Processor Best Management Practices and Opportunities

Lessons Learned from Natural Gas STAR

Processors Technology Transfer Workshop

Gas Processors Association,
Devon Energy, Enogex,
Dynegy Midstream Services and
EPA's Natural Gas STAR Program

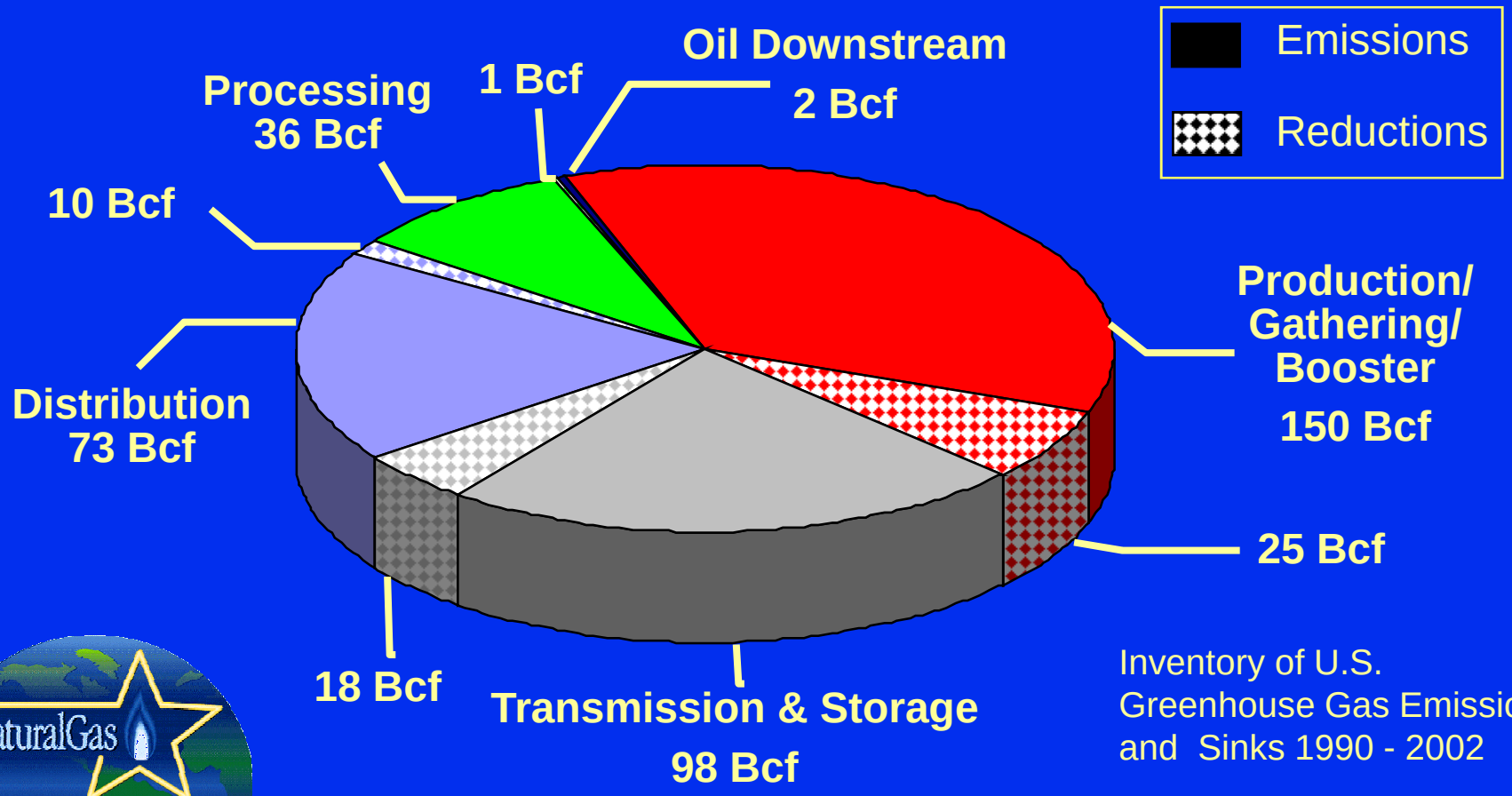
April 22, 2005

Processor Opportunities: Agenda

- Industry Emissions
- Processing Best Management Practices (BMPs)
- Selected Methane Saving Opportunities
  - **Eliminate Unnecessary Equipment**
  - **Composite Wrap**
  - **Leak Inspection & Maintenance**
- Discussion Questions

Natural Gas and Petroleum Industry Emissions

- Processing plants responsible for 36 Bcf of methane emissions annually, and gathering/ booster stations contribute >22 Bcf



Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990 - 2002

Best Management Practices

- BMP 1: Convert Gas Pneumatic Controls to Instrument Air
  - **Gas pneumatic controls bleed methane to the atmosphere**
- BMP 2: Install Flash Tank Separators in Glycol Dehydrators
  - **Glycol regeneration vents methane**
- BMP 3: DI&M at Gas Processing Plants and Booster Stations
  - **Equipment leaks cause methane emissions**

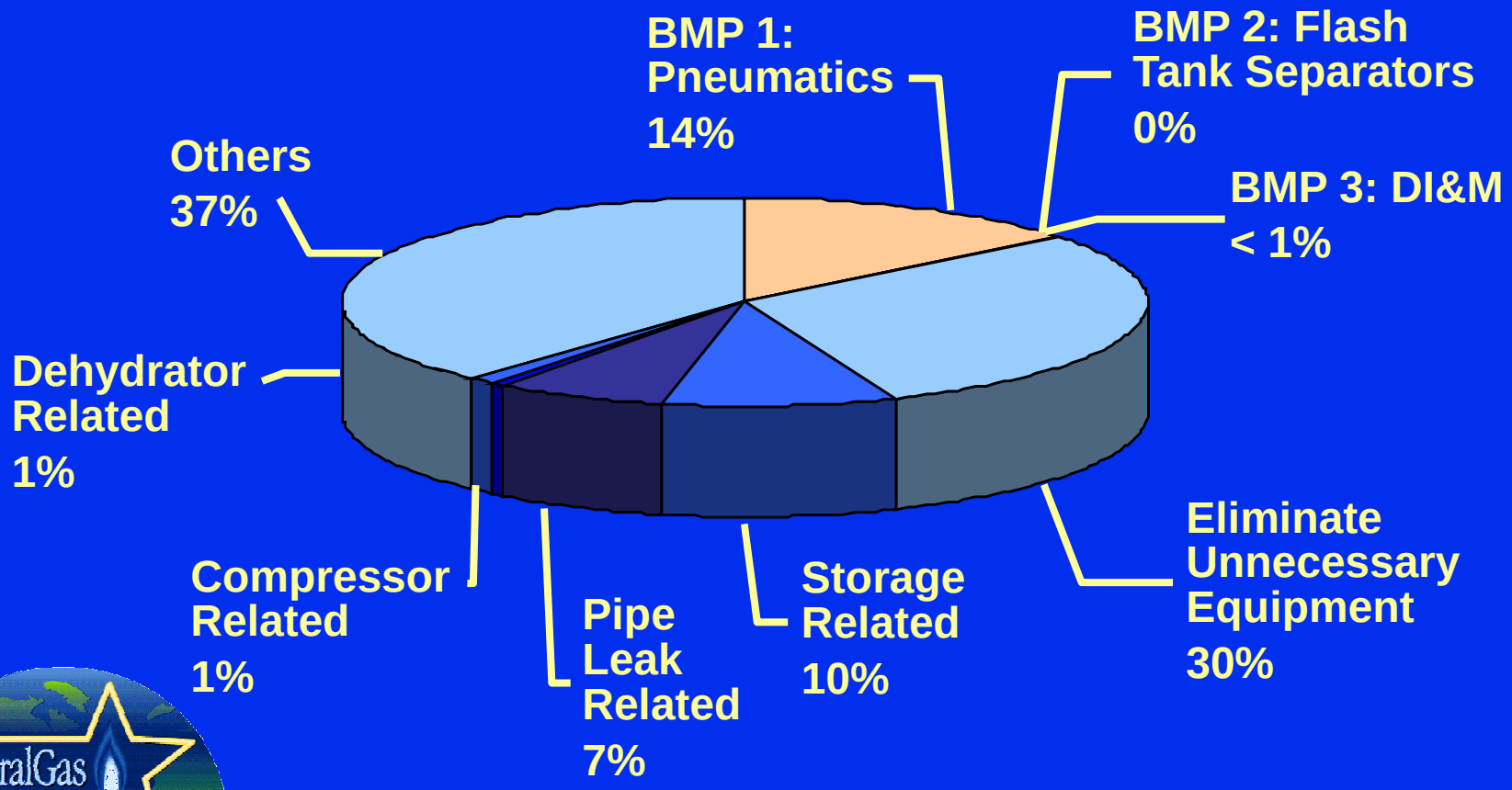
BMP4: Partner Reported Opportunities (PROs)

- *Partner*
  - **Identified and practiced by Gas STAR partners - your peers**

- *Reported*
  - **Submitted to EPA in partners' Annual Reports**
- *Opportunities*
  - **Peer-identified, cost-effective practices and technologies to reduce methane emissions**

Processor BMPs

- 86% of the processing sector reductions came from PROs



PRO Fact Sheets

- Additional valuable information
  - **Facilitate technology transfer**
  - **One page**
  - **Easy to review**
- 29 PROs apply to Processing sector
  - **17 focused on operating practices**
  - **12 focused on technologies**
- PRO Fact Sheets are derived Annual Reports 1994-2003
  - **Total 63 posted PRO Fact Sheets at epa.gov/gasstar/pro/index.htm**

Overview of PROs

- Sample of Processing PROs
  - **Begin DI&M at Remote Facilities**
  - **Convert Engine Starting to Nitrogen**
  - **Convert Pneumatics To Mechanical Controls**
  - **Eliminate Unnecessary Equipment and/or Systems**
  - **Install Electric Starters**
  - **Pipe Glycol Dehydrator to VRU**
  - **Recycle Line Recovers Gas During Condensate Loading**
  - **Replace Ignition –Reduce False Starts**
  - **Use Inert Gases & Pigs to Perform Pipeline Purges**
  - **Use of Composite Wrap Repair**

Operating Practice PROs

- Eliminate unnecessary equipment and/or systems
- Rerouting of glycol skimmer gas
- Pipe glycol dehydrator to vapor recovery unit
- Inspect and repair compressor station blowdown valves
- Begin DI&M at remote facilities

Eliminate Unnecessary Equipment and/or Systems

- What is the problem?
  - **As operating parameters change over time, partners have found that certain pieces of equipment initially crucial to operations have become superfluous**
- Partner solution
  - **Take unnecessary equipment out of service**
- Methane savings
  - **Based on removal of 10 separators and 3 glycol dehydrators**
- Applicability
  - **Applies to all facilities that are operating well below design levels**

Methane Savings

5 to 130,000 Mcf/yr

Project Economics

Project Cost	< $1,000
Annual O&M Costs	< $100
Payback	< 1 yr

Eliminate Unnecessary Equipment and/or Systems

- ExxonMobil
  - **Replaced a 930 horsepower (Hp) compressor with 465 Hp at its Fresh Water Bayou facility in southern Vermilion Parish, Louisiana**
    - **Total project cost = $30,000**
    - **Emissions reductions = 1,556 Mcf/yr**
    - **Value Savings: $3/Mcf x 1556 Mcf = $4,668/yr**
  - **Took two satellite tanks out of service and began pumping directly to the tank battery**
    - **Total project cost = $120,000**
    - **Emissions reductions = 15,735 Mcf/yr**
    - **Value Savings: $3/Mcf x 15,735 Mcf = $47,205/yr**

Technology PROs

- Use of composite wrap repair
- Install pressurized storage of condensate
- Use ultrasound to identify leaks
- Recycle line recovers gas during condensate loading
- Convert gas-driven chemical pumps to instrument air

Use of Composite Wrap Repair

- **What is the problem?**
  - Pipeline is shutdown and vented to cut and weld pipe segment in damaged areas
- **Partner solution**
  - Use composite wrap, which consists of a filler material, a thin composite wrap and a special adhesive
- **Methane savings**
  - Based on repair frequencies between 2 - 65 times per year
- **Applicability**
  - Suitable for non-leaking defects on straight sections with up to 80% wall loss and no internal corrosion

Methane Savings

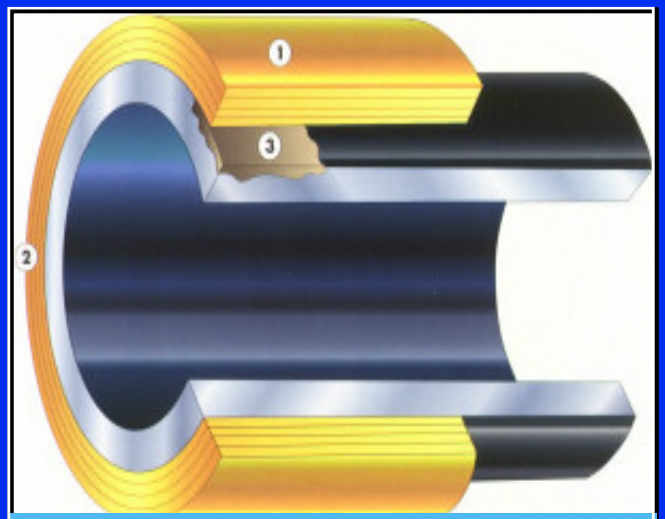
5,400 Mcf/yr

Project Economics

Project Cost	> $10,000
Annual O&M Costs	< $100
Payback	Immediate

Use of Composite Wrap Repair

- Repairing non-leaking pipeline damage with composite wrap sleeves, such as Clock Spring®
  - **Eliminates venting emissions**
  - **Inexpensive**
  - **Can repair while operating**
- Non-leaking pipeline defects
  - **Corrosion**
  - **Dents**
  - **Gouges**



Source: Clock Spring® Company L. P.

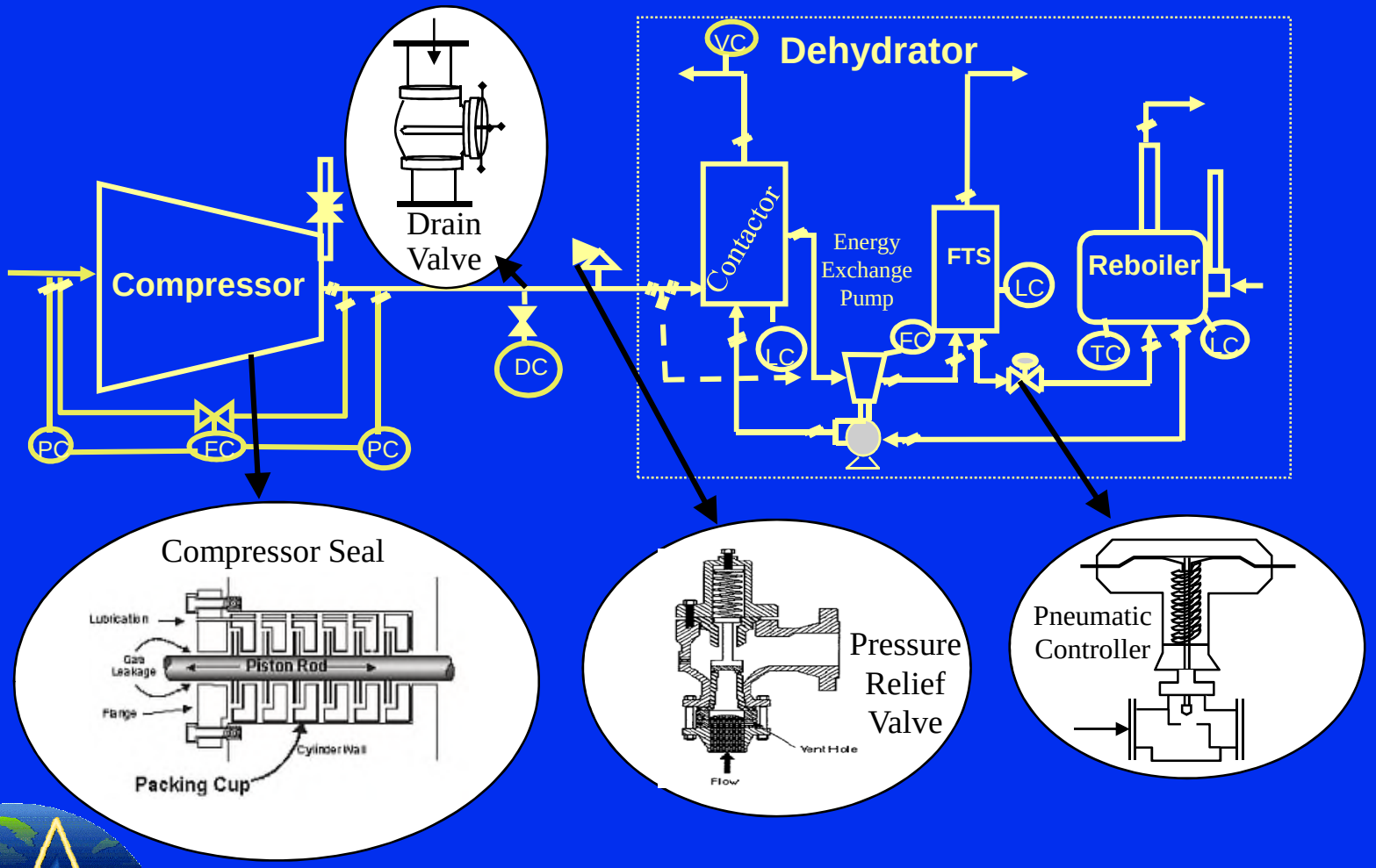
New PROs

- Broad dissemination of PROs is key to program success and effective peer-based technology transfer
  - **Zero Emission Dehydrators**
  - **Recover Gas from Pipeline Pigging Operations**
  - **Nitrogen Rejection Unit Optimization**

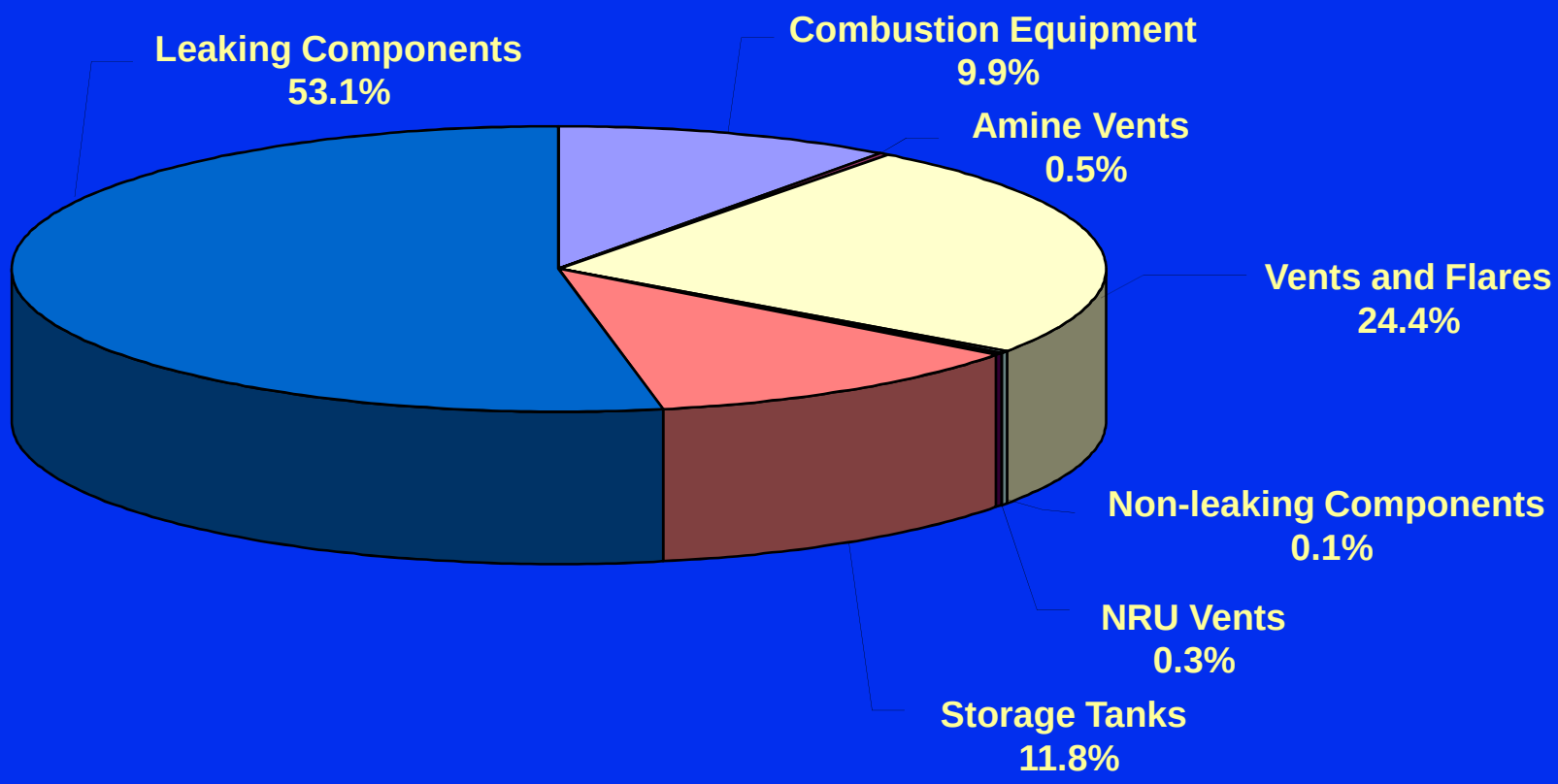
DI&M at Gas Processing Plants and Booster Stations

- Gas leaks are *invisible*, *unregulated* and *go unnoticed*
- Gas STAR Partners find that valves, connectors, compressor seals and open-ended lines (OELs) are major sources
  - **24 Bcf of methane lost from processing plant fugitive emissions each year**
- Fugitive methane emissions depend on operating practices, equipment age and maintenance

Sources of Emissions

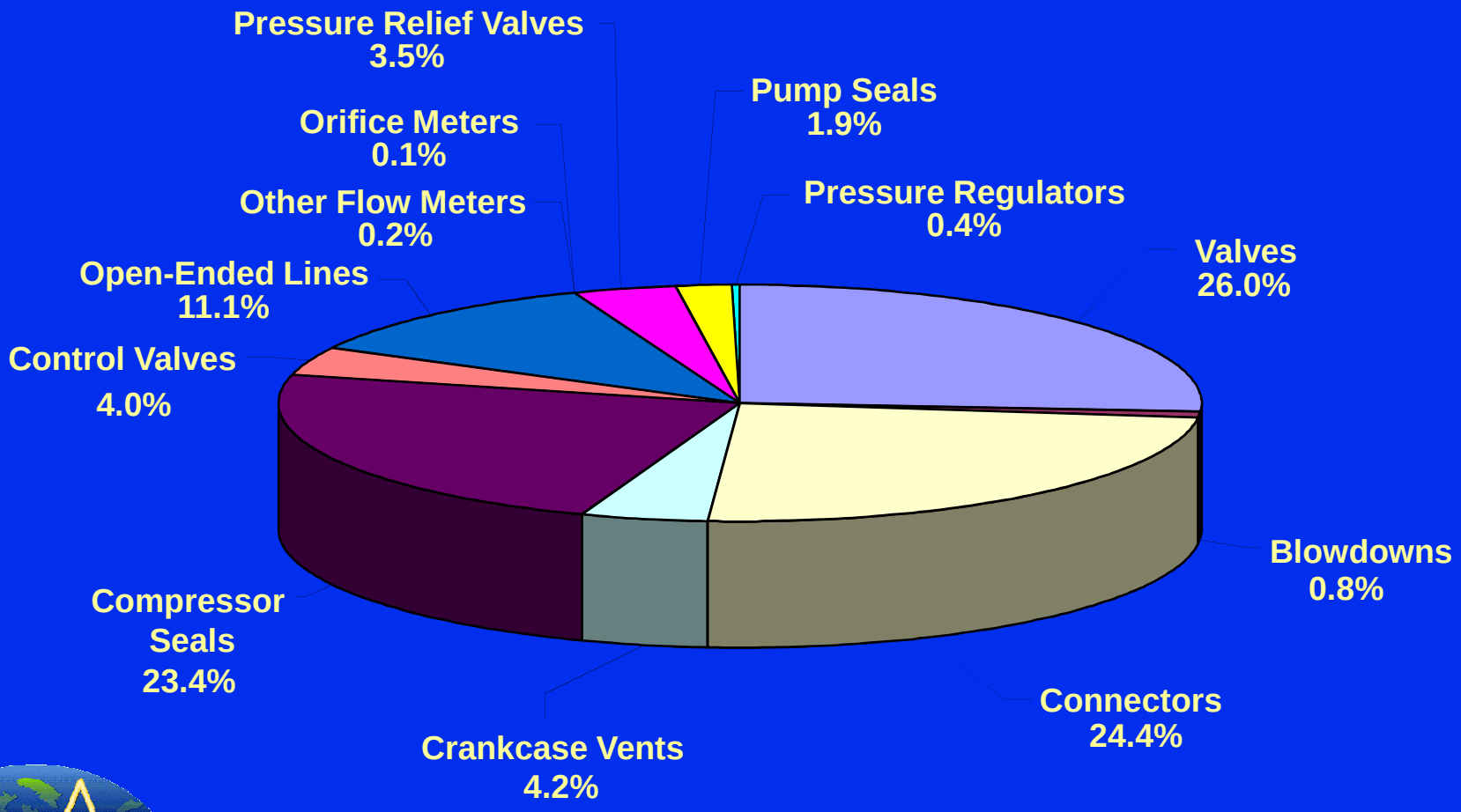


Distribution of Losses by Category



Source: Clearstone Engineering, 2002

Distribution of Leaks by Component



Source: Clearstone Engineering, 2002

Partner Experience

- Success #1
  - **A leaking cylinder head was tightened, which reduced methane emissions from almost 64,000 Mcf/yr to 3,300 Mcf/yr. The repair required 9 man-hours of labor, and the annualized gas savings were approximately 60,700 Mscf/yr. The estimated value of the gas saved was $182,100/yr.**
- Success #2
  - **A one-inch pressure relief valve emitted almost 36,774 Mcf/yr. Five man-hours of labor and $125 of materials eliminated the leak. The annualized value of the gas saved was more than $110,300.**

Gas values based on $3/Mcf

Partner Experience Cont.

- Success #3
  - **A blowdown valve leaked almost 14,500 Mcf/yr. Rather than replace the expensive valve, the Partner spent just $720 on labor and materials to reduce the emissions to approximately 100 Mscf/yr. The gas saved was approximately 14,400 Mcf/yr, worth $43,200.**
- Success #4
  - **A tube fitting leaked 4,121 Mcf/yr. A very quick repair requiring only five minutes reduced the leak rate to 10 Mcf/yr. The annualized value of the gas saved was approximately $12,300.**

DI&M by Leak Imaging

- Real-time visual image of gas leaks
  - **Quicker identification & repair of leaks**
  - **Screen hundreds of components an hour**
  - **Screen inaccessible areas simply by viewing them**
  - **Aerial surveillance of flow lines**

Infrared Gas Imaging Technology

- Active and passive IR technologies
- Shoulder- and/or tripod- mounted
  - **Hand-held prototype 2005**
- Aerial surveillance applications
- Require battery or power cord
- Most very large leaks (> 3cf/hr) clearly seen

Infrared Gas Imaging

- Video recording of fugitive leak found by infrared camera

Discussion Questions

- To what extent are you implementing any of these PROs?
- What are the barriers (technological, economic, lack of information, regulatory, etc.) that are preventing you from implementing any of these technologies?
- How often do you perform DI&M at your processing facility?