Chevron Experience: Methane Emission Mitigation

Natural Gas STAR
Producers & Processors Technology Transfer Workshop
Midland, TX
July 23, 2008

Methane Emission Mitigation Strategy

- Opportunity identification
- Opportunity prioritization
- Action plan development
- Plan deployment
- Look backs

Opportunity Identification

IR Gas Camera

- Tank battery inspections
- Compressor inspections and installations
- Wellhead inspections
- Self audits
- Vent/Flare audits
- Gas driven equipment (i.e. diaphragm gas actuated equipment)
- Gas engine driven pumping units

Opportunity Prioritization

- Cost
- Financial hurdles
- Ease of implementation
- Capital or expense
- Operational timing
- Origin of development
- Scalability/best practice candidate
- Safety and environmental
  - Emissions
  - Regulatory impact – current and future

Action Plan Development

- Involvement of right personnel
  - HES
  - Facilities and/or Production Engineers
  - Field personnel: Mechanics, Electricians, Construction Reps, etc.
- Training required
- Company or contract
- Pilot or project
- Success metrics

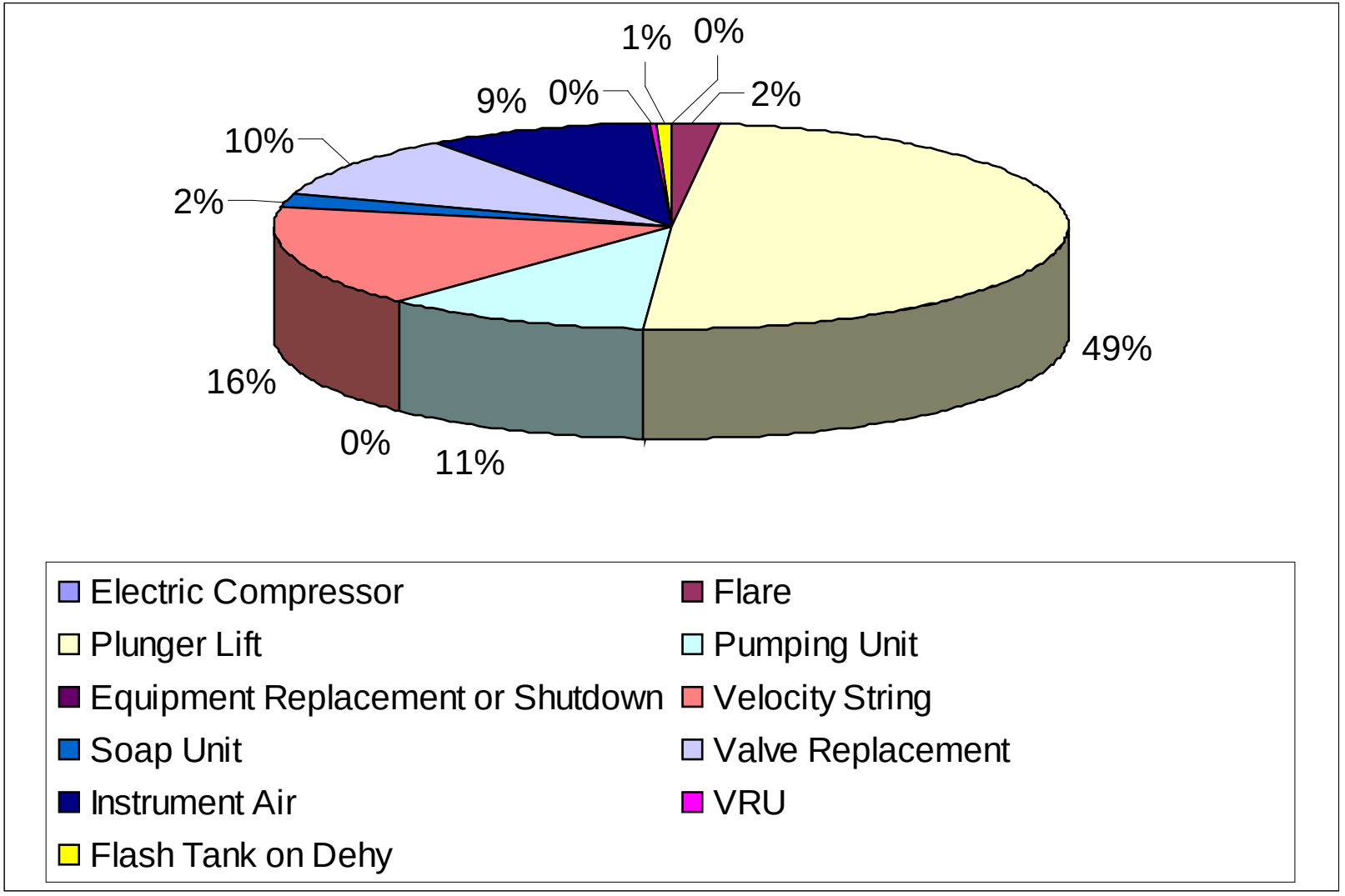
Action Plan Development (cont.)

- Labor market
- Existing paradigms
- Limited expertise

Look Back

- Track and trend results
- What worked
- Continuous improvement
- Network sharing

2007 Methane Emissions Reductions



DI&M Demonstration Study - IR Camera

- Conducted a pilot study in the Permian Basin
- Scanned facilities using IR Gasfinder camera
  - Gas plants, CO2 Plant, Compressor stations, Tank batteries, and Satellite stations
- Quantified leaks with a high flow sampler
- Determined a dollar amount for associated leak volumes

IR Camera Observations – Demo Study

- Compressor Leaks
  - Distance pieces
  - Flanges
  - Valve stems
  - Seals

- Tank Leaks
  - Hatches
  - Enardo valves
  - Vent lines
- Valves/Fittings/Flanges
  - Instrument gas leaks
  - Cryogenic valves
- Fluid levels in tanks

IR Gasfinder Camera Findings – Demo Study

- Camera results
  - 112 total leaks recorded (60 from gas plants)
- Gas plant quantification results
  - Estimated leak volume: 100,000 Mcf/yr
  - Estimated annual revenue lost: $2.1MM
    - C2+ included for some sites (i.e. $/MSCFD are not equivalent)
    - NG - $7.58/MMBtu, Propane - $8.83/MMBtu, Condensate -$10.12/MMBtu
    - Value excludes sources from combustion, flare activities and well sites.
    - Survey does not include all fugitive emissions sources from these facilities
  - Natural gas (processed), field gas (unprocessed), and propane
  - Wide range in leak volumes - difficulty bagging leaks

Current IR Camera Initiatives

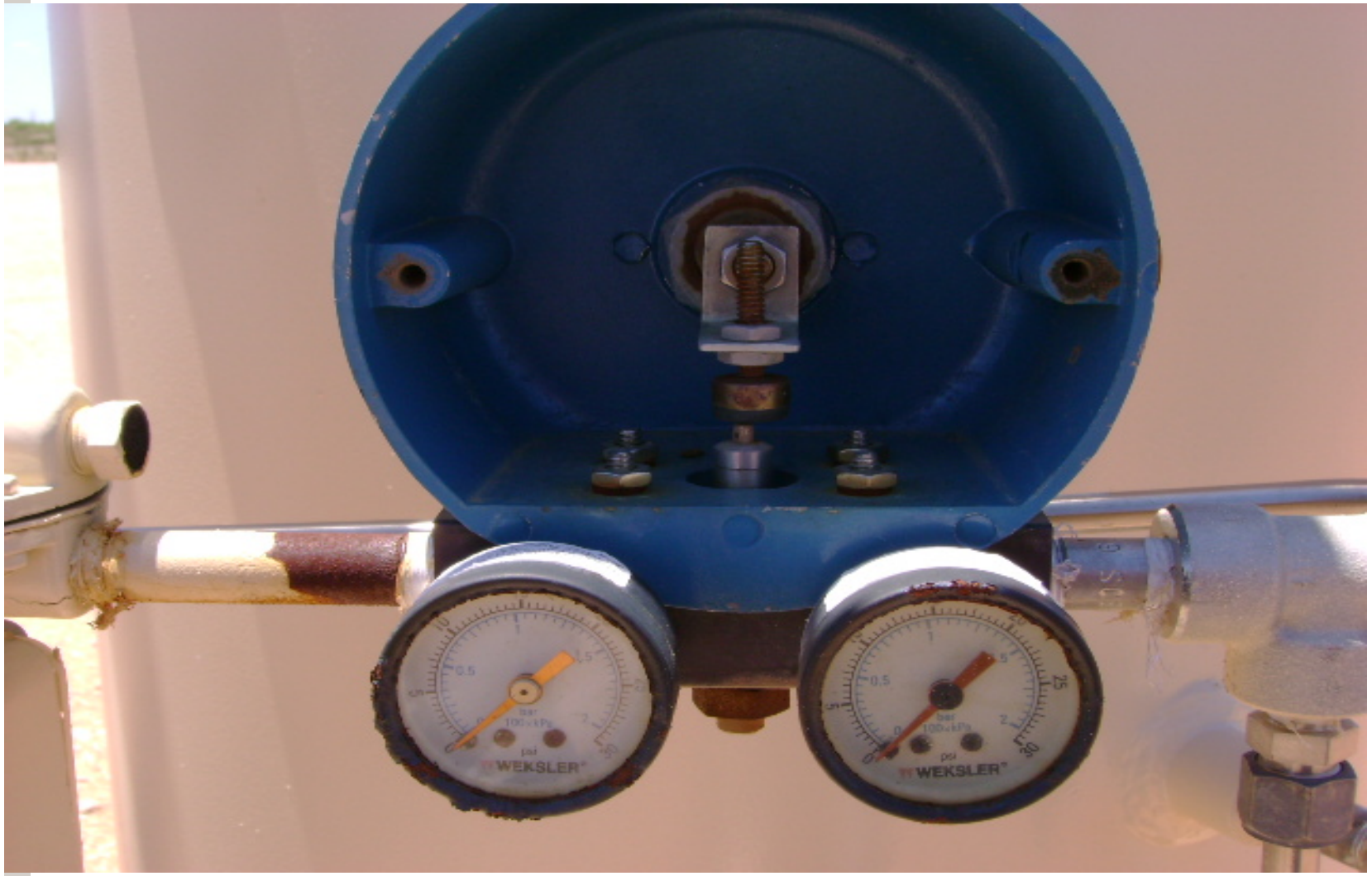
- Liquid level controllers
- Gas driven equipment audit
- Gas prime movers on pumping unit audit
- Compressor inspections before and after preventative maintenance
- Flare audit
  - Other business units' surveys indicated flares and vents represented an Energy Management opportunity. Audit provides an opportunity for baseline development. No preconceived audit expectations.
- Tank battery survey
  - Leak Detection: VRUs, Enardo valves, thief hatches, and misc. equipment

Low Bleed Pneumatic Devices

- Mizer Pilot Valve
  - Complete controller replacement or controller retrofit available. Current BU policy specifies low bleed pneumatics for new installation
  - Retrofit LLCs with Wellmark Mizer Pilot Valves resulted in savings at an ave. of .6 mcf gas per day per install. Cost $250 per valve, installs in 15 minutes. 80 installed last year with plans for 80 more by end of this year
  - Plan to conduct before/after IR Gasfinder Camera survey 30, 60, and 90 days after installation

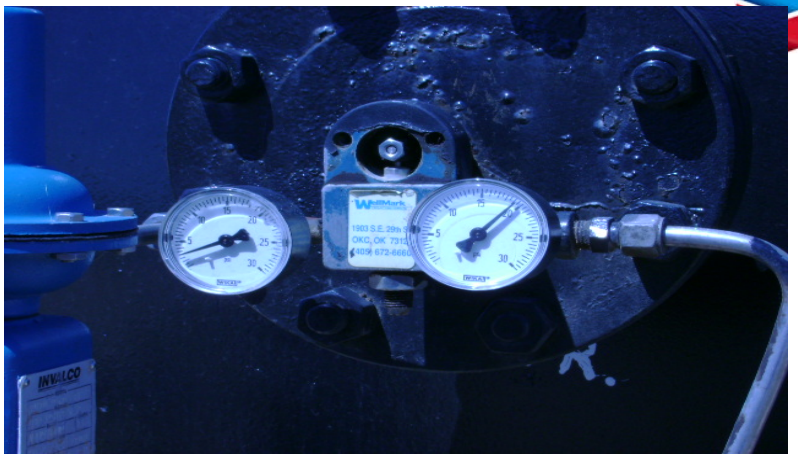
Two examples of the patented Mizer retrofits

Invalco Controller Retrofitted with Mizer Pilot Valve

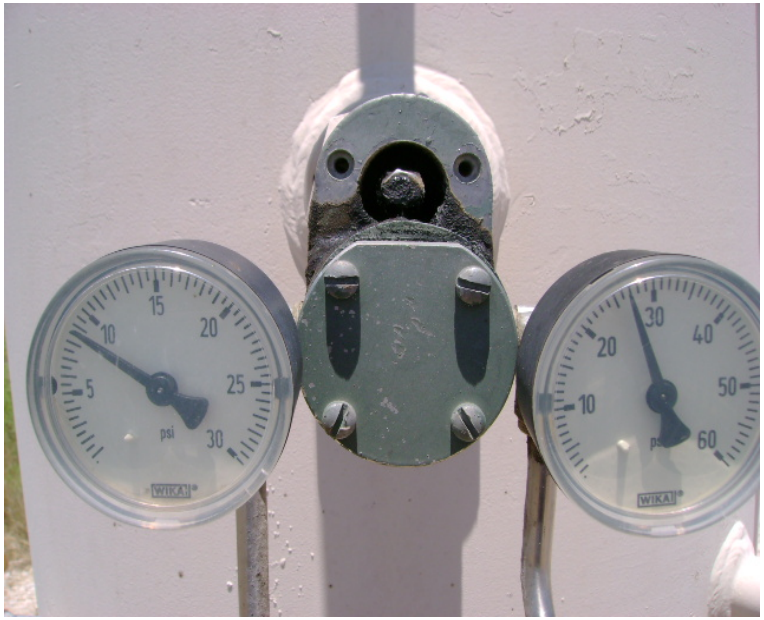


Retrofit LLC's to Mizer

Invalco LLC #415, 717scfd = $3,035/yr.



Cemco LLC #6900, 614scfd = $2,600/yr.



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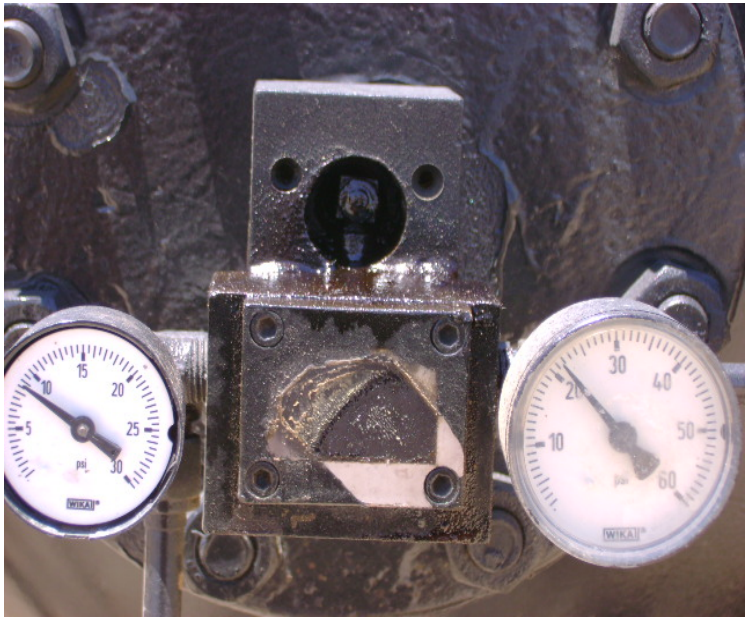

Cemco LLC #6900, 614scfd = $2,600/yr.

Savings per year 4 LLC = $10,835

Gas Driven Equipment

- Glycol dehy pumps driven by gas pressure and exhausted to vent stacks. Re-piping the exhaust to a contactor burner provided efficient gas use. Saving 200 mcf gas per day at $7 mcf
- Spurred a Gas Driven Equipment Audit Business Unit wide
- At least 2 other locations being studied for replication possibilities

Other Technologies & Initiatives

- Standardizing VRU design and installation processes
- Reviewing cold weather applications for enclosed installations
- Evaluating electric and solar powered pumps and valves
- Reviewing use of instrument air instead of gas Maintaining cleaner instrument supplies
- Scheduling Energy Management/HES meetings
- Evaluating the benefit of dedicated Leak Detection Teams

MCA Energy Management and HES

Questions?