

Enhancing Air Quality

Rocky Mountain

Energy Technology Conference

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Denver, Colorado

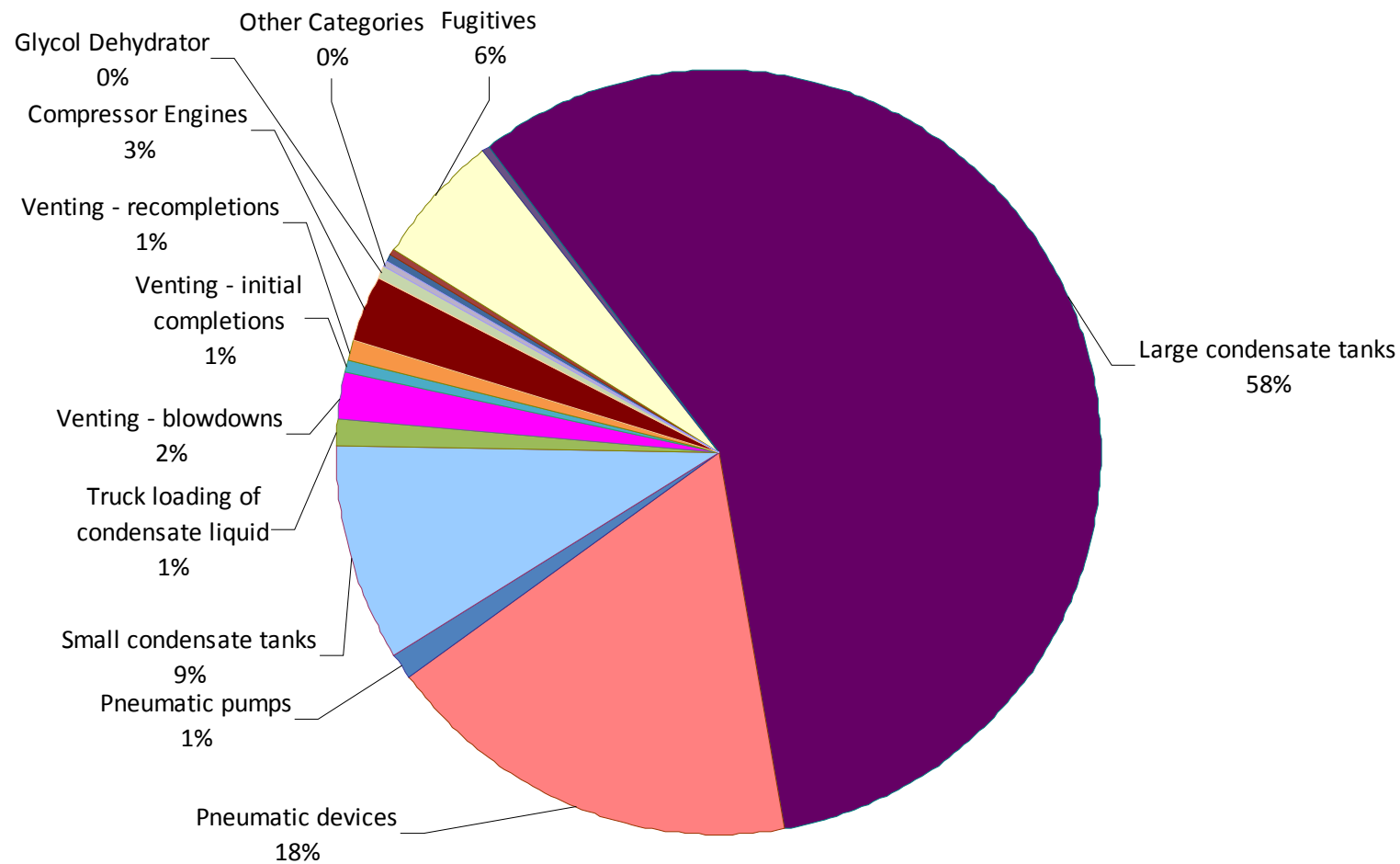
Outline

- Regional air quality picture
- Urban sprawl
- Strategies to reduce air emissions
- Measuring success in voluntary programs

Regional Air Quality Picture

- Ambient ozone concentrations
 - *Revisions to the ambient standard*
- Regional haze
- NEPA analyses
- New developing inventories
 - *WRAP Phase III*

DJ Basin Phase III Oil & Gas 2006 VOC



Urban Sprawl

- **Responsible operator**
- **Buffer between conventional operations and development**
- **Source of significant regulatory development**

Strategies for Emission Reductions

- **Pneumatic retrofits**
 - *Simple retrofit*
 - *Capital cost: \$250 – \$500*
 - *Three month payout*
- **Pneumatic replacements**
 - *Installed cost: \$1,200 – \$1,750*
 - *Three to six month payout*
- **Center of significant regulatory development**



Flashing Emission Controls

Vapor recovery units (VRU) are the preferred alternative.

- *Historic installation configuration – VRU connected directly to storage tanks*
- *Operations and safety*
 - O₂ intrusion
 - Equipment repairs result in extended down time

Process Enhancements to Reduce Flash Emissions

In 2006, Anadarko voluntarily piloted the use of secondary flash vessels.

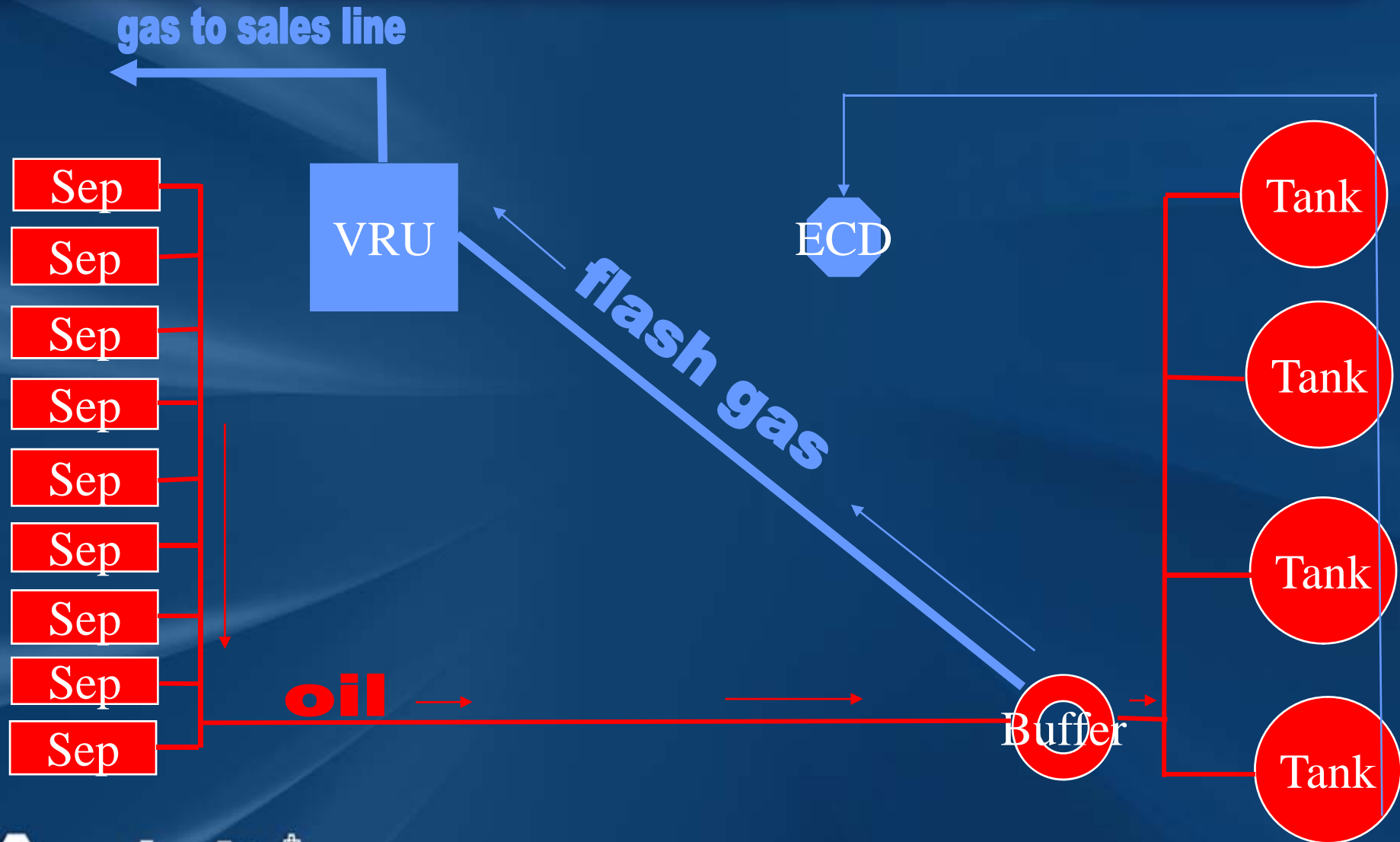


Process Enhancements to Reduce Flash Emissions

In 2007, Anadarko voluntarily enhanced the design to larger buffer tanks.



Buffer Tank Process



Buffer Tanks

Anadarko voluntarily installs buffer tanks, which provide numerous benefits.

- Reduce emissions*
- Reduce products of combustion to atmosphere*
- Enhanced safety due to lower pressure seen at tank*
- Gas from buffer tank is compressed back into sales line*
- Eliminate O₂ intrusion*

Pneumatic Pump Exhaust

Anadarko voluntarily implemented the use of pneumatic pump exhausts.

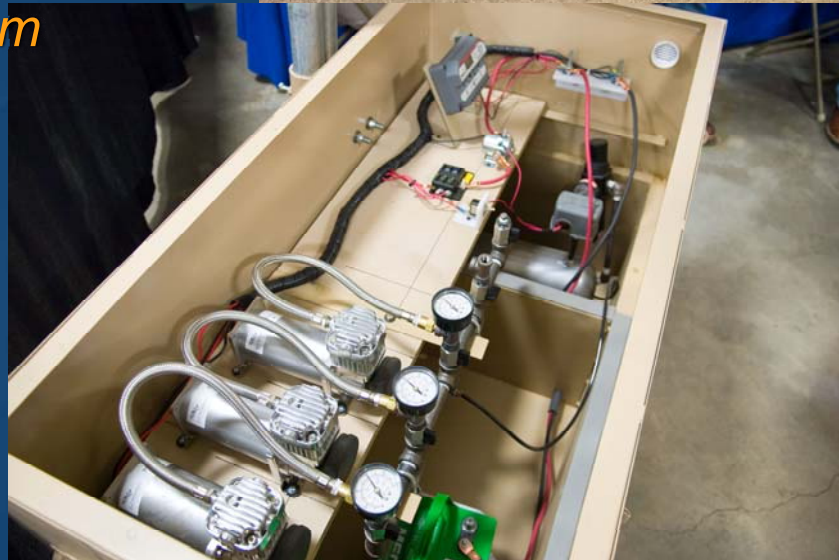
- *Seasonal use*
 - Utilized for 100 –120 days per year
- *Recovers approximately 2 – 3 MM/scf gas per year*
- *Very quick payback times*



Compressed Air-Driven Pneumatics

Anadarko voluntarily implemented compressed air-driven pneumatics.

- *Low capital cost*
- *Scalable system to meet various pad sizes*
- *Approximate one-year payout*
- *Limited pilot program*



IR Camera Inspections

Anadarko voluntarily implemented infrared (IR) camera inspections in summer 2007.

- *12 cameras currently in use throughout the Rockies*



IR Camera Inspections – DJ Basin

- Initial findings led to the formation of maintenance teams to incorporate the use of the IR camera and facilitate repairs.
- Goal was to inspect every separator, tank and wellhead in the DJ Basin.
- Developed simple record keeping and maintenance log to facilitate data trending in the future.

IR Camera Inspections

Use of the IR Camera was a proactive means to identify and quickly repair leaks that were otherwise not detectable.

- *Thermostats*
- *Fittings*
- *Regulators*
- *Gaskets*
- *Valves*

Result: Less natural gas vented to the atmosphere.

Measuring Success

- **Direct measurement**
 - *Increased sales volumes*
 - *Reduced concentrations at ambient monitors*
- **Indirect measurement**
 - *Increased awareness*
 - *Innovative solutions*
 - *Technology transfer*

Questions?

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