



CLIMATE AND CLEAN AIR COALITION
TO REDUCE SHORT-LIVED CLIMATE POLLUTANTS

CCAC Oil and Gas Methane Partnership: Methane Emissions Detection and Measurement Techniques, Equipment and Costs



Emissions Detection And Quantification - Overview

- A field emissions detection and quantification survey (similar to a Directed Inspection and Maintenance (DI&M) practice) recommended
 - Initial (baseline) survey
 - Subsequent surveys are based on data from previous surveys

- **Direct measurement**
 - is deemed as the most accurate method for quantifying annual methane emissions
 - contributes to greater certainty on emissions levels and economic costs and benefits
 - Allows for decisions based on fact, and accurate field data



Emissions Detection And Quantification – Overview

➤ Identification:

- Optical leak imaging (IR camera)
- Laser leak detector (RMLD)
- Soap bubble screening
- Organic Vapor Analysers (OVAs) and Toxic Vapor Analysers (TVAs)
- Acoustic Leak Detection

➤ Quantification:

- Turbine meters
- Thermal Dispersion Flow Meters
- Calibrated vent bag
- Vane anemometer
- Hotwire anemometer
- High volume sampler

Optical Leak Imaging (IR Camera)

- Scans the leak area in real time
- Applicable for cold/hot temperature environments
 - Recommended operating temperature ranges from -20 to 50°C (-4 to 122 °F)
- Capable of screening hundreds of components per hour
- Requires no calibration
- The only change required might be replacement of lenses for detecting emissions from longer distances
- Purchase cost: from \$85,000 to \$115,000



FLIR's GasFindIR

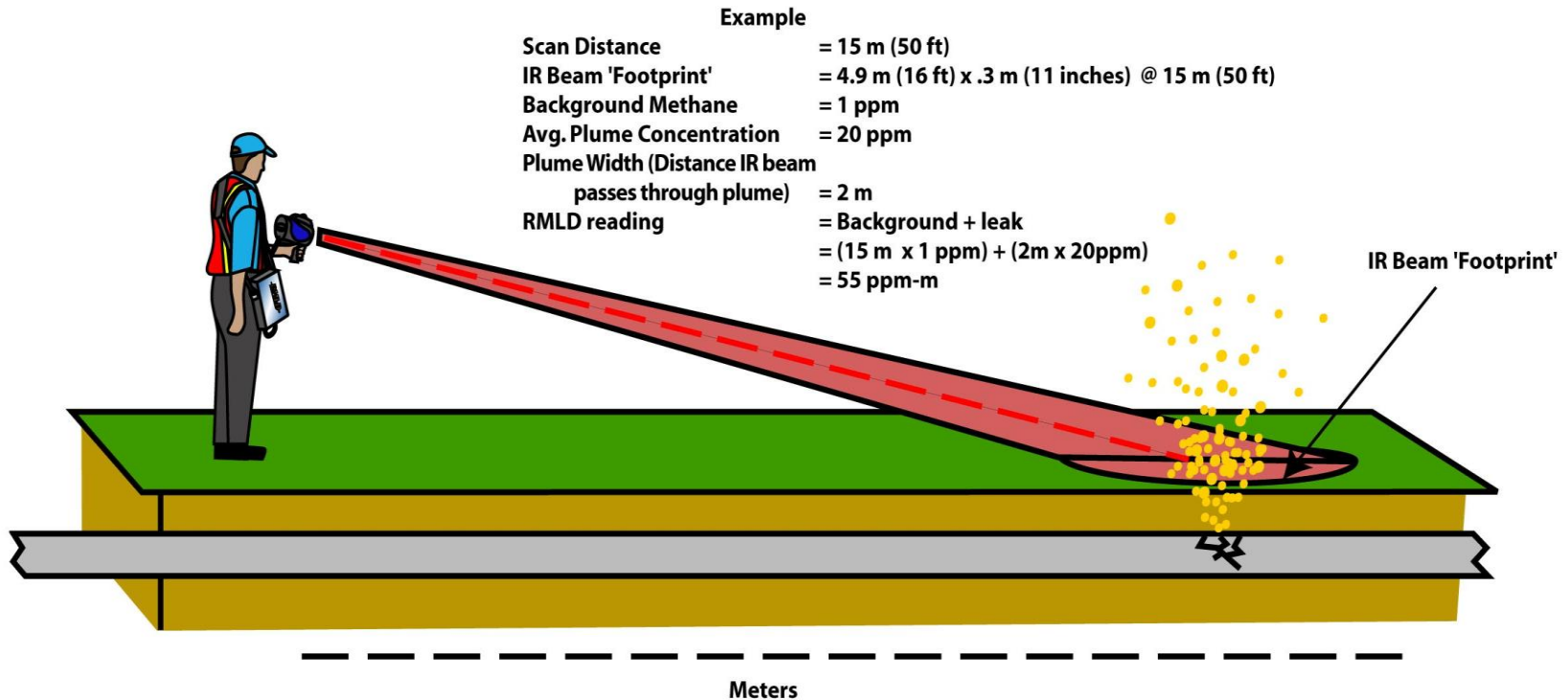


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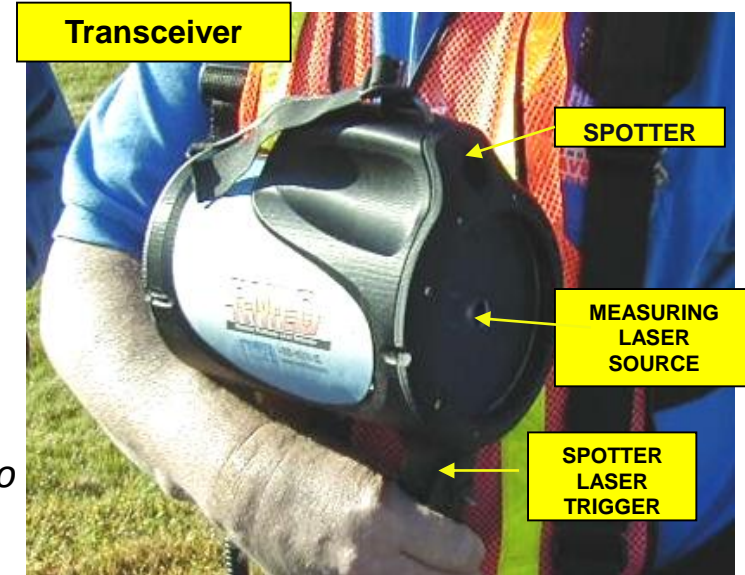
Laser Leak Detector (RMLD)

- Only detects methane gas
- Detects from a maximum distance of 30 meters (100 feet)
- A background surface within 34 meters (110 feet) from the device is necessary
- Useful for detecting methane leaks originating from hard-to-reach sources and/or throughout difficult terrain
- Can quickly screen hundreds of components per hour
- Purchase cost: [cost being verified with Heath]



Laser Leak Detector (RMLD)

- Shows methane concentration in parts per million per meter (ppm-m) of beam pathlength
 - Cannot be converted to the quantity of gas leakage
 - Measurement range: 0 to 99,999 ppm-m
 - Sensitivity:
 - 5 ppm-m at distances from 0 to 15 meters (0 to 50 feet)
 - 10 ppm-m and higher at distances from 15 to 30 meters (50 to 100 feet)
- Operating temperature: from -17 to 50 °C (0 to 122 °F)
- Relative humidity range: 5-95%
- Weight: 4.5 kilograms (10 pounds)
- Operates on a rechargeable internal lithium-ion battery pack:
 - Lasts for up to 8 hours



Soap Bubble Screening

- Quick and low-cost
- Effective for locating loose fittings and connections
- Not effective on large openings
- Screening: ~100 components per hour
- Cannot be used on equipment above the boiling point of water (100 °C/212 °F) or below the freezing temperature of water (0 °C/32 °F)
- Costs: < \$100



Organic Vapor Analysers (OVAs) and Toxic Vapor Analysers (TVAs)

➤ OVA:

- Measures the organic vapor concentration ranging from 9 to 10,000 ppm

➤ TVA:

- Measures organic vapor concentrations over 10,000 ppm

- In combination can measure methane concentration in the area surrounding a leak over a large range
- Concentrations can be converted to an approximate mass emissions rates using SOCOMI correlation equations
- Slow: each device can survey ~40 components per hour
- Require frequent calibration
- Costs: < \$10,000

Toxic Vapor Analyser



Organic Vapor Analyser



- Applicable to internal through valve leaks
- Can detect either high or low frequency signals
- Useful for detecting leaking valves when the vent is inaccessible
- Scan from distances up to 30 meters (100 feet)
- Have frequency tuning capabilities
- Particularly useful for inaccessible components, larger leaks, and pressurized gas
- Costs: \$1,000 - \$20,000 depending on instrument sensitivity, size, and any associated equipment/parts



Turbine Meters

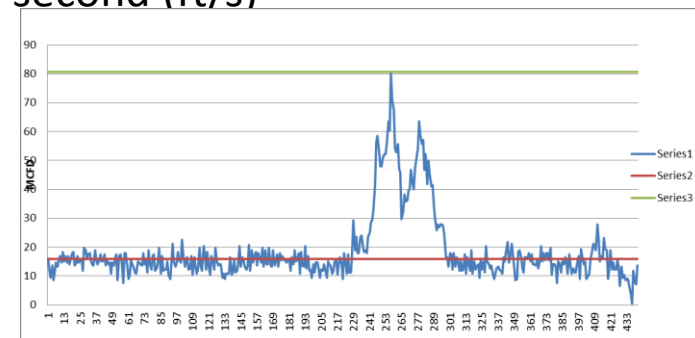
- Used for flows exceeding or equal to 0.283 standard m³/minute or 10 scf/minute; good for higher volume tank measurements
- Measure cumulative flow volume
 - Can be converted to standard volume using the temperature and pressure of the gas
- Allow continuous and automated measurement with a recording device
- Accuracy:
 - ±1 percent if within the stated flow range
 - ±25 percent if outside of the stated flow range
- Operational temperature: -18 to 104 °C (0 to 219 °F)
- Do not require field calibration; works well in high BTU gas
- Requires a good seal between the venting line and the meter itself
- Need to insure a separate pressure relief system is working
- Costs: \$4,000





Thermal Dispersion Flow Meters

- Extremely versatile meter, handling extremely large gas flows of extremely wet, high BTU gas; while also covering lower ranges effectively.
- Inserted in the gas flow from an open ended pipe or through a port in a gas flow pipeline or flare line.
- Probe configurations: ½" to 24" diameter pipe (multiple probe lengths)
- Flow Measurement System can be permanently mounted for continuous monitoring
 - Flare stacks
 - Open ended Vents
- Flow profile generation; works very well in wet, high BTU gas
- Data logging saved to USB and opened in Excel
- Measureable flow velocity range: 0.2 – 100 feet per second (ft/s)
 - can be translated into a volumetric flow rate
- Operating temperature: -40 to 121 °C -40 to 250 °F)
- Factory Calibrated on NIST traceable flow stands;
 - No field calibration required
- Costs: \$4,500 to \$8,500



Calibrated Vent Bag

- Measurement is made by timing the bag expansion to full capacity; not recommended for very large volume streams
- Does not exert a significant back pressure on the vented component
- Allows for low-pressure drop measurements
- Requires no additional power source
- Can be reused up to ~100 times
- Measurement of gas temperature and composition is required
- Measurable leak range: 17 m³/hour (600 ft³/hour) - 408 m³/hour (14,400 ft³/hour)
- Measurable temperature range: 0 to 49 °C (32 to 120 °F)
- Accuracy: ±10 percent
- Costs: \$50 per bag



- Best for measuring open ended lines and end-of-pipe vents of known cross-sectional area; typically used for wind speed
- Do not require complete capture of emissions
- Volumetric flow rate = Cross-sectional area x flow velocity
- Measuring range of gas flow velocity: 0.4 - 80 meters/second
- Measuring uncertainty: 0.9%-1.5% of gas velocity
- Working temperature:
 - Wheel sensor: -15 to 260 °C (5 to 500 °F)
 - Handheld sensor: 0 to 50 °C (32 to 122 °F)
- Measurement of gas temperature is required
- Avoid using when the device exerts a backpressure on the measured vent
- Require calibration
- Costs: \$1,400 - \$5,500



High Volume Sampler

- Converts calibrated air flow and hydrocarbon concentration to a volumetric flow rate of the gas sucked into the device
- Designed to capture the total amount of the emissions from a leaking component or vent line; best on small volume leaks
- Measures combustible hydrocarbon concentrations in the captured air stream ranging from 0.01% to 100%
- Does not distinguish between methane and heavier hydrocarbons
- Measureable leak rate: 0.02 - 18 m³/hour
(1 - 630 ft³/hour)
- Operating temperature: 0 to 50 °C (32 to 122 °F)
- Accuracy: ±10%
- Max capacity: 14 m³/hour (480 ft³/hour)
- Calibration is recommended every 30 days
- Costs: \$17,500 + \$1,200 (calibration kit)



Source: Natural Gas STAR, Heath Consultants

Gas Analysis Sampling Kit

- Extended Gas Analysis is often needed to accurately design VRUs, flares, or other control technologies
- Captures quality atmospheric tank vapor gas samples
- Low pressure gas line sampling
- Stainless steel sample canisters for pressurized samples
- Battery operated – 12 volt
- Allows for quick, accurate gas samples from the true source
- Costs: \$3,500 to \$5,000





THANK YOU!

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