Leak Measurement Techniques

Methane to Markets Partnership Workshop

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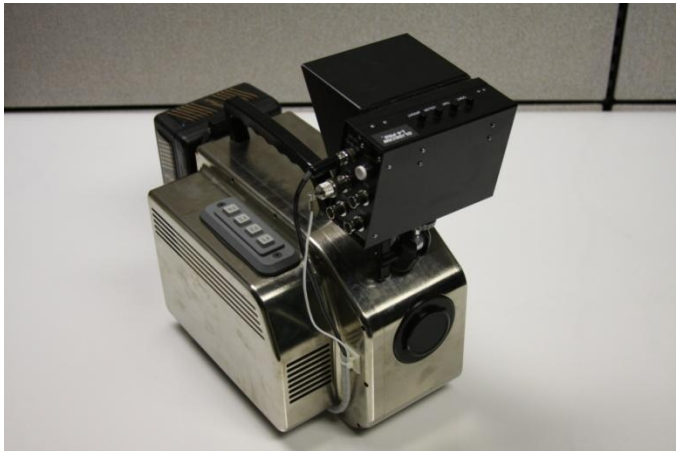
Leak Detection – IR Cameras

- Advantages:
  - Easy and efficient to use (fast leak detection).
  - Real-time qualitative indication of leak rate.
  - Allows remote leak detection.

Leak Detection – IR Cameras

- Disadvantages:
  - Sees methane, VOCs and steam
  - Expensive ($70,000 to $120,000 US)
  - Not effective during rain, snow, sleet, drizzle or fog


FLIR



Why Quantify Emission Rates?

- Justification for repair/control costs
- Prioritization and optimization of efforts?
- Objective performance monitoring
- Potential to generate marketable GHG credits and value avoided gas losses

Key Measurement Parameters:

- Temperature
- Pressure
- CH_4 Concentration
- Volumetric Flow

Performance Requirements

- Practical and safe to use in the field
- Reasonable cost
- Readily available
- Sufficient accuracy for economic evaluations (e.g., 25% or better)
- Greater accuracy for carbon credit projects (e.g., 15% or better)

Measurements at the Source

- **Typical Applications:**

✓ Equipment leaks, venting and flaring.

- **Basic constraints:**

✓ Requires easy or supplied access to source.

- **Potential Issues**:

✓ Safety concerns (H2S or relief events).

✓ Backpressure limitations.

✓ High or cold temperature surfaces.

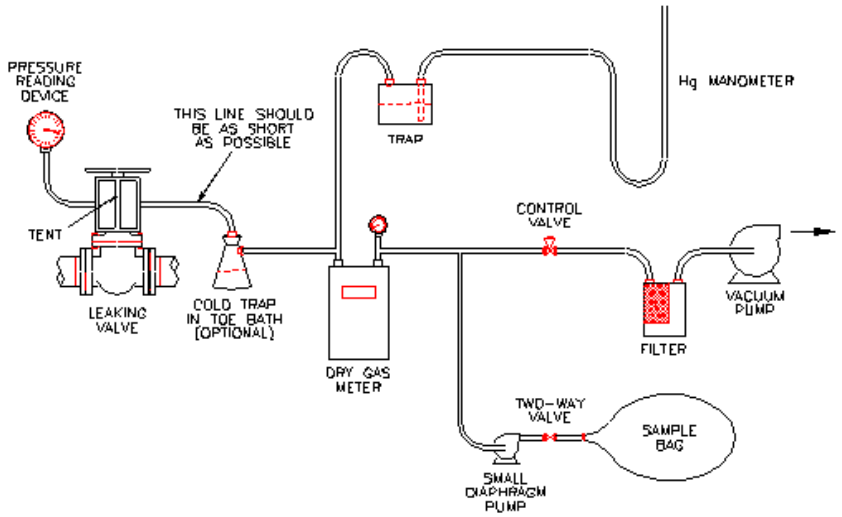
✓ Fouling (e.g., condensing vapor or lube oil mist)

Source: Clearstone Engineering, 2002

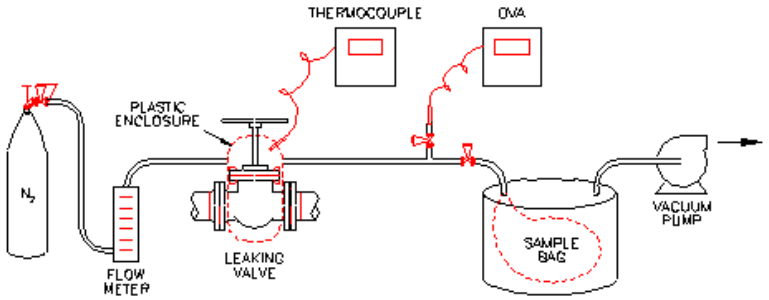
Measurements at the Source:

- Methods:
  - ✓ **Bagging**
    - ❑ Time consuming and costly to apply.
    - ❑ Applicable for small to moderate leak rates.
  - ✓ **Hi-Flow Sampler**
    - ❑ Convenient approach for smaller to medium sized leaks (e.g., 8 to 10 scfm or $25,200 to $31,500/y at $6/mscf).
  - ✓ **End-of-Pipe Capture & Measurement Techniques**
    - ❑ Calibrated Bag
    - ❑ Full-flow flow meters.
    - ❑ Velocity Traverses
  - ✓ **Inline Measurements**
    - ❑ Velocity Traverses
    - ❑ Tracer Techniques

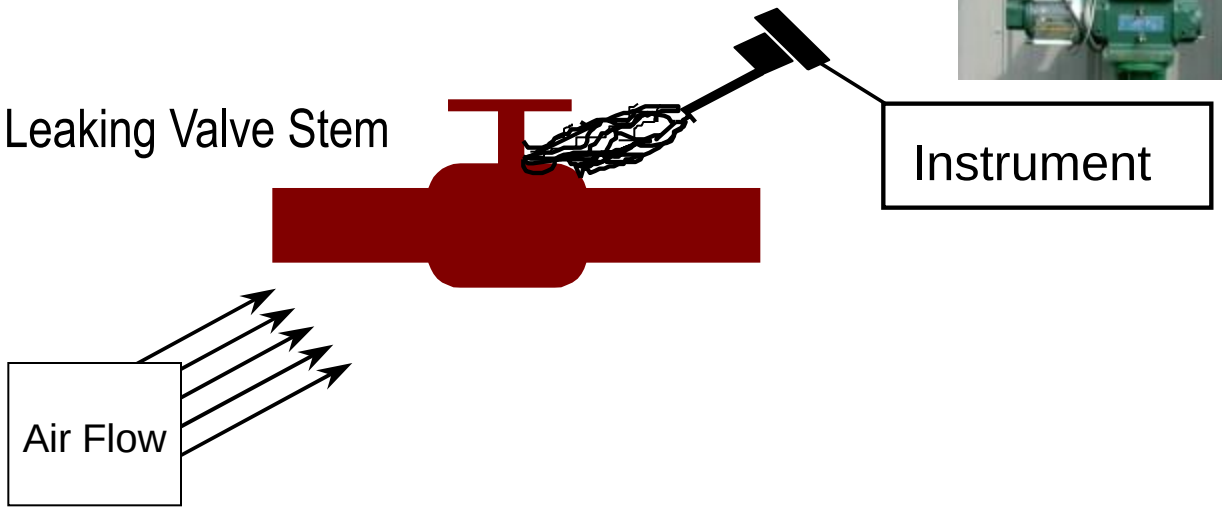
VACUUM METHOD



BLOW-THROUGH METHOD



HiFlow Sampler



Compressor Seal Vents:

- Causes of Emissions:
  - Seal wear.
- Typical Measurement Problems:
  - Potentially multiple leakage points:
    - Centrifugal:
      - Lube oil degassing reservoir.
      - Seal Vent
    - Reciprocating compressors:
      - Distance piece and packing case vents
      - Lube oil drain tank vent.
      - Crank case vent.
  - Potentially large flows.
  - Minimal tolerance to any back-pressure.
  - Fouling due to lube oil mist.

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Compressor Seal Vents:

- Typical Measurement Problems:
  - Oily roof-tops and limited roof-top access.
  - Lack of ports on vent lines.
  - Possibly weather caps on vent outlets.
- Measurement Approaches.
  - Vane anemometers.
  - Diaphragm meters or calibrated bags where some backpressure can be tolerated.
  - Hi-Flow Sampler
  - Quantitative remote sensing methods.
  - Permanent Solutions:
    - Flow switches.
    - Rotameters.

Blowdown and Vent Systems:

- Causes of Emissions (During Passive Periods):
  - Purge gas.
  - Leakage past the seats of blowdown/relief valves (5 to 10% leak and 1 to 2% of these contribute over 75% of the emissions)
  - Blowdown or drain valves not fully closed
  - Compressor seals

- Typical Measurement Problems:
  - Potentially large flows
  - Difficulty accessing end of pipe
  - Limited or no suitable ports for insertion of velocity probes.

Blowdown and Vent Systems:

- Typical Measurement Problems:
  - Low flow velocities.
  - Potentially wet or fouling environment inside pipe.
  - Safety concerns (relief episodes).
- Measurement Approaches.
  - Micro-tip vane and thermal dispersion anemometers.
  - In-line tracer tests.
  - Ultrasonic sensors (portable & online).
  - Remote sensing methods.
  - Permanent Solutions:
    - Ultrasonic transit-time flow meters.
    - Flow switches.

Vane Anemometer:

Pitot Tube

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Clamp-on Ultrasonic Flow Meter

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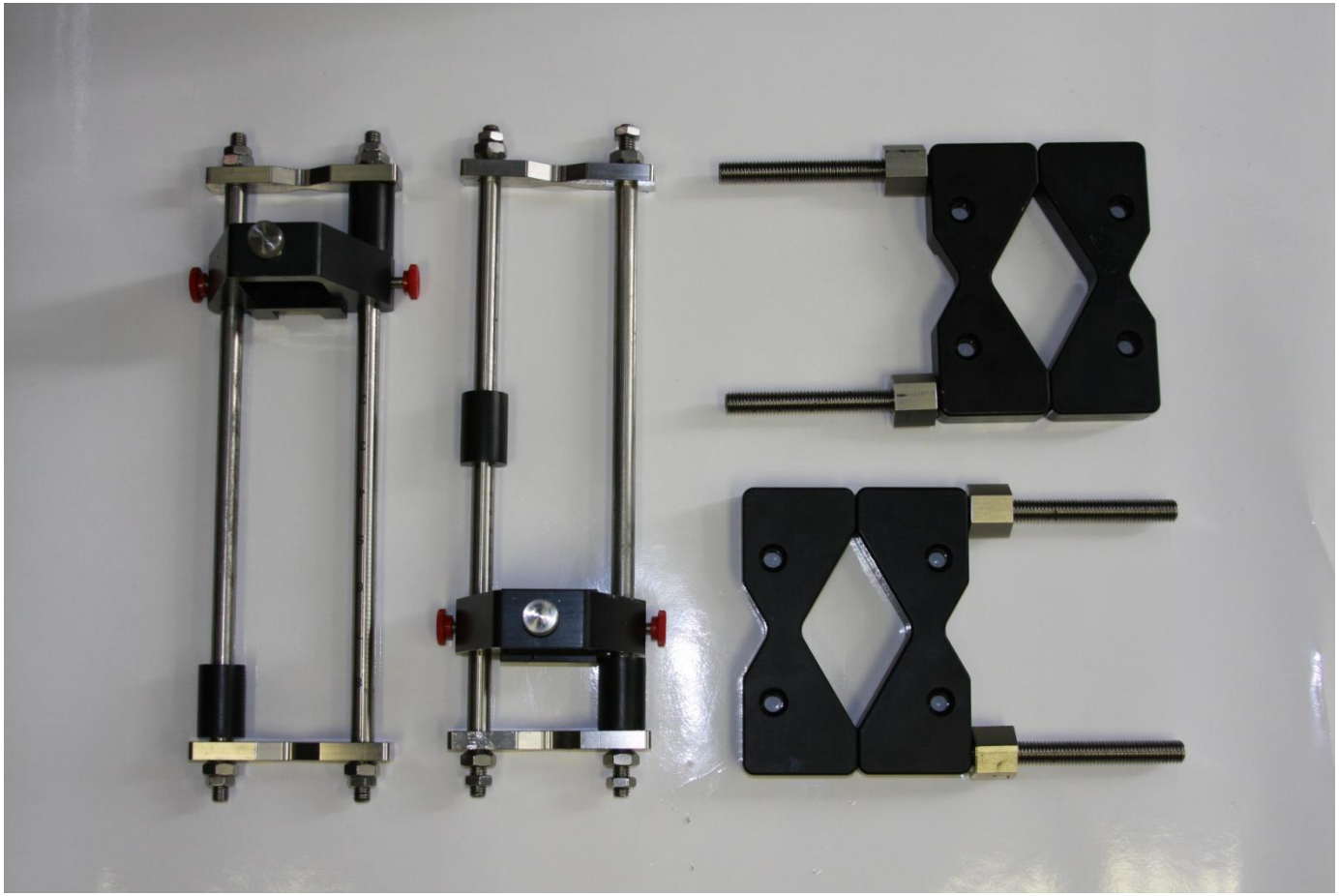
Clamp-on Ultrasonic Flow Meter



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Hi-Flow Sampler

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Conclusions on Leak Measurement:

- A selection of measurement techniques is needed.
- Instrumented solutions are the best choice for large potential emitters:
  - Compressor seals
  - Flare and vent systems
  - Metering of gas blanketing systems

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