# Overview of DI&M, Quantification and Economic Repair for Compressors

## Turkmenistan Meeting

**November 9, 2011**
**Farmington, New Mexico**

**Milton W. Heath III**
**Heath Consultants Inc.**
**Director – Environmental Services**

# Agenda

- Program to Find and Fix Large Leaks, also referred to as Directed Inspection and Maintenance Programs (DI&M), the process
- Establishing your “Priority of Work” plan.
- Leak Screening & Tagging
- Leak Measurement and quantification
- Safety Considerations with heights and blow down occurrences.  Ladders, man-lifts and use of fall protection
- Prioritize Leak Repair
- Opgal Gas Imaging Camera Demonstration

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# Partial List of Potential Leak Sources

- Compressor Unit Valves
- Relief Valves
- Unit Blowdowns
- Compressor Packing
- Meter Tubes
- Valve Stems
- Fuel Valves
- Various Piping & Vessel Flanges
- Online Gas Analyzers
- Centrif. Comp. Seals
- Pipeline Damage

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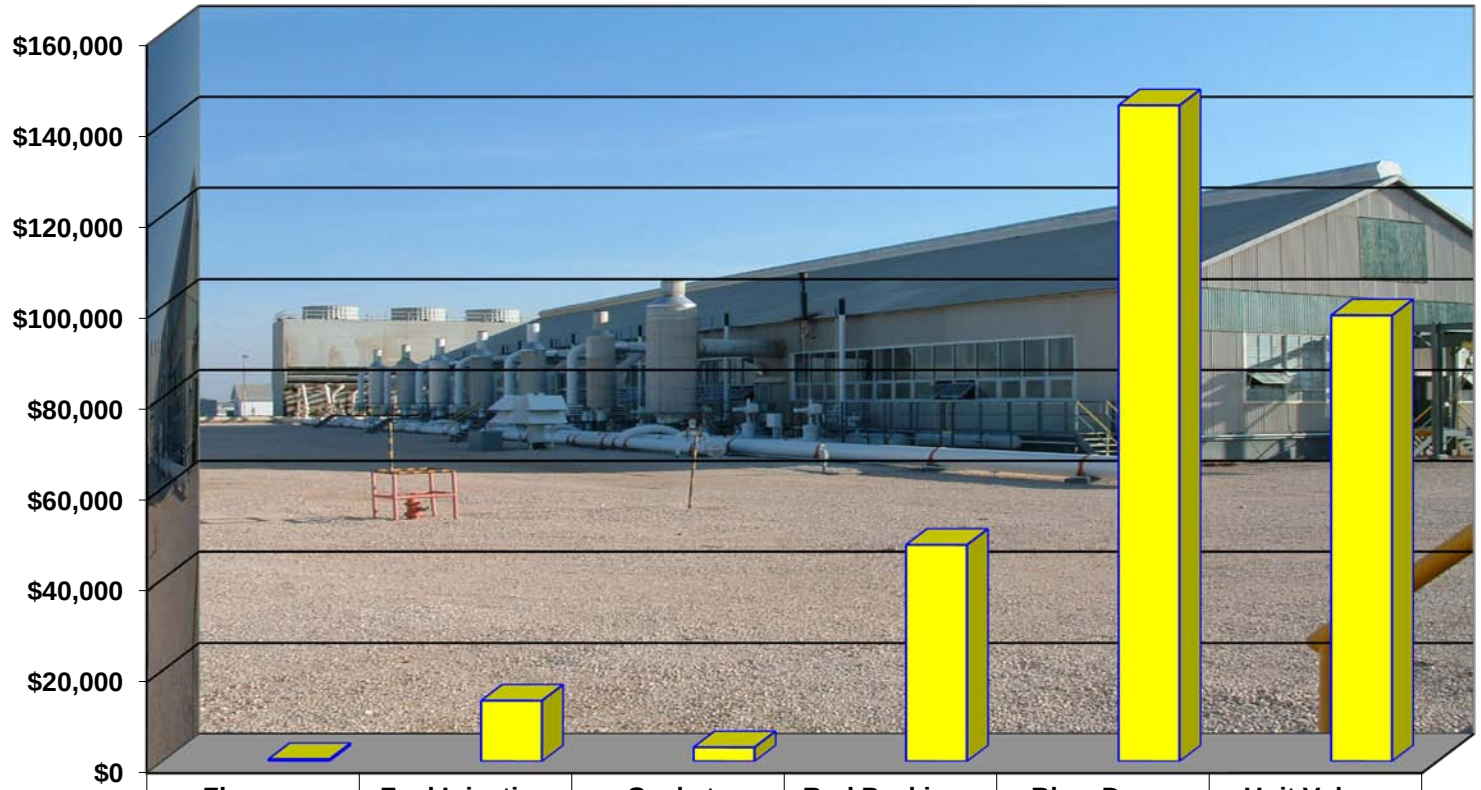
# Top 4 Typical Fugitive Sources

- Reciprocating Compressor Packing
- Blow Down Valves
- Unit Valves
- Scrubber Dump Valves

"Find The Needle In The Haystack"


# Component Category Profile

**Annual Leakage by Component**
**Natural Gas Compressor Station**




| | Flanges | Fuel Injection Valves | Gaskets | Rod Packings Systems | Blow Down Valves | Unit Valves |
|---|---|---|---|---|---|---|
| Total Leakers | 5 | 60 | 27 | 47 | 15 | 13 |
| Annual Leakage | $468 | $13,352 | $3,085 | $47,532 | $144,197 | $98,081 |

Source: Heath Consultants Incorporated, Environmental Services.

# Approach to Reducing Leakage

- Institute a measurement program that accurately measures all leaks
- Station personnel then have the information necessary to weigh the cost of the leak repair versus the value of the lost gas for each leak.

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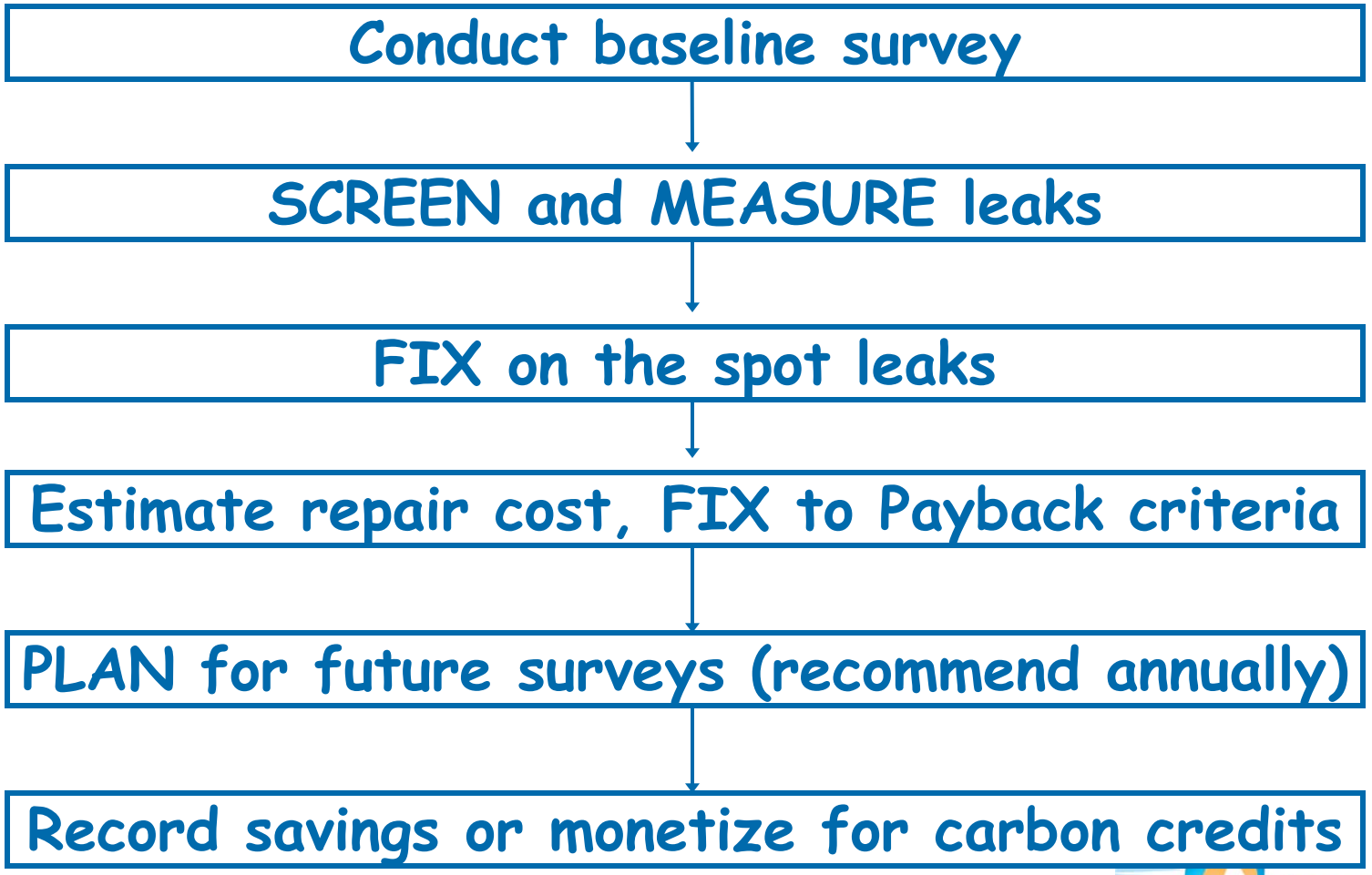
# Implementing a Leak Reduction Program at Compressor Stations

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# Step 1: Familiarize & Strategize

- Walk through facility and determine plan of attack
- Focus your attention on all Vented Components (i.e., Packing Vents, Distance Piece “dog-house” Vents, Blowdown Vents, Pressure Relief Vents, Starter Gas Vents, ESD Vents & even Crankcase vents).
- Determine safe approach to access vents with the use of ladders, man-lifts and Certified Fall Protection.

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# Step 2: Screening & Tagging

- Recommend the use of a reliable pump-driven combustible gas indicator that can see down to 50 PPM. (Infrared Imaging Cameras, Lasers and non-corrosive bubble solution are the best combinations.)
- For Vented Components, recommend measuring as you go. (if you can't pre-screen for leakage)
- For Components on the ground you should screen, tag and then quantify.

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# Leak Survey Methods

- Leak Detection Tools
  - Remote Methane Leak Detector (RMLD)
  - Gas Imaging Cameras
  - Liquid bubble solution
  - Infrared Methane Detectors
  - Catalytic oxidation/thermal conductivity
  - Ultrasonic
  - Visual

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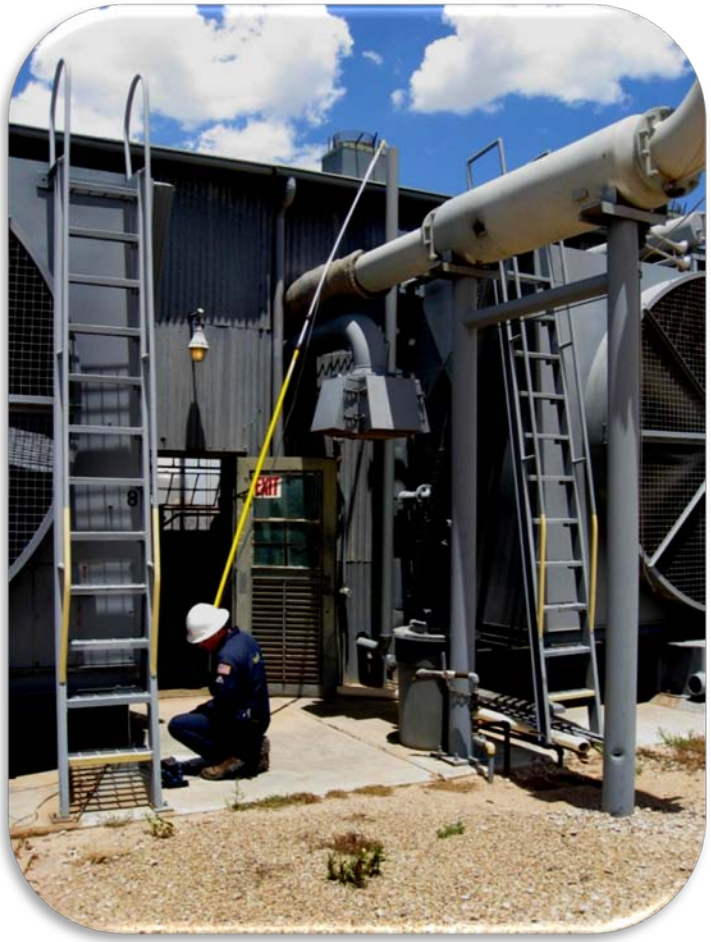
# Screening Difficult to Reach Vent Stacks – With Electronic Screeners ($,$$$)



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# What Does Passive Plume Imaging Look Like


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Source: Heath Consultants Incorporated

# Eye-C-Gas Video Recordings for You to See Firsthand

Video recording of fugitive leaks detected by Heath Consultants using the Opgal Eye-C-Gas thermal infrared Gas imaging camera.

..\..\Gas Imaging\New Folder\Eye-C-Gas Videos\Opgal Video Demo.wmv

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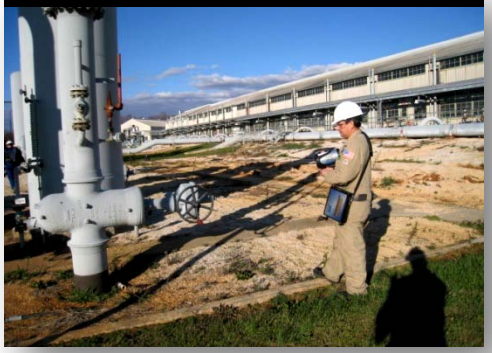
# What does Active Plume Detection Look Like?

- Real-time detection of methane leaks
  - Quicker identification & repair of leaks
  - Screen hundreds of components an hour
  - Screen inaccessible areas simply by pointing at them

RMLD
Remote Methane Leak Detector

**Pipe Connectors**

**Valve Stem Packing**

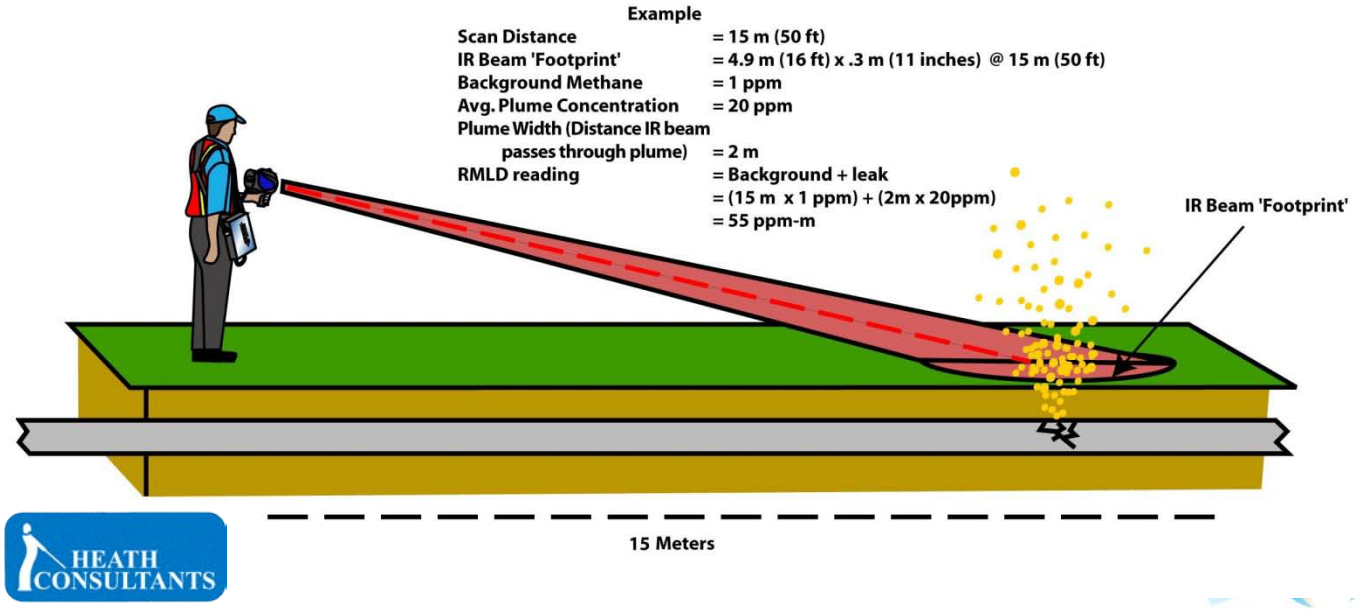


**Mobile Leak Detection**


Source: Heath Consultants

# Remote Methane Leak Detection: How Does it Work?

- Works using Tunable Diode Laser Absorption Spectroscopy (TDLAS)
- Specific to methane gas only
- Displays gas reading in parts per million metered




Source: Heath Consultants Incorporated

# Turkmenistan Project – WYG and Heath Turkmenbasy, 2008

# Turkmenistan Project – WYG and Heath Turkmenbasy Region, 2008

# Step 3: Measuring Fugitive Methane Emissions

- Leak Measurement
  - Hi Flow Samplers
  - Vent-Bag
  - Hot Wire Anemometer
  - Rotameter

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# Step 4: Fix Leaks On The Spot

- **Example 1:** Blowdown valve leaked almost 14,500 Mcf/yr
  - Rather than replace the expensive valve, Partner spent just $720 on labor and materials to reduce the emissions to approximately 100 Mcf/yr
  - Value of gas saved was $58,000 at $4/Mcf

- **Example 2:** Tube fitting leaked 4,121 Mcf/yr
  - Very quick repair requiring only five minutes reduced leak rate to 10 Mcf/yr
  - Value of the gas saved was $16,484 at $4/Mcf

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# Liquid Condensate Dump Tanks

# Natural Gas Scrubber Tanks

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# Condensate Tank Leakage from Faulty Dump Valve

**Storage Tank Emissions**


**Scrubber Dump Valve Leakage through Condensate Storage Tank**


**Estimated Annual Loss with 3 CFM Anti-Static Measurement Bag**

**13,515 Mcf/yr**
**Or**
**$54,060/Yr @ $4/Mcf**

# Leaking Scrubber Dump Valve at Compressor Station

**$$$$$$**

**Leaking Scrubber Dump Valve Closed Manually Reducing Leakage by an estimated >300 scfm.**

**Estimated Savings = $473,040/year**

**$$$$$$**


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# About Rod Packing Leakage

- Under best conditions leak rate can be expected at a minimum of 11.5 scfh
- Leakage can be reduced through proper monitoring and a cost effective schedule for replacing packing rings & piston rods.
- Step one is to monitor and record baseline packing leakage and piston rod wear.
- Establish a replacement threshold

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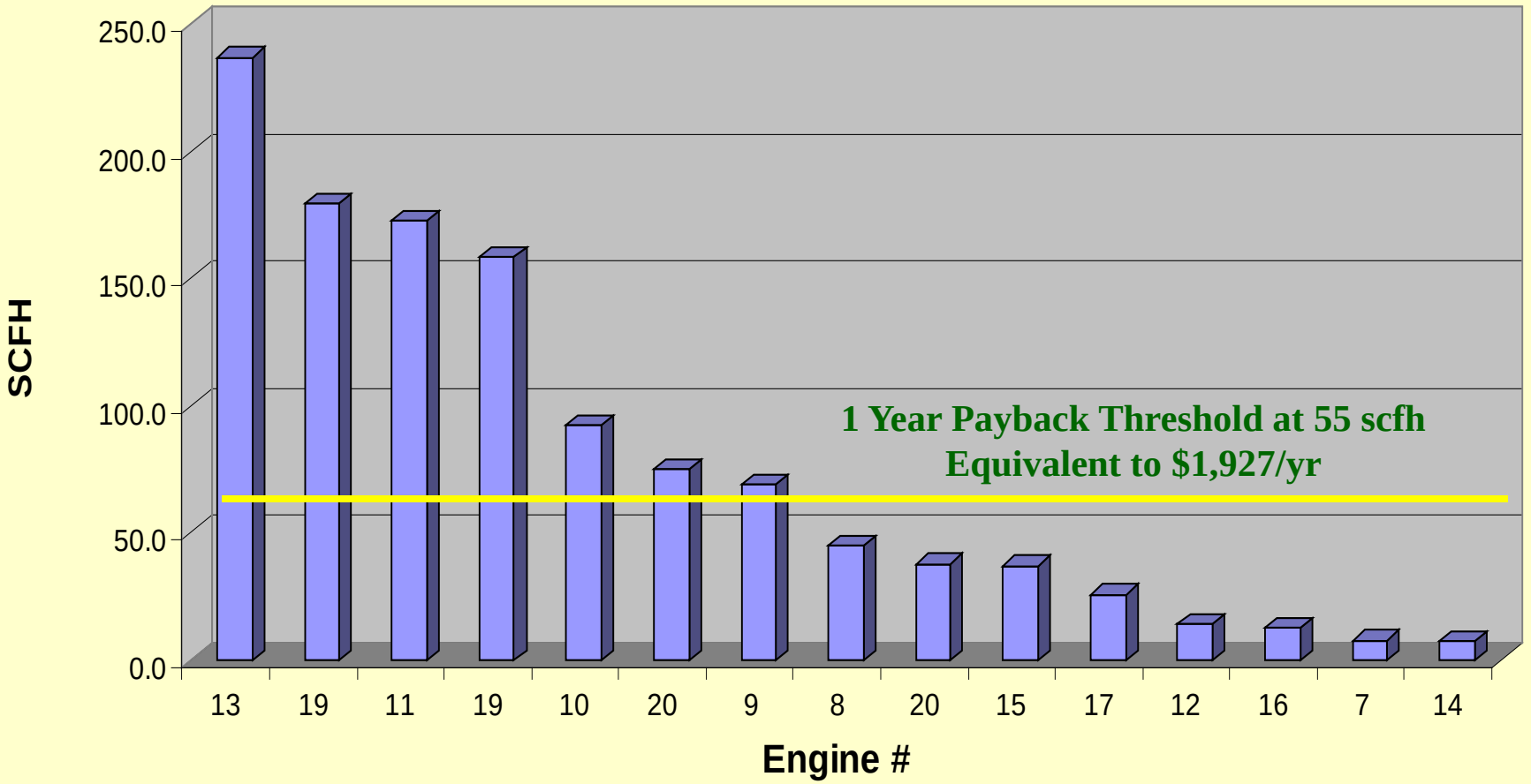
# Rod Packing Leak Rates at Oklahoma Compressor Station

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# Rod Packing Leakage

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# Step 5: Perform Maintenance and/or Repair and Conduct Post Measurement to Verify Leak Repair/Reduction

- Determine true savings achieved for economic analysis.
- Confirm and verify leak reductions to report your value added to the company or carbon value for future credit

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# Step 6: Routine Monitoring of Known Culprits and Plan for Future DI&M

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# OPGAL: EYE-C-GAS Demonstration
## Fugitive Emissions Detection Camera

- A design formed by the demands of the industry.
- Specially designed for the applicative market of natural gas, oil and petrochemical industries.
- Design for intrinsically safe, allowing the inspection at hazardous places in the plant.
- Current Approvals: Class 1, Division 2 & ATEX.


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# How The Eye-C-Gas Camera Works

- The leaking gas absorbs reflected infrared light
- The EYE-C-GAS™ camera spectral band coincides with the absorbance spectra of the leaking gas
- The sensitivity of the EYE-C-GAS™ camera enables the measurement of the difference in signal value, caused by the leaking gas
- EYE-C-GAS™ produces images of infrared energy and display it on a screen, similar to how a camcorder displays video.

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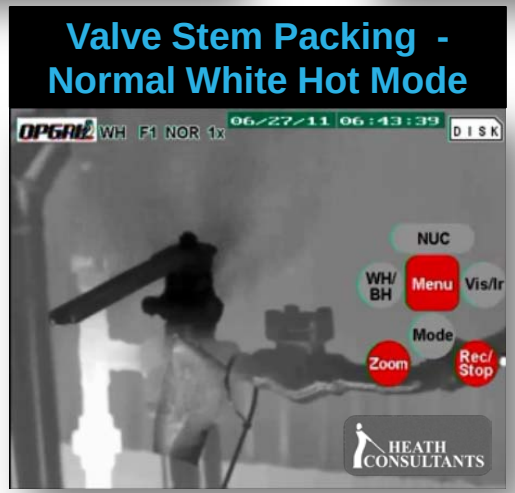
# Adjusting Polarization with Eye-C-Gas Camera

**Valve Stem Packing - Enhanced, Black Hot Mode**


**Valve Stem Packing - Normal Black Hot Mode**


**Valve Stem Packing - Normal White Hot Mode**

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# Contacts and Further Information

- More detail is available on these practices and over 80 others online at: epa.gov/gasstar/tools/recommended.html
- For further assistance, direct questions to:


*Roger Fernandez*
*EPA Natural Gas STAR Program*
*fernandez.roger@epa.gov*
*+1 (202) 343-9386*

*Milton W. Heath III*
*Heath Consultants Inc.*
*Milt.heath3@heathus.com*
*+1 (713) 844-1304*