Development and Applications of Infrared Technology for Air Quality Monitoring

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SNC•LAVALIN Environment

Introduction

- Infrared technologies for air quality monitoring on petrochemical plants and refineries
- Late 90’s infrared cameras for gas detection
- Last 10 years Smart LDAR
- SNC-Lavalin Environment Inc. purchased a GasFindIR camera from FLIR System (Summer 2009)
- Tests performed on different applications to determine the capabilities and limits of the camera

Introduction

OUTLINE

1. Technology Overview
2. Applications

OBJECTIVES

1. Demonstrate Applications for the Camera
2. Understand Advantages/Disadvantages

Technology Overview

Camera GasFindIR HSX MW Specs

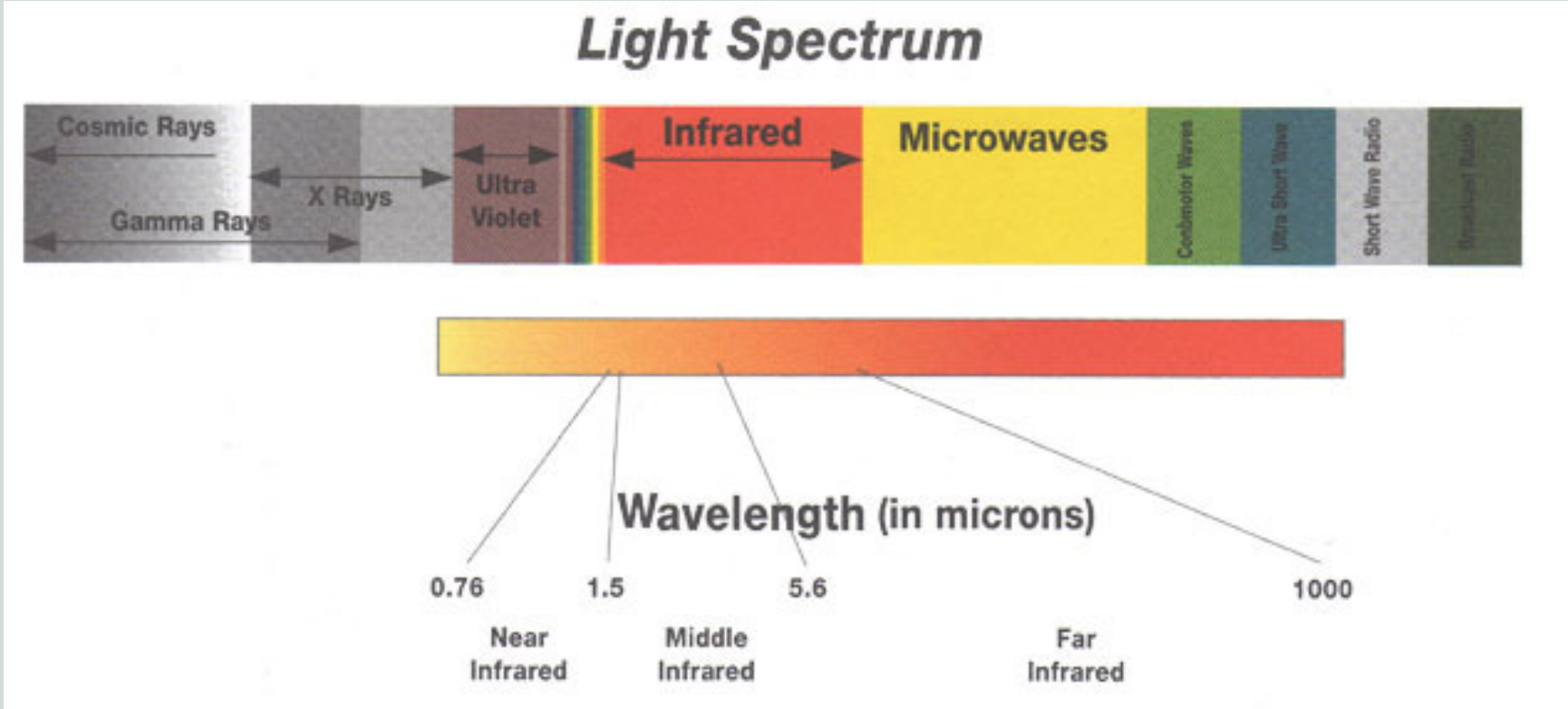
- NOT intrinsically safe (Hot Work Permit)
- Detector : 320 x 240 pixels (76 800 pixels)
  InSB Focal Plane Array (cooled to -196°C)
- Waterproof and shock resistant
- No internal memory
- Li-ion batteries (last 6-8 hrs each)
- 2.4 kg
- Removable 25 mm lens

Technology Overview

Camera GF-320 Specs

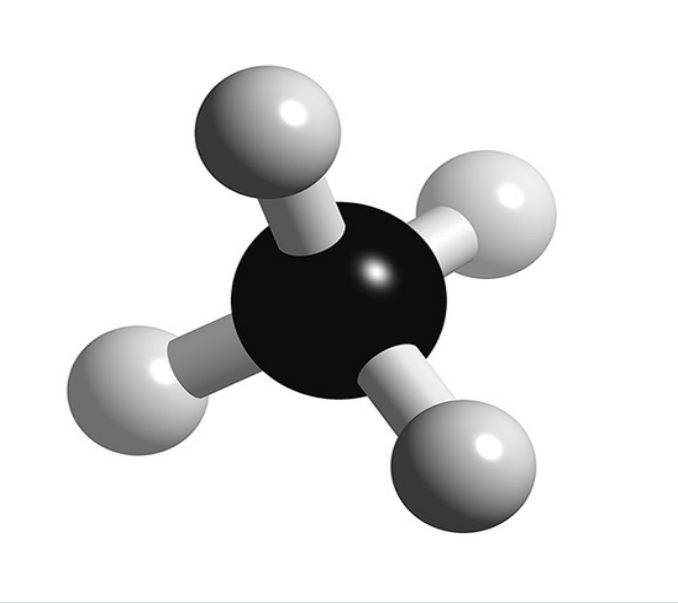
- Built-in memory
- Built-in GPS
- LCD screen
- Visual camera

Technology Overview



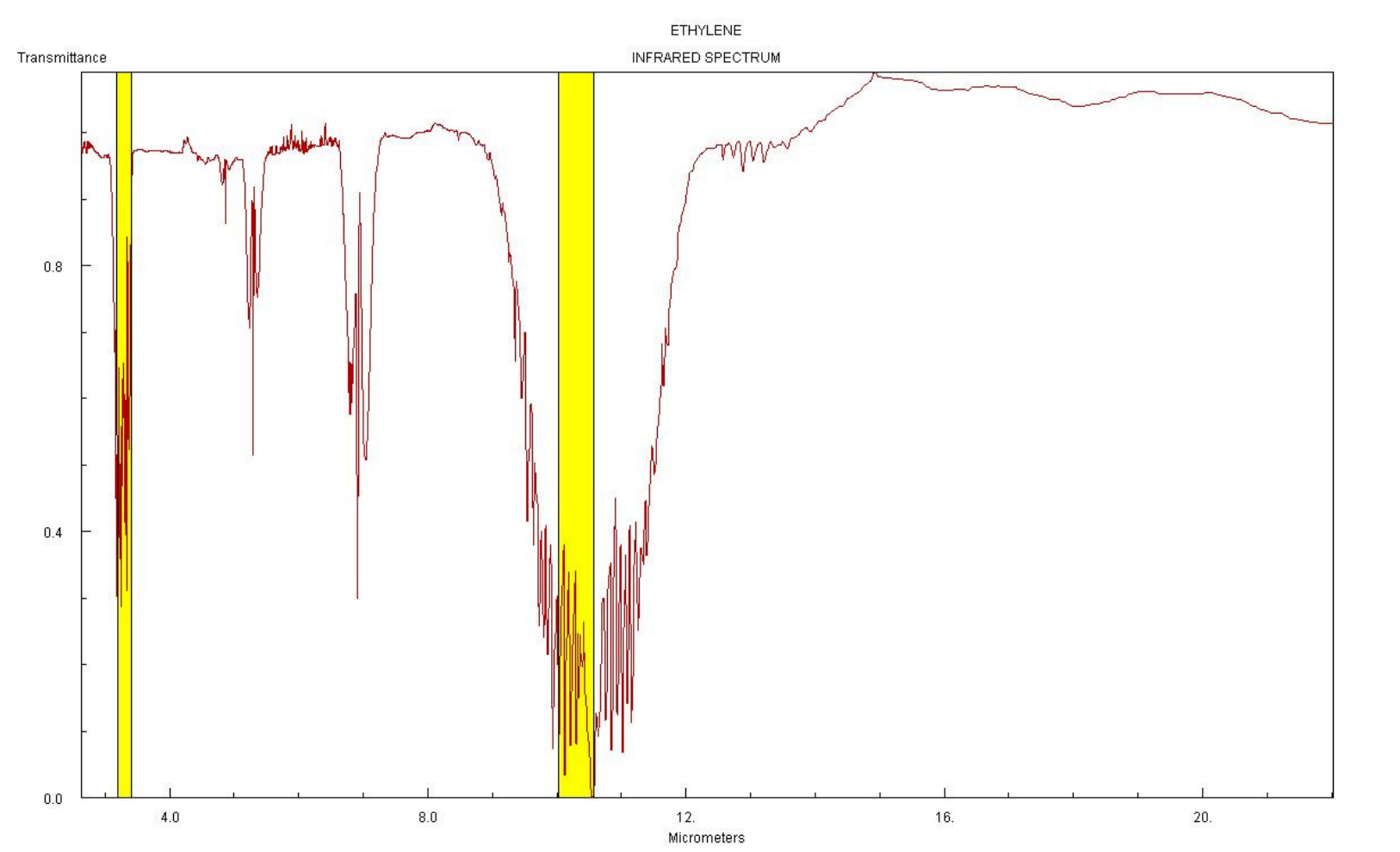
Technology Overview

"A travelling EM wave incident on an atomic structure induces oscillation in the atoms of that structure, thereby causing them to emit their own EM waves."

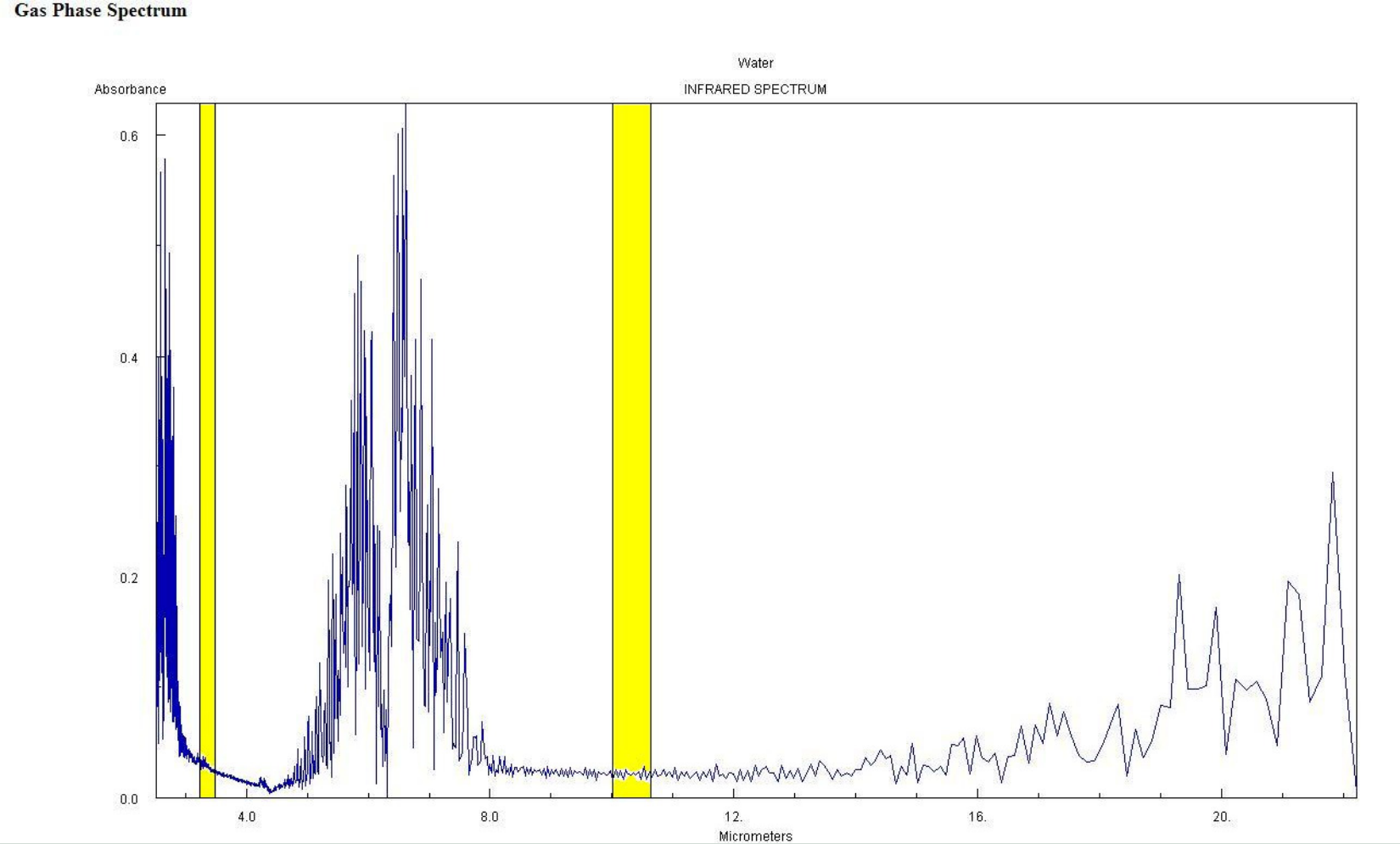


C-H bond stretch ~3 µm

Technology Overview



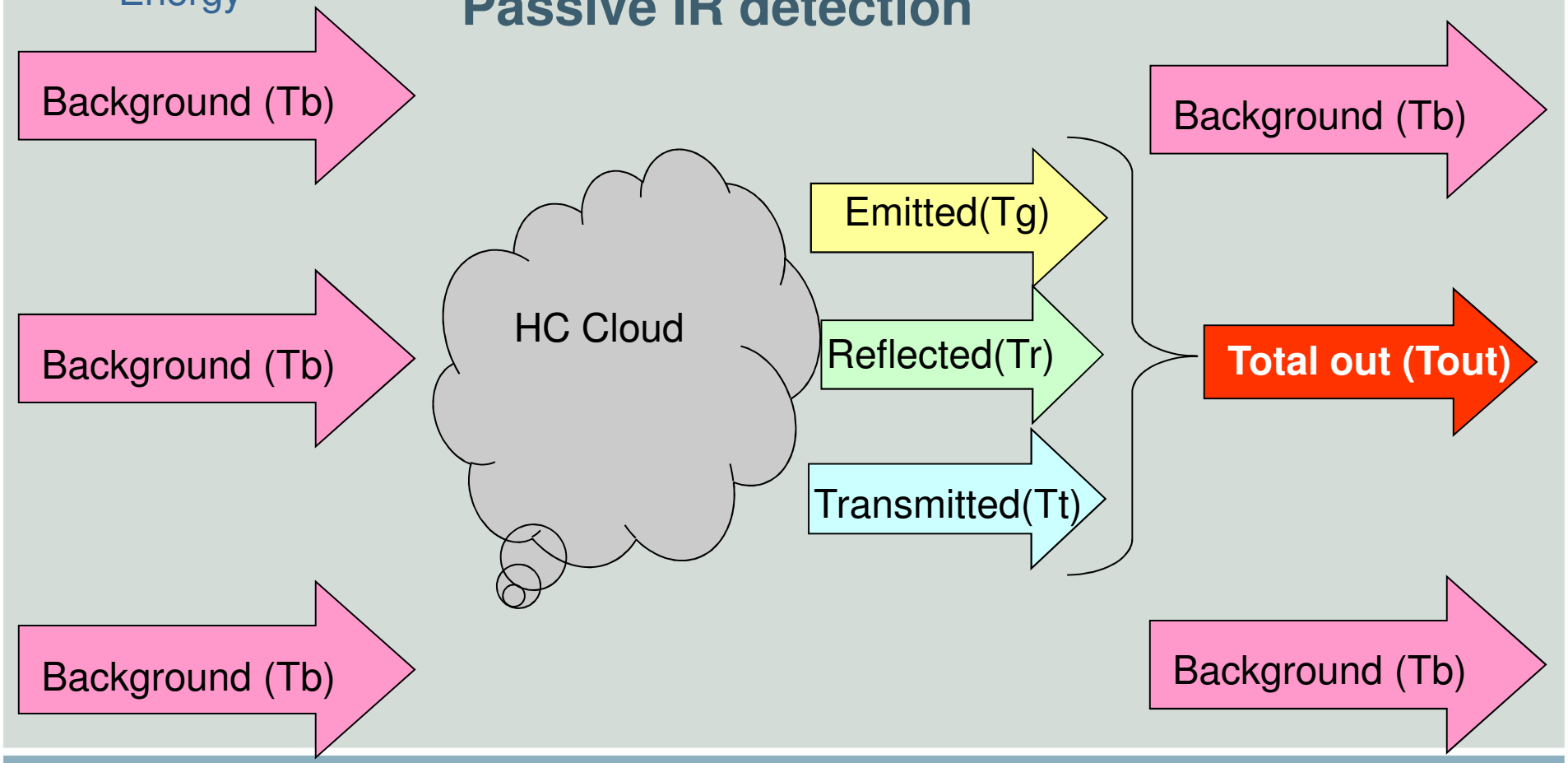
Technology Overview



Technology Overview

Radiation Energy

Passive IR detection



Technology Overview

List of detectable gases by MW IR Camera

- Benzene
- Butane
- Dimethylformate
- Ethane
- Ethanol
- Ethyl Benzene
- Heptane
- Hexane
- Toluene
- Xylene
- MEK
- MIBK
- Octane
- Pentane
- 1-Pentene
- Propane
- Isoprene
- Methane
- Propylene
- Methanol

Applications - LDAR

LDAR Overview

- **Fugitive emissions detection**
- **EPA Method 21 (Portable vapour analyzer)**

  - Flame Ionisation Detection / Photo Ionisation Detection
  - 100 000 ppm detection limit (FID)
  - Minimum 15 seconds per monitoring
  - Firmware for easy multiple recording
  - Exclusions : +2m/out of reach, dangerous to monitor, insulated

Applications - LDAR

Smart LDAR

- Use of optical instrument for emission detection
- EPA Alternative way of practice (IR Camera)
- 50% of total hydrocarbon emissions come from fugitive emissions[1]
- 90% of fugitive emissions comes from 0.13% of the equipment[2]

1-Robinson et al. Refinery Evaluation of Optical Imaging to Locate Fugitive Emissions, Journal of AWMA, July 2007.

2-API analysis of refinery screening data. Pub 310, Nov 1997

Applications - LDAR

Smart LDAR – Advantages

- Rapidly scan a large number of equipment
- +2m/inaccessible/dangerous to monitor/ insulated
- No maximum
- Visual impact (identification)

Smart LDAR – Disadvantages

- Field condition dependant
- Operator dependant
- Compound dependant
- No quantification
- Large memory requirements for record keeping

Applications – Tanks

Applications – Tanks

Advantages

- Security
- Accessibility
- Time

Disadvantages

- Quantification

Applications – Process Vents

Applications – SF_6

SF_6 Detection on high voltage equipment

Applications – SF_6

FLIR SF6

Applications – Landfills

Detection of methane emanations from landfills

Detection of fugitive emissions from biogas production piping

Lindum Ressurs (Norway)

Applications – Pipelines

Detection of important HC leak from pipelines

Use of moving vehicle (even helicopter) and GPS

QUESTIONS

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