Leak Measurement Techniques

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Dave Picard
Leak Detection – IR Cameras

- Advantages:
  - Easy and efficient to use (fast leak detection).
  - Real-time qualitative indication of leak rate.
  - Allows remote leak detection.
Disadvantages:
- Sees methane, VOCs and steam
- Expensive ($70,000 to $120,000 US)
- Not effective during rain, snow, sleet, drizzle or fog
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
- CH₄ 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

Leaking Valve Stem

Air Flow

Instrument
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.
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:

- HFA-Ex Handheld Display
- Vane Wheel Flow Sensor TSR mn80A
- Power Supply & Charger
- International Power Connection Adapters
Pitot Tube
Clamp-on Ultrasonic Flow Meter
Clamp-on Ultrasonic Flow Meter
Hi-Flow Sampler

Hi-Flow Sampler Assembly

Bellows Attachment

Captured Bag Assembly

Batteries, Power Supply & Charger

Boveled Attachment, 24” long

Leak Tag Securing Zipties

Leak Tags

Sampling Hose Assembly
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