Quantification and Measurement Panel

Annual Implementation Workshop
Field Trip

San Antonio, TX
October 21, 2009

epa.gov/gasstar

Methane Emissions Quantification Challenges

- Gas well drilling completion venting
- Gas well liquids unloading venting
- Crude oil & gas condensate stock tank venting
  - Scrubber dump valve leaks
- Glycol dehydrator vent
- Acid gas removal vent
- Compressor seal vent
- Fugitives
- Equipment blow-down venting
- Gas gathering/processing plant emissions
- Cross-country pipeline leaks

Quantification and Measurement of Fugitive and Vented Methane Emissions

Panel

- Engineering Calculation: *Reid Smith, BP*
- Material Balance: *Bob Berry, DCP Midstream*
- Direct Measurement: *John Cordaway, El Paso*
- Emissions Modeling: *Danielle Nesvacil, TCEQ*
- Remote Quantification: *Leanne Meyer, NNG*

- Questions & Answers

Engineering Calculation Approaches

- Reid Smith, BP
  - Senior Climate Advisor

- **Volume** and **Composition** are the only information needed
- What are “Engineering Approaches”?
  - Approaches that use physical fluid behaviors, chemical behaviors, and physical data to determine emissions
    - Not: Activity X Factor or Direct Measurement (CEM)
    - Can be used to generate factors for specific conditions, areas, sites, fields
    - Includes various modeling suites/approaches

Engineering Calculation Approaches

- Sources types where engineering approaches are robust
  - Combustion Emissions
  - Acid gas (amine) vents; Equipment/system blow-down; Dehydrator overheads; Gas driven pneumatic pumps; Gas actuated pneumatic valves; Pneumatic controllers; Tanks
- Source types where engineering approaches are useful
  - Flare stacks.
- Source types where engineering approaches are not very useful
  - Component fugitives; Compressor seal fugitives; Pump fugitives;

Emission Estimation
Pneumatic Pump Example

Pneumatic Pumps

- Amount of fluid pumped
- Gas inlet pressure
- Pump discharge pressure
- Mechanical inefficiency

Gallons of Fluid Pumped =	**1**	
Pneumatic Gas Pressure =	**40**	**psig**
Pneumatic Gas Temperature =	**75**	**degrees F**
Discharge Pressure =	**600**	**psig**
Mechanical Inefficiency =	**30%**	
Gas Volume	**8.83**	**scf**

$$Q=((Pg+11.2)/14.7)*(520/(460+T))*(V/7.48)*Pd/Pg*(1+I)$$

Where:

P_g = Pneumatic Gas Pressure

T = Pneumatic Gas Temperature

V = Gallons Fluid Pumped

P_d = Pump Discharge Pressure

I = Mechanical Inefficiency

Q= Gas SCF

Emission Estimation
Acid Gas (Amine) Vent Example

Acid Gas Vents

- Gas Volume to Contactor
- CO2 Mole % In
- CO2 Mole % Out
- CH4 in Vent Stream

Gas Flow to Contactor	**100**	**MMSCF**
Inlet Gas CO2 Content	**4%**	**Mole Percent**
Outlet Gas CO2 Content	**0.20%**	**Mole Percent**
Vent Methane Content	**1%**	**Mole Percent**
CO2 Metric Tonnes	**200**	
Methane Metric Tonnes	**0.73**	

CO2= Vinlet*1000000*(CO2 In-CO2Out)/379.48*44/2204

Methane= Vinlet*1000000*(CO2In-CO2Out)/379.48*CH4Vent*16/2204

Where

Vinlet= Volume of Gas into Amine Contactor

CO2in= Mole % CO2 in Contactor Inlet

CO2out= Mole % CO2 in Contactor Outlet

CH4vent= Mole % CH4 in Regenerator Vent Stream

Material Balance Approach

- Bob Berry, DCP Midstream
  - BTU Efficiency Manager

Direct Measurement Approach

- John Cordaway, El Paso
  - Principal Reliability Engineer

Emissions Modeling Approach

- Danielle Nesvacil, TCEQ
  - Team Leader, Emissions Assessment Section
- Russ Nettles, TCEQ

Remote Quantification Approach

- Leanne Meyer, Northern Natural Gas
  - Senior Director, Right of Way, Environmental, Safety and Pipeline Integrity Groups

QUESTIONS????