

# Producer and Processor Best Management Practices



Lessons Learned from the  
Natural Gas STAR Program

Chevron Corporation,  
New Mexico Oil and Gas Association,  
Texas Oil and Gas Association

Producers and Processors Technology  
Transfer Workshop  
Midland, TX  
July 23, 2008

[epa.gov/gasstar](http://epa.gov/gasstar)



# Best Management Practices: Agenda

## 🔥 Dehydrators

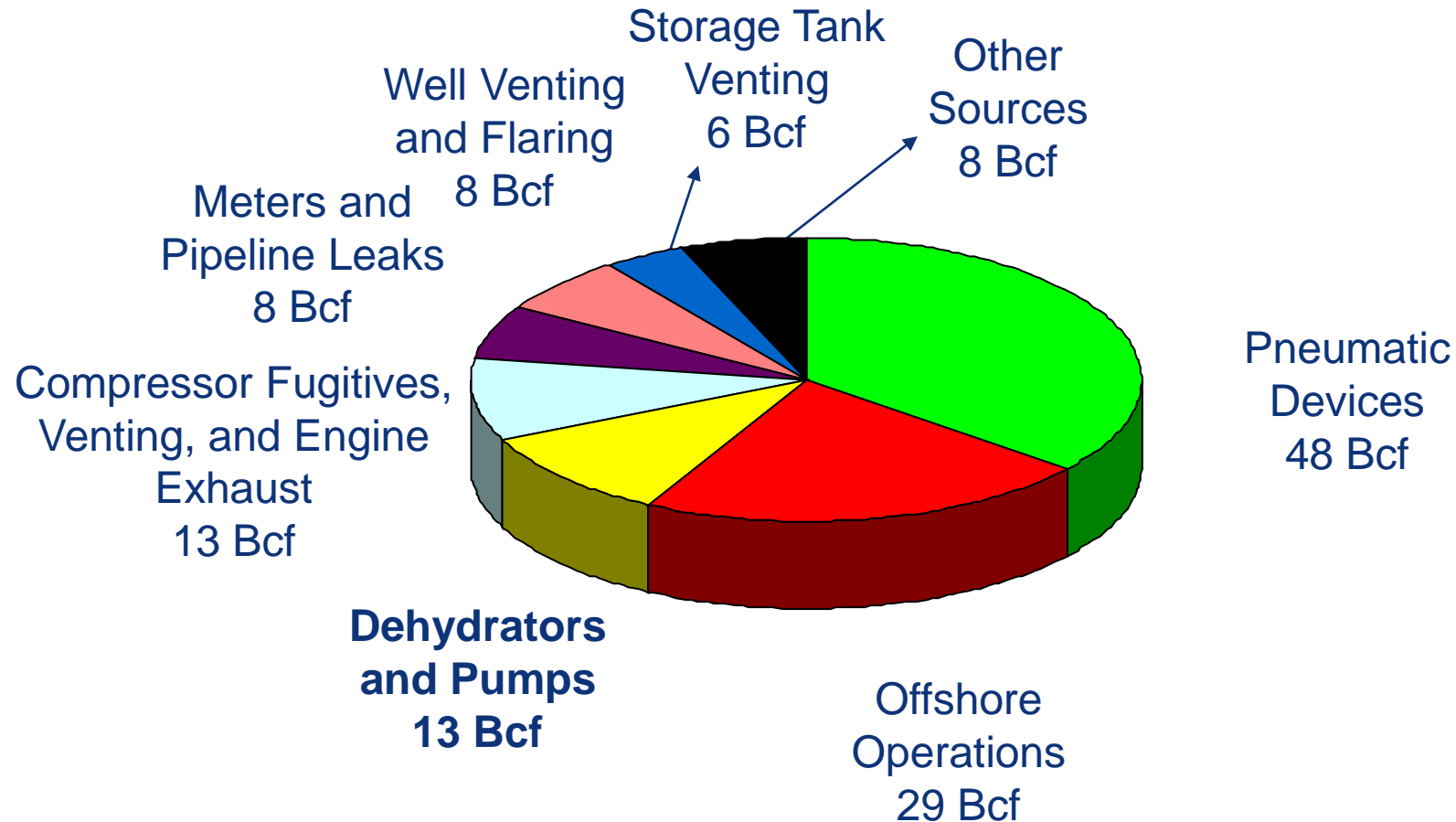
- 🔥 Methane Losses
- 🔥 Methane Recovery
- 🔥 Is Recovery Profitable?
- 🔥 Additional Dehydration Opportunities

## 🔥 Condensate Storage and Handling

- 🔥 Methane losses
- 🔥 Methane Recovery
  - 🔥 Pressurized Storage of Condensate
  - 🔥 Recycle Line to Recover Gas During Condensate Loading

## 🔥 Discussion

# Industry Emissions: Production, Gathering, and Boosting

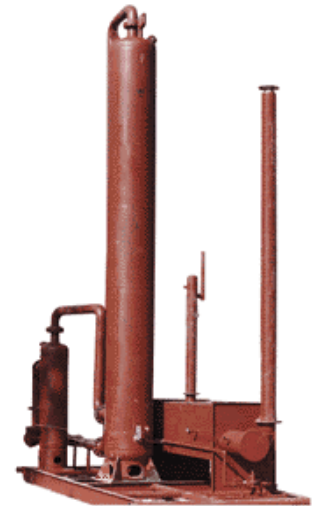


Source: EPA. *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990 – 2006*. April, 2008. Available on the web at: [epa.gov/climatechange/emissions/usinventoryreport.html](http://epa.gov/climatechange/emissions/usinventoryreport.html)

Note: Natural Gas STAR reductions from gathering and boosting operations are reflected in the production sector.

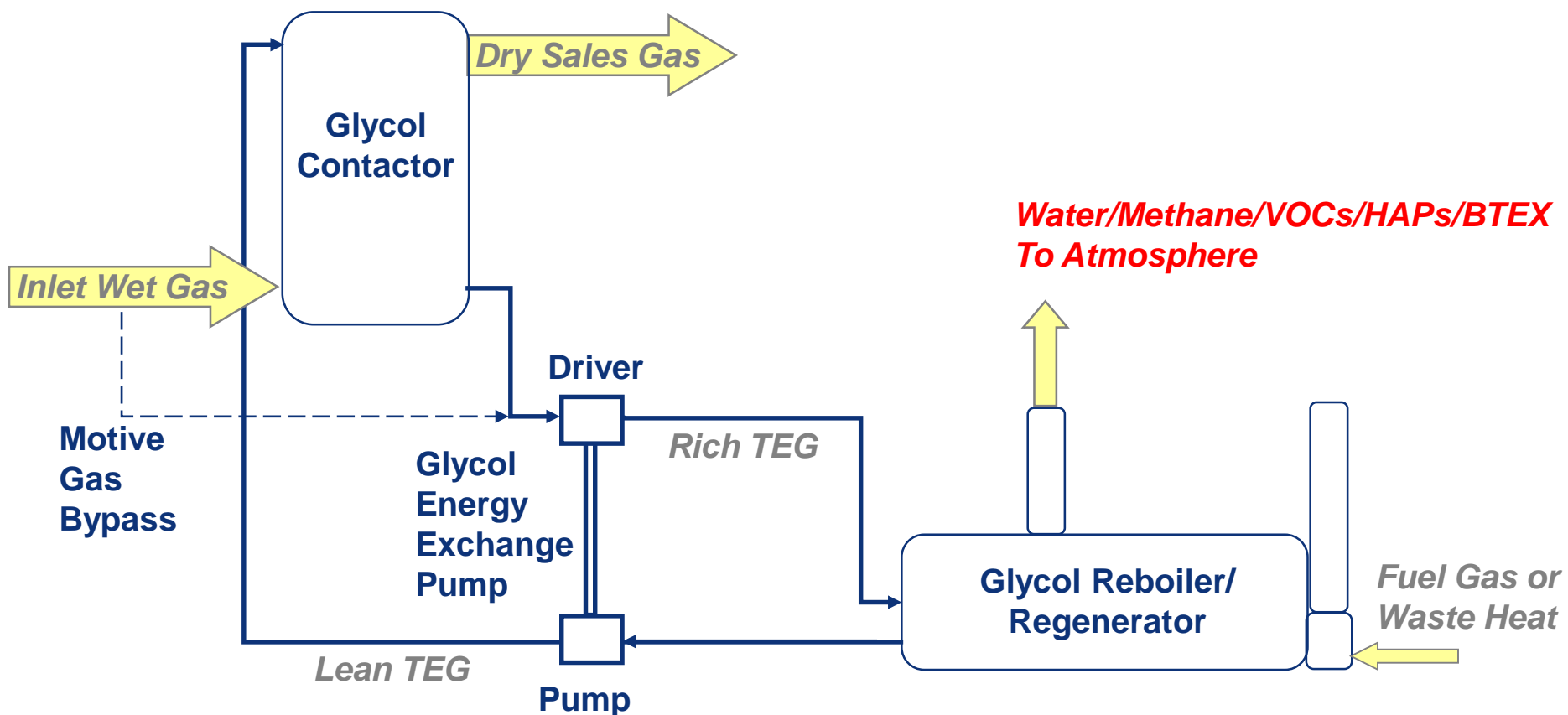
# Dehydrators: Methane Losses

- Produced gas is saturated with water, which must be removed for long distance gas pipelines
- Glycol dehydrators are the most common equipment used to remove water from gas
  - Nearly 38,000 dehydration units in natural gas production, gathering, and boosting
  - Most use triethylene glycol (TEG)
- Glycol dehydrators emit methane
  - Methane, Volatile Organic Compounds (VOCs), Hazardous Air Pollutants (HAPs), Benzene, Toluene, Ethylbenzene, Xylene (BTEX) from reboiler vent
  - Methane from pneumatic controllers and glycol circulation pumps



Source: [www.prideofthehill.com](http://www.prideofthehill.com)

# Basic Glycol Dehydrator System Process Diagram



# Methane Recovery: Three Options

- 🔥 Optimized glycol circulation rates
- 🔥 Flash tank separator
- 🔥 Electric pump



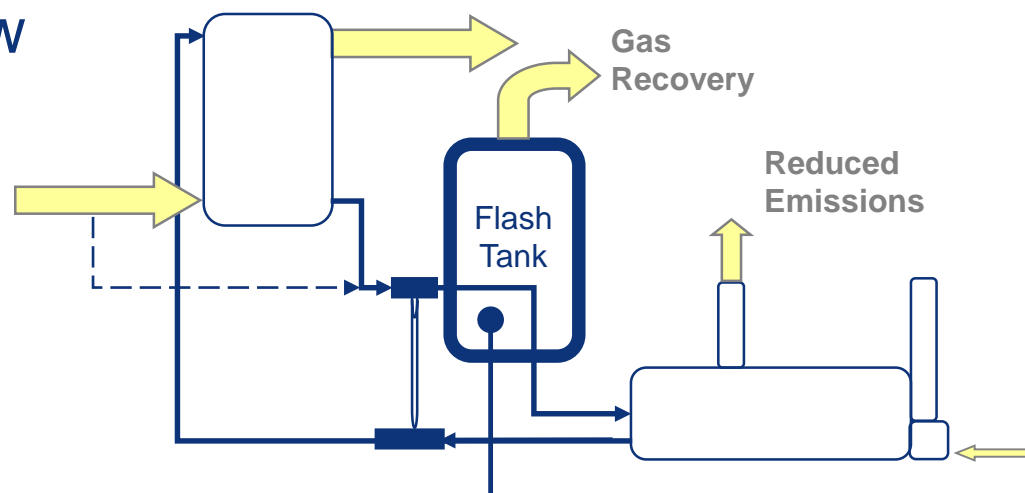
Glycol Dehydrator Unit  
Source: GasTech

# Optimizing Glycol Circulation Rate

- 🔥 Gas pressure and flow at gathering/booster stations vary over time
  - 🔥 Glycol circulation rates are often set at a maximum circulation rate
- 🔥 Glycol overcirculation results in more methane emissions without significant reduction in gas moisture content
  - 🔥 Partners found circulation rates two to three times higher than necessary
- 🔥 Methane emissions are directly proportional to glycol circulation rate
  - 🔥 Reduction in the glycol circulation rate reduces methane emissions
  - 🔥 Lessons Learned study: optimize circulation rates

# Flash Tank Recovers Methane

- 🔥 Methane and VOC's entrained with the rich TEG is vented to the atmosphere from the TEG regenerator
- 🔥 Installation of flash tank separators enables gas and liquid separation at either the fuel gas system pressure or a compressor suction pressure
- 🔥 Recovers about 90 percent of methane emissions and 10 to 90 percent of VOC's
- 🔥 Must have an outlet for low pressure gas
  - 🔥 Fuel
  - 🔥 Compressor suction
  - 🔥 Vapor recovery unit (VRU)



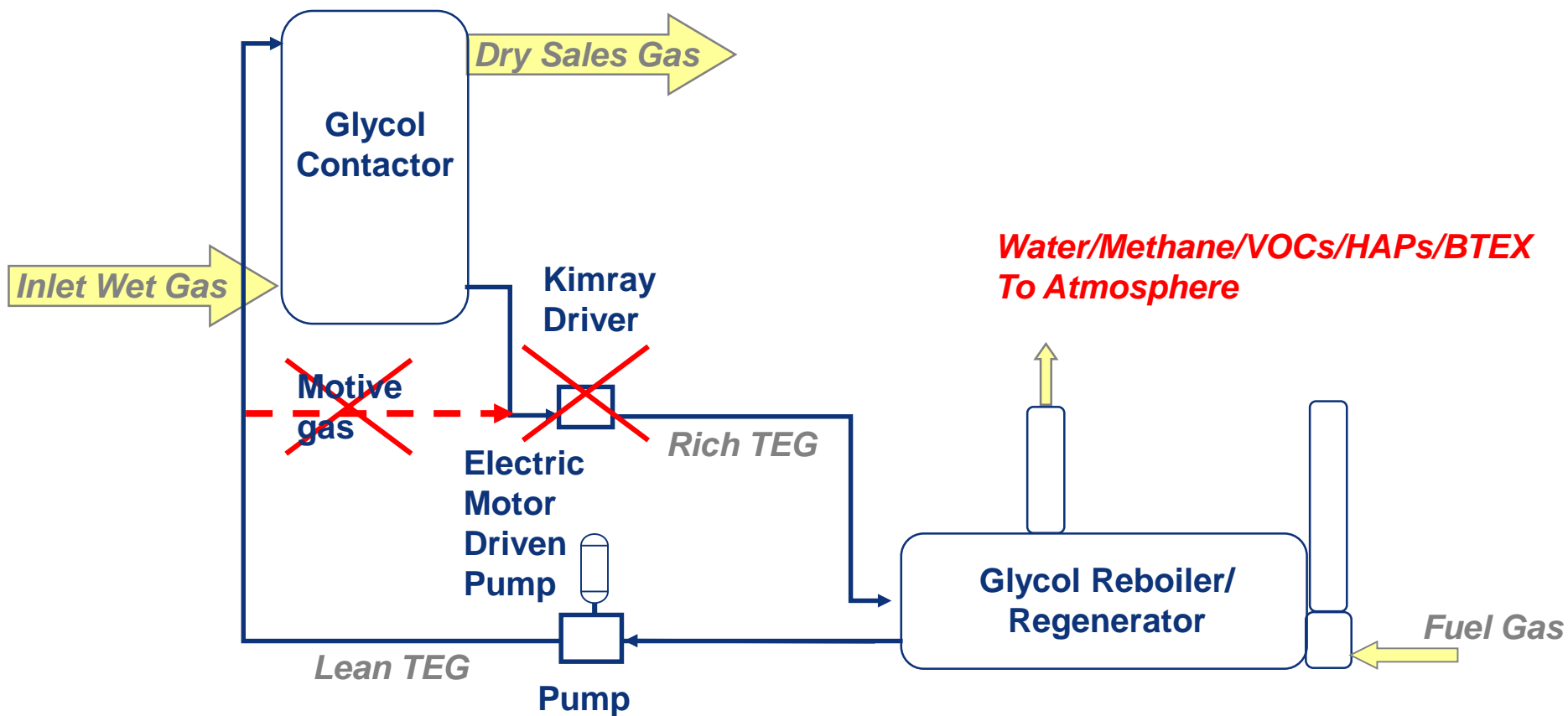
Low Capital Cost/Quick Payback



# Flash Tank Costs

- 🔥 Lessons Learned study provides guidelines for scoping costs, savings and economics
- 🔥 Capital and installation costs:
  - 🔥 Capital costs range from \$3,300 to \$6,700 per flash tank
  - 🔥 Installation costs range from \$1,600 to \$3,000 per flash tank
- 🔥 Negligible operational and maintenance costs

# Electric Pump Eliminates Motive Gas



# Overall Benefits

- 🔥 Financial return on investment through gas savings
- 🔥 Increased operational efficiency
- 🔥 Reduced Operational and Maintenance costs (fuel gas, glycol make-up)
- 🔥 Reduced compliance costs (HAPs, BTEX)

# Is Recovery Profitable?

## Three Options for Minimizing Glycol Dehydrator Emissions

Option	Cost of Implementation	Emissions Savings (\$/year)	Payback Period <sup>1</sup>
Optimize Circulation Rate	Negligible	\$2,800 to \$276,000	Immediate
Install Flash Tank	\$6,500 to \$18,800	\$8,000 to \$75,000	4 to 11 months
Install Electric Pump	<b>\$2,700 to \$15,100</b>	\$2,520 to \$252,000	< 1 month to several years

<sup>1</sup> Gas price of \$7/ thousand cubic feet (Mcf)

# Additional Dehydration Opportunities

## 🔥 Desiccant dehydrators

- 🔥 Use packed column of desiccant salts to remove water instead of using glycol

## 🔥 Zero emission dehydrators

- 🔥 Combine several dehydration technologies (flash tanks, electric pumps, reroute skimmer gas, electric control valves) to virtually eliminate methane emissions

## 🔥 JATCO venturi system

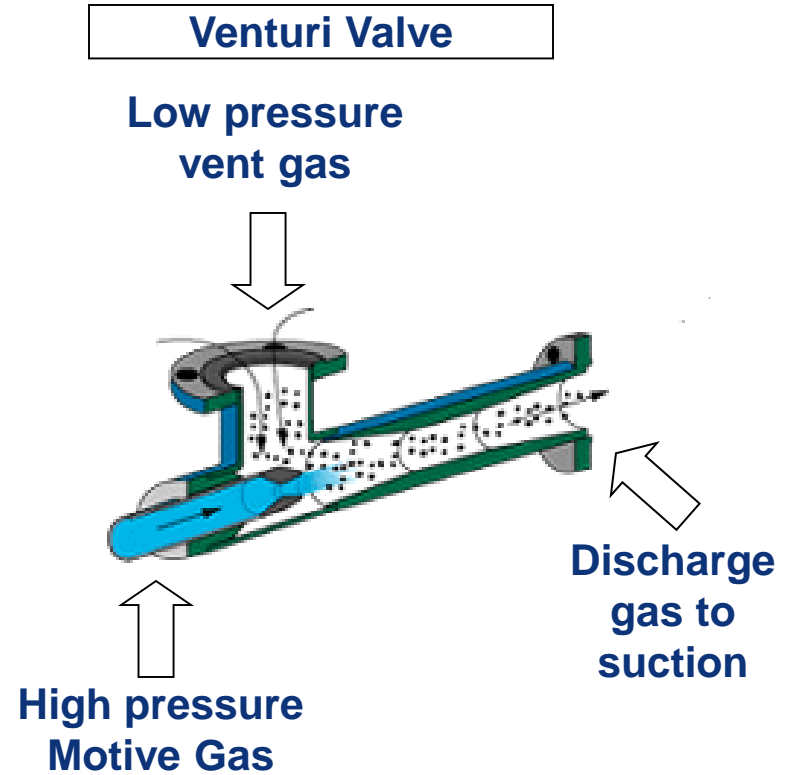
- 🔥 Use high pressure motive gas to capture still gas and reroute to facility suction to create a closed loop system

# Industry Experience: EnCana Oil & Gas

- 🔥 Technology used to route vapors back to the suction of the facility
- 🔥 In the DJ Basin, EnCana uses Jatco BTEX condensers and venturi valves
- 🔥 All vapors post condenser are routed to the inlet via a venturi valve
- 🔥 Creates a closed loop system



Source: EnCana Oil & Gas (USA) Inc.



# JATCO Venturi - Application

- 🔥 Must have high pressure motive gas
- 🔥 Motive gas can be from a compressor or dry gas from the dehydrator
- 🔥 Must have low suction pressures, or low pressure gas stream
- 🔥 EnCana's DJ Basin operations are applicable because they have suction pressures of 25 – 30 psi



## EnCana Experience: Costs of Installation

- 🔥 Average unit cost ~ \$12,000
- 🔥 Average piping cost ~ \$1,300
- 🔥 Average installation ~ \$6,500
- 🔥 Total Cost ~ \$19,800
  
- 🔥 Technology allows for large emissions savings. Quantity of methane captured is small and will vary by site.
- 🔥 Eliminates the need for a BTEX combustor

# Best Management Practices: Agenda

## 🔥 Dehydrators

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- 🔥 Is Recovery Profitable?
- 🔥 Additional Dehydration Opportunities

## 🔥 **Condensate Storage and Handling**

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## 🔥 Discussion

# Methane Losses from Condensate Storage

- ⚡ Natural gas production often accompanied by production of water and condensate
- ⚡ Lease condensate, composed of light hydrocarbons, will flash off most of its volume if stored at atmospheric pressure
- ⚡ At remote well sites vapor recovery units (VRUs) may not be feasible for reducing emissions from atmospheric storage tanks
  - ⚡ No outlet for recovered vapor
  - ⚡ Not enough vapor to justify expense

# Methane Recovery: Pressurized Storage of Condensate

- 🔥 Installation of a pressurize storage tank
  - 🔥 Reduce pressure drop between separator and tank
  - 🔥 Minimize driving force behind flashing losses
- 🔥 Methane savings vary
  - 🔥 Gravity of condensate
  - 🔥 Separator pressure
  - 🔥 Storage tank pressure
- 🔥 Condensate must be periodically unloaded by tank trucks equipped to handle liquid under pressure

## Partner Experience: Pressurized Storage of Condensate

- 🔥 A partner reported installing four, 400 barrel pressurize condensate tanks
- 🔥 Methane emissions estimated by simulation software to be 250 scf/barrel if flashed to atmospheric pressure
- 🔥 Total methane savings of 28,000 Mcf/year
- 🔥 Tank costs - \$37,500 per tank
- 🔥 Operating costs - \$2,500 per year (unloading)
- 🔥 Payback – 10 months at \$7/Mcf

# Methane Losses from Condensate Handling

- 🔥 When condensate is transferred from storage into tank trucks methane may be vented due to
  - 🔥 Pressure changes
  - 🔥 Temperature changes
  - 🔥 Displaced vapor
- 🔥 Venting vapor maintains pressure of the tank truck
- 🔥 Frequent unloading of condensate can result in large volumes of methane emissions

# Methane Recovery: Recycle Line to Recover Gas During Condensate Loading

- 🔥 A vapor recovery line can be connected to the tank truck vent to recover displaced vapor during loading
- 🔥 Vapor recovery line must have a low pressure outlet for the gas
  - 🔥 Fuel gas system
  - 🔥 Suction of VRU
  - 🔥 Flare
- 🔥 Methane savings from the recovery line are estimated as 100 Mcf/year
  - 🔥 3 to 5 day loading cycle
  - 🔥 100 loadings per year
  - 🔥 Methane emissions estimated as 50% of the volume to be filled<sup>1</sup>

# Discussion Questions

- 🔥 To what extent are you implementing these opportunities?
- 🔥 How could these opportunities be improved upon or altered for use in your operation?
- 🔥 What are the barriers (technological, economic, lack of information, regulatory, focus, staffing, etc.) that are preventing you from implementing these practices?