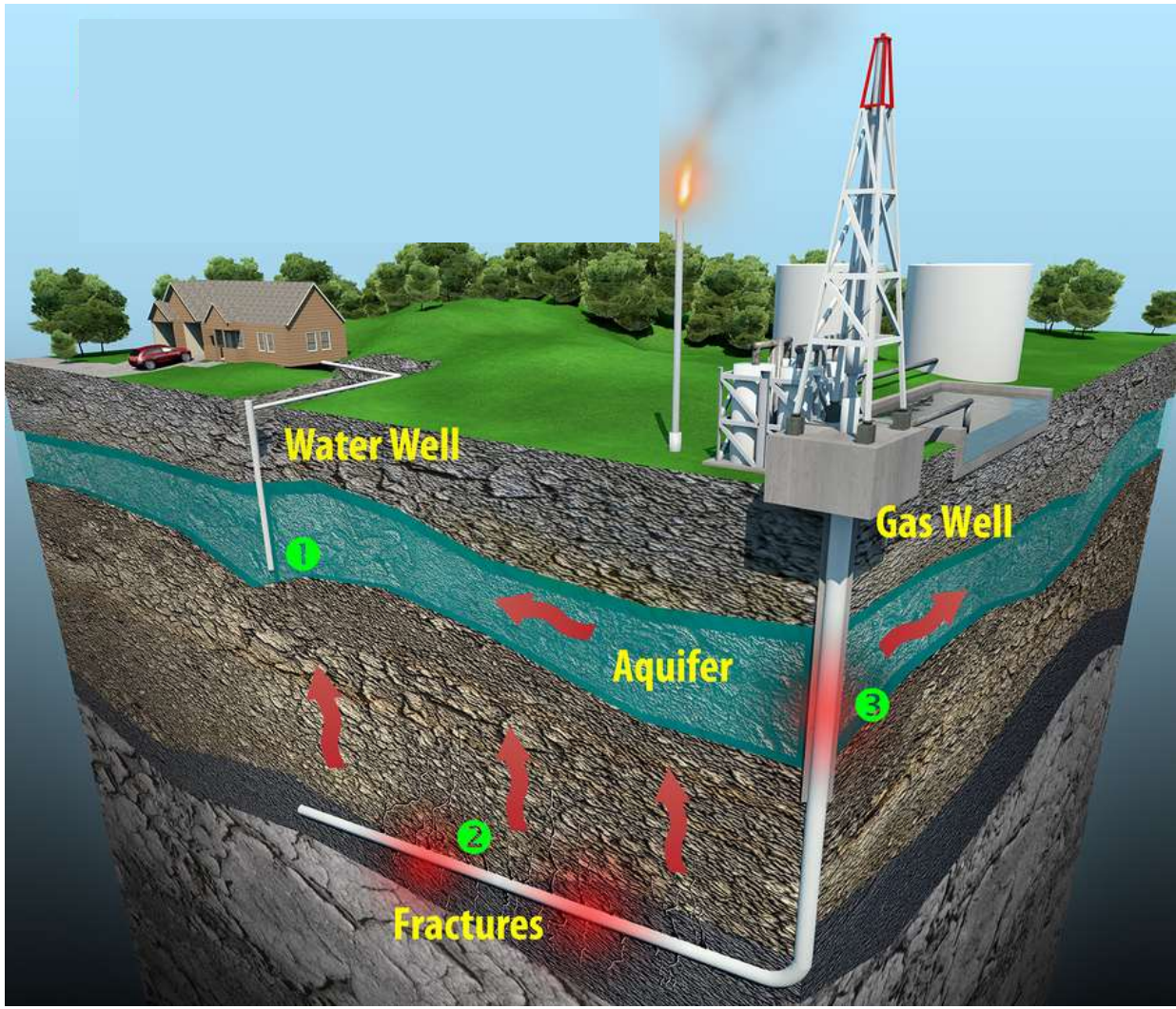


Note: All emission estimates from the *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2014*.

It’s possible to reduce methane emissions in industry, agriculture

Upgrading equipment

Controlling leaks



It’s also possible to capture methane and use it for fuel

This presentation - reduce gas leaks and recover methane from landfills

Burn to electricity

Power vehicles

Carbon credit

Some definitions regarding landfill methane

Biogas – bacteria decomposes organic matter

Landfill gas – decomposition of organic matter in a landfill.

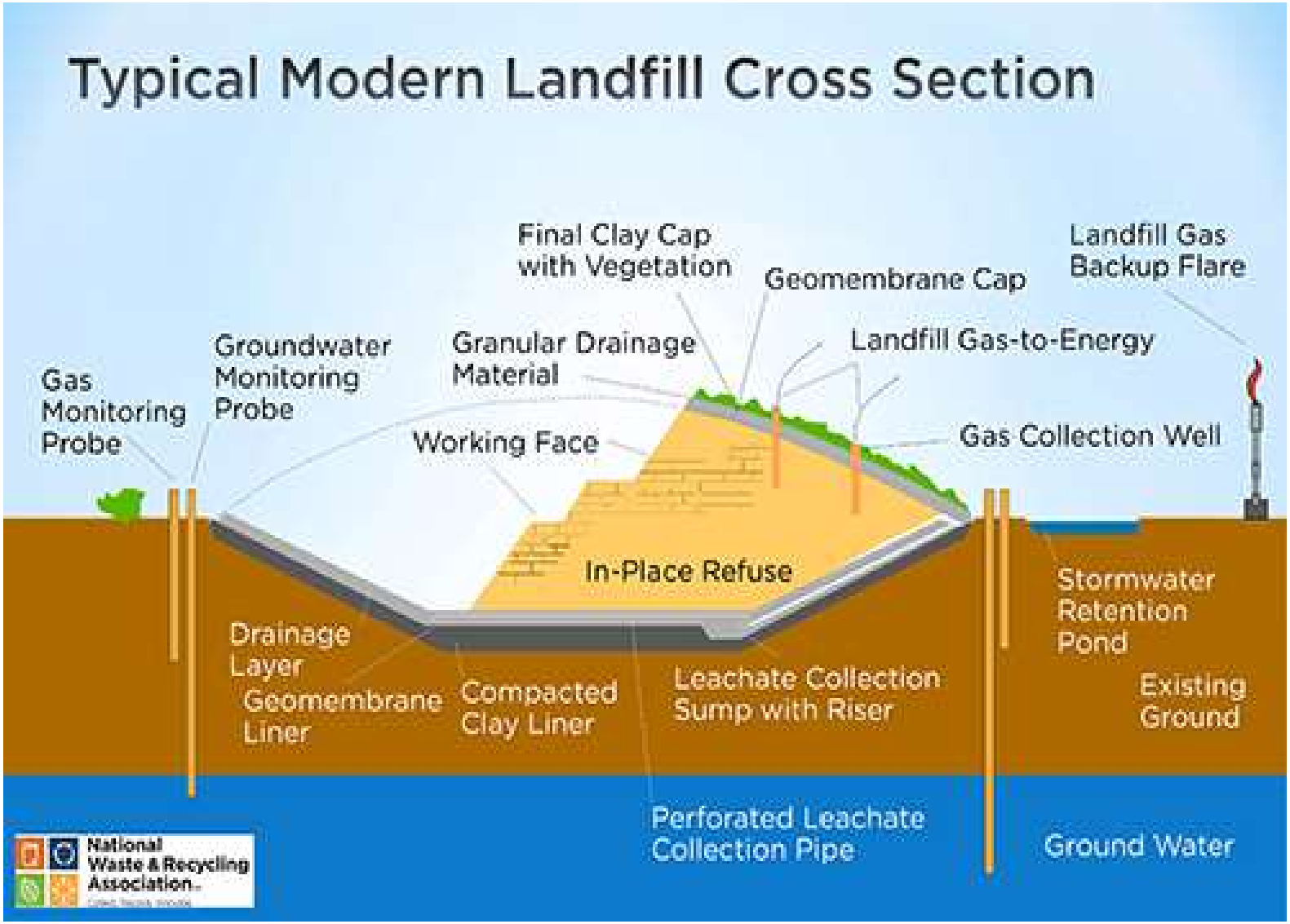
Generalized reaction to form methane

$$C_6H_{10}O_4 + 2H_2O \rightarrow 3CH_4 + 3CO_2$$

About ½ methane
About ½ carbon dioxide

Remainder = ammonia, nitrogen, oxygen, and sulfur

Anatomy of a landfill



Methane can leak along edges, or through fissures

Need an easy way to measure methane – real time:

- **Map emissions**
- **Find fissures**
- **Carbon accounting**

How to sample and measure methane at a landfill

- **Spatial variability**
- **Methane migrates horizontally through layers**
- **Production varies with weather**

More definitions – regarding sampling of methane

- **Soil gas – vapor in soil taken at depth**
- **Near surface gas – no higher than 4 inches off ground**

How to analyze for methane

- Discrete samples to lab
- Portable monitor
- Stationary monitors
- Remote sensing

Laboratory analysis of grab samples

- Stick probe in dirt or just above ground
- Fill a bag
- Analyze by GC-FID
- May take weeks
- More info than just methane

Using a portable monitor

- Stick probe in dirt or just above ground
- Take a reading and record
- Analyze by FID or a sensor
- Instantaneous results
- Only tests for methane

Stationary monitors

- Stick probe in dirt or just above ground
- Continuous readout from fixed locations
- Analyze by FID, IR, or a sensor
- Instantaneous results and trending
- Usually only methane, but CO, CO_2 possible

Remote sensing or “lasers”

- Shine light across field, or look from sky
- No localized data
- IR
- Not instantaneous data

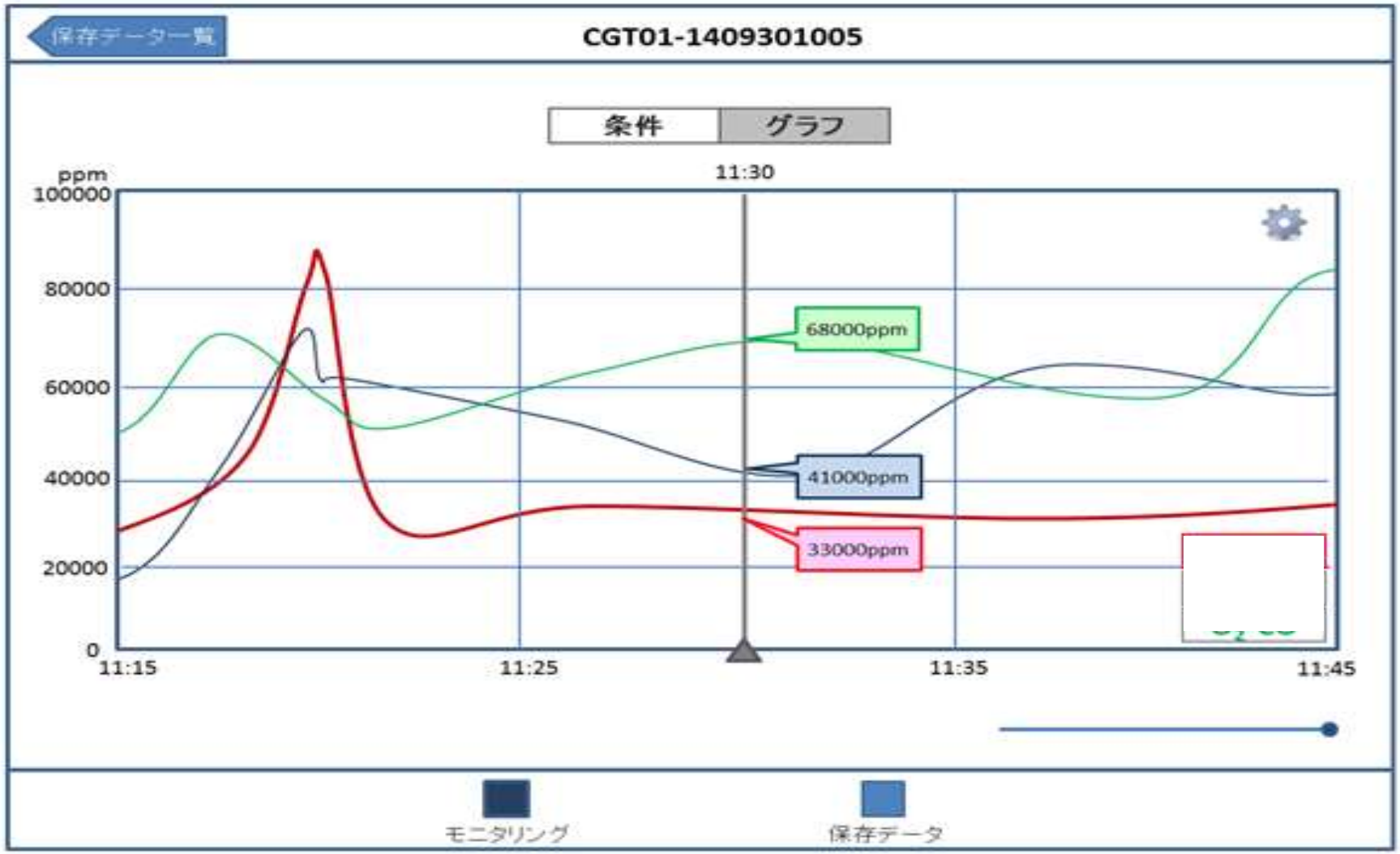
RCRA Subtitle D – must measure methane around perimeter

If exceeds limit → action

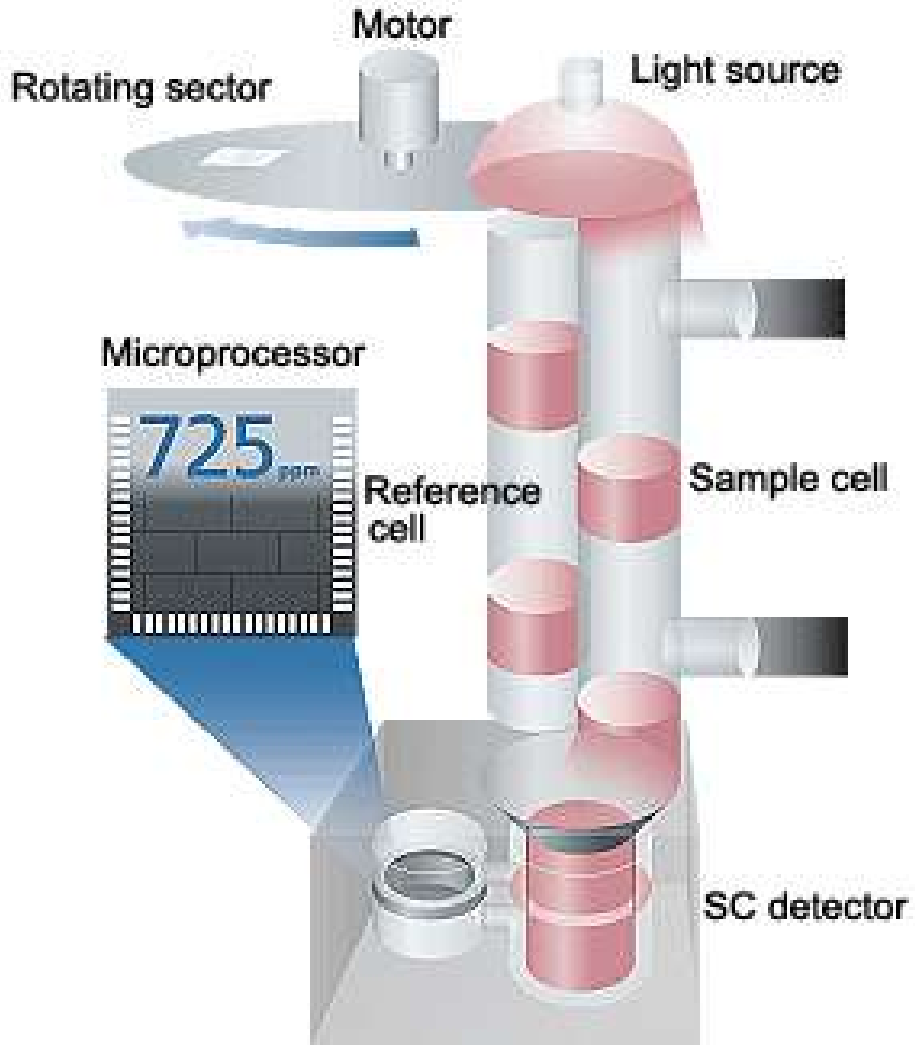
A hybrid combination of laboratory grade, portable continuous monitor

0-200ppm CO,
0-25vol% O2
0-100vol% CH4

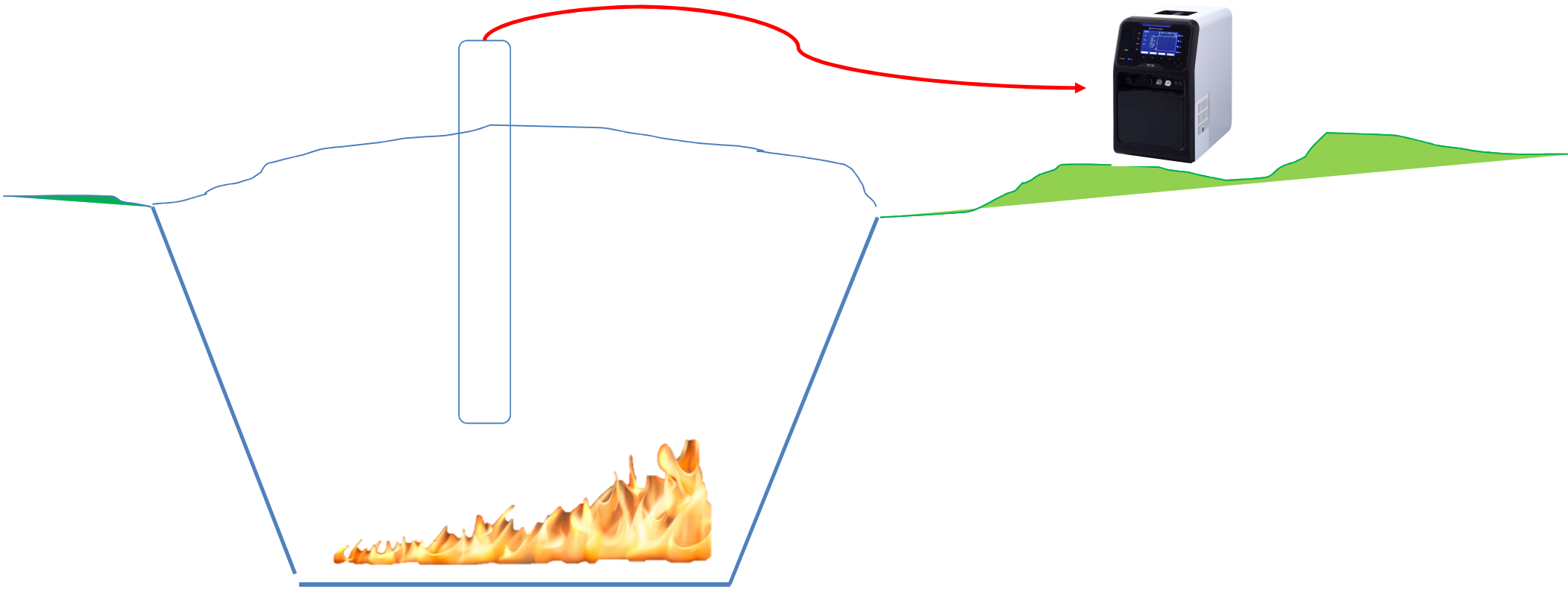
Provides continuous readout so fluctuations can be detected



Detection is by laboratory quality IR similar to TOC analyzers



Can measure CO, which detects landfill fires



Can continuously measure CH_4 that is burned to create electricity

Summary

- Methane is a greenhouse gas produced emitted by landfills and needs to be measured
- Geography of the landfill requires “mapping” emissions
- Lab results are too slow
- Portable sensors are only instantaneous readings.

Summary

- **A “hybrid” transportable analyzer can be used to measure methane emissions.**
- **Results are laboratory grade, based on proven detection techniques**

Thank You!

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For more information contact