






## Landfill Gas measurement



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## Subjects for discussion

-  Introduction to Hitech Instruments
-  Definitions – Landfill gas, Biogas
-  Why these gases are important
-  How we can monitor these gases
-  The economics of collection and measurement

## Hitech Instruments Ltd

- UK manufacturers of gas analysis equipment for over 25 years
- Applications specialists available for advice
- Industry specific products a speciality
- ATEX certified products for use on landfill sites
- Global network of distributors and service centres

## Definitions

- Biogas gas - is a product of the anaerobic digestion or fermentation of biodegradable materials such as manure or sewage, or municipal waste. Main components are methane ( $\text{CH}_4$ ) and Carbon Dioxide ( $\text{CO}_2$ )
- Landfill gas – is the term usually applied when Biogas is produced from a Landfill environment
- Also known as swamp, marsh, or digester gas

## Importance of Landfill Gases

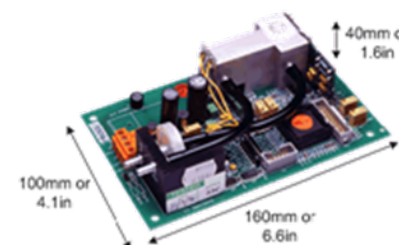
- If left to vent from landfill, methane contributes to global warming 20 times more than carbon dioxide (the most quoted 'normal' greenhouse gas)
- If left to vent, methane can form an explosive mixture in the atmosphere
- Methane can be used as a fuel
- Carbon credits are available where these gases are recovered
- The UK has Health & Safety legislation for the correct treatment of landfill gases

## Methods of measuring

- The important gases to measure are:
- Methane – main fuel to gas engines
- Oxygen – can cause explosions / fire
- Carbon dioxide – needs removal before methane can be used

## Methane and Carbon dioxide measurement

- ❖ Main emitted gases – normally measured using infra-red sensor technology
- ❖ Advantages
  - ❖ low cost, specific to methane or carbon dioxide
  - ❖ Non-depleting
  - ❖ Fast responding
- ❖ Disadvantages
  - ❖ Can vary with temperature
  - ❖ Can vary with pressure
- ❖ This technology is well understood and implemented within the UK landfill gas market



## Oxygen measurement and why

- If methane and air combine in the correct proportions, an explosion can occur
- Proportions are: Between 5% and 15% methane in air
- Since methane is present, oxygen needs to be monitored to prevent explosions below ground
- Alarms are used to warn of these conditions

## Oxygen measurement and why

- ❖ Various technologies available
  - ❖ Galvanic (Electrochemical) cell – most popular
  - ❖ Zirconia oxide ceramic
  - ❖ Paramagnetic sensors
- ❖ Advantages of galvanic
  - ❖ Very accurate
  - ❖ Low cost
  - ❖ Can be used with hazardous gases (eg methane)
- ❖ Disadvantages of galvanic
  - ❖ Measuring cell is eventually used up and needs replacing
  - ❖ Temperature sensitive
  - ❖ Relatively slow speed of response
- ❖ This technology is also well understood and implemented within the UK landfill gas market



## Instruments for measuring

- Best solution is an instrument designed specifically for landfill monitoring eg.
- Hitech GIR5000



- ❖ Approved for use in Landfill gas measurements, with ATEX approval as safe – an important requirement in the UK
- ❖ One instrument houses all that you need to monitor the three main components, methane, carbon dioxide and oxygen
- ❖ Alarms are used to indicate dangerous or fault conditions
- ❖ Can be connected to PLC systems and will integrate with other process monitoring equipment

## **The economics of collection and measurement of landfill gases**

- Reclaimed landfill gas can be used to run engines to generate electricity
- This is 'free' electricity
- Because the gases would normally have been vented, schemes that use this technique benefit from the Clean Development Mechanism (CDM) derived from the Kyoto agreement on greenhouse gas emissions
- In order to benefit from Certified Emission Reductions (Carbon Credits), instrumentation is needed to measure the reduction
- The cost of the instrumentation is small compared to the free electricity + carbon credit equation

## A simple solution

- ❖ A single instrument measuring the landfill gas as it enters the engine can provide the information needed for both a safe working environment and carbon credits
- ❖ No need for overcomplicated graphs and plots, just optimised gas values for efficient running of engines
- ❖ Easy to retrofit to existing sites or part managed facilities
- ❖ As long as it's safe....
  - ❖ Alarms levels can be set to monitor safety and efficiency
  - ❖ Outputs from the instrument can be fed into other recording devices

Thank you for your attention