

Table 5. Summarizing Examples of Technology/Applications

Source: ITRC Methane Team.

| Technology | Primary Data Type | Result Type | Detection Range (low to high) - Represents Typical Sensitivity of the Technology | Specificity to Methane/ Interference | Other Benefits | Measurement Temporal Resolution | Size (small, handheld, large) | Typical Deployment Method (walking, vehicle path, or fixed location) | Environmental Limitations (humidity, temperature, etc.) | Calibration Procedure | Maturity (developing, newly available, mature) | Miscellaneous |
|--|-------------------|------------------------------|--|--------------------------------------|--|---------------------------------|-------------------------------|--|---|--|--|---------------|
| Pellistor (Catalytic Bead) | quantitative | quantitative (concentration) | 500 ppm-5% | nonspecific/high | low cost, widely used or readily available | seconds | small | walking, fixed | humidity, temperature, contaminants | calibration gas; weeks to months | mature | See text |
| Metal Oxide Semi-conductor (MOS) | quantitative | quantitative (concentration) | 50 ppm - 1% | nonspecific/high | low cost, widely used & readily available | seconds | small | walking, fixed | humidity, temperature, contaminants | calibration gas; frequent and self-zeroing | mature | See text |
| Flame Ionization Detector (FID) | quantitative | quantitative (concentration) | 5 ppm (low) | nonspecific/high | widely used & readily available | seconds | handheld | walking, fixed | humidity, temperature, contaminants | calibration gas; frequent | mature | See text |

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| Gas Chromatography (GC) | quantitative | quantitative (concentration) | ppb to % | specific/low | high specificity; used to detect large variety of other compounds | >3 minutes | large | fixed location | requires controlled environment | calibration gas; daily to monthly | mature | Clean dry carrier gas is typically required |
| High Volume Dilution Sampling | quantitative | quantitative (emission rate) | 1.4 - 226 slpm | depends on sensor | | seconds | handheld | walking | depends on sensor | calibration gas; daily (depends on sensor) | mature | No longer manufactured; calibration procedures are very important |
| Mass Spectrometry | quantitative | quantitative (concentration) | ppb to % | specific/low if combined with GC | some devices can distinguish thermogenic and biogenic by isotopic determination (C12-C13) | 3 min when paired with a GC | handheld to large | fixed | requires controlled environment | calibration gas; daily to monthly | mature | Most often paired with a GC |
| Printed Nanotubes Sensors | quantitative | quantitative (concentration) | 5 ppm - unknown | nonspecific/high | low power and low voltage | minutes | small | fixed location | unknown | unknown | developing | Currently being field tested under DOE ARPA-E MONITOR |

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| Dual Frequency Comb Spectroscopy | quantitative | quantitative (concentration) | 20 ppm-meters (ppmm) | specific/low | simultaneous detection of other hydrocarbons; can distinguish thermogenic and biogenic | depends on deployment; can be from 1-100 minutes | large | fixed | precipitation reduces signal in path | reference cell | developing | Currently a research-based field instrument |
| Laser Absorption Spectroscopy – Closed Path Single-Pass Tunable Laser Absorption Spectroscopy | quantitative | quantitative (concentration) | ppm to % | specific/low | can distinguish thermogenic and biogenic | millisecond | large | vehicle path and fixed | none | calibration cell; some technologies are calibration free | mature | |
| Laser Absorption Spectroscopy – Closed Path Multi-pass Tunable Laser Absorption Spectroscopy | quantitative | quantitative (concentration) | ppb to % | specific/low | can distinguish thermogenic and biogenic | millisecond | handheld, large | vehicle path and fixed | none | calibration cell; some technologies are calibration free | mature | |
| Laser Absorption Spectroscopy – Closed Path Cavity Ring Down Spectroscopy | quantitative | quantitative (concentration) | ppb to % | specific/moderate | some can distinguish thermogenic and biogenic | seconds | large | vehicle path and fixed | controlled environment | calibration gas | mature | Moderate interference from water - sample must be dried |

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| Laser Absorption Spectroscopy – Closed Path Integrated Cavity Output Spectroscopy (ICOS) | quantitative | quantitative (concentration) | ppb to % | specific/moderate | some can distinguish thermogenic and biogenic | seconds | large | handheld, vehicle path, and fixed | somewhat controlled environment | calibration gas | mature | Moderate interference from water - sample must be dried |
| Laser Absorption Spectroscopy - Open Path Bistatic, Monostatic, Backscatter, and Ranged Resolved DIAL | quantitative | quantitative (concentration) | 0.2 ppmm - 100,000 ppmm | specific/low | highly reliable and durable | millisecond | handheld, large | walking, fixed | precipitation reduces signal in path | build in calibration cell typical | mature | Widely used for gas distribution surveys |
| Etalon | quantitative | quantitative (concentration) | 100 ppb - 10,000 ppm | specific/low | highly reliable and durable | milliseconds | handheld, large | walking, vehicle path, and fixed | | build in calibration cell typical | mature | Widely used for gas distribution surveys |
| Optical Gas Imaging (OGI) Passive Mid Wave IR Imaging; Quantitative Mid-Wave IR Imaging; and Passive Long-Wave IR Imaging | qualitative | image | 0.8 grams/hour (lab demonstrated); MDL may be poorer under actual field conditions | nonspecific/high | allows visualization of plume | 30 milliseconds | handheld | walking, vehicle path, and fixed | precipitation interferes; solar flux; gas temperature differential | tested with a daily release | mature | Results improve with operator training and experience |

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| Fourier Transform Infrared (FTIR) Spectroscopy Open Path; Passive (Monostatic); and Solar (Monostatic) | quantitative | quantitative (concentration) | Few hundred ppm to %m | specific/low | can also detect multiple hydrocarbons | 10 minutes | large | fixed | precipitation | calibration and some technologies can be calibration free | mature | |
| Gas Filter Correlation Radiometer | quantitative | quantitative (concentration) | TBD - (satellite target is 15 kg/hr to 150 k/hr for 20 m ² to 1 km ² resolution, depending upon satellite design) | specific/moderate | allows visualization of plume | 10 seconds | large | vehicle path | clouds, precipitation, requires sun | calibration gas (ground-based instrument) | developing | |