Green Completions: Agenda

- Methane Losses
- Methane Recovery
- Is Recovery Profitable?
- Industry Experience
- Discussion Questions
Methane Loss During Well Completions

- It is necessary to clean out the well bore and formation surrounding perforations
  - After new well completion
  - After well workovers

- Produce the well to an open pit or tankage to collect sand, cuttings and reservoir fluids for disposal

- Vent or flare the natural gas produced
  - Venting may lead to dangerous gas buildup
  - Flaring is preferred where no fire hazard or nuisance
Methane Losses: Well Completions and Workovers

- EIA reported annual losses due to flaring and venting from onshore gas well completion, workovers and blowdowns to be 76 Bcf
- Estimated 45 billion cubic feet (Bcf) of natural gas lost annually due to well completions and workovers\(^1\)
- Estimated a total of 480,000 barrels (Bbl) condensate lost annually due to venting and flaring
- A total of $145 million lost due to well completions and workovers

Note:
- \(^1\)Percentage that is flared and vented is not known
- Value of natural gas at $3/Mcf
- Value of condensate at $22/bbl
Methane Recovery by Green Completions

- Recover natural gas and condensate produced during well completions or workovers
- Estimated 24 Bcf of natural gas can be recovered annually using Green Completions
- Use portable equipment to process gas and condensate suitable for sales
- Direct recovered gas through permanent dehydration and meter to sales line, reducing venting and flaring
Green Completions: Equipment

- Truck- or trailer- mounted equipment to capture produced gas during cleanup
  - Sand trap
  - Three-phase separator
- Use portable desiccant dehydrator for workovers requiring glycol dehydrator maintenance

Temporary, Mobile Surface Facilities, Source: BP
Green Completions: Preconditions

- Permanent equipment on site before cleanup
  - Piping to well head
  - Dehydrator
  - Lease meter
  - Stock tank
- Sales line gas can be used for energy and/or gas lift in low pressure wells
Green Completions: Low Pressure Wells

- Use portable compressors when pressure in well is low
  - Artificial gas lift to clear fluids
  - Boost gas to sales line
  - Higher cost to amortize investment

Source: Herald

Portable Compressors, Separator and Other Equipment on a trailer

Source: Herald
Green Completions: Benefits

- Reduced methane emissions during completions and workovers
- Sales revenue from recovered gas and condensate
- Improved relations with state agencies and public neighbors
- Improved safety
- Reduced disposal costs
Partners report recovering 2% to 89% (average of 53%) of total gas produced during well completions and workovers.

Estimated 7 to 12,500 thousand cubic feet (Mcf) (average of 3,000 Mcf) of natural gas can be recovered from each cleanup.

Estimate 1 to 580 Bbl of condensate can be recovered from each cleanup.

Note: Values for high pressure wells.
BP Experience

- Capital investment ~ $1.4 million on portable three phase separators, sand traps and tanks
- Used Green Completions on 106 wells
- Total natural gas recovered ~ 350 million cubic feet per year (MMcf/yr)
- Total condensate recovered ~ 6,700 Bbl/yr
BP Experience

- Total value of natural gas and condensate recovered
  ~ $840,000 per year

- Investment recovered in 2+ years

Note:
- Value of natural gas at $1.99/Mcf
- Value of condensate at $22/Bbl
Devon Energy Experience

- Implemented Reduced Emission Completion (REC) in the Fort Worth Basin
- REC performed on 30 wells at an average incremental cost of $8,700
- Average 11,900 Mcf of natural gas sold vs. vented per well
  - Natural gas flow and sales occur 9 days out of 2 to 3 weeks of well completion
  - Low pressure gas sent to gas plant
  - Conservative net value of gas saved is $50,000 per well
- Expects emission reduction of 1.5 to 2 Bcf in year 2005
Weatherford Durango Experience

- Successfully completed pilot project in the Fruitland coal formations in Durango, Colorado
  - Well depth: 2,700 to 3,200 feet
  - Pore pressure: estimated at 80 pounds per square inch gauge (psig)
  - Well type: coal bed methane
  - Hole size: 5 ½ inches
  - No. of wells: 3 well pilots

- Captured 2 MMcf of gas and sold by client
Weatherford Portable Equipment
Weatherford Green Completions

- Use natural gas from pipeline along with proprietary foaming agent as compressible fluid to initiate cleanout.

- Cleaning system consists of a wet screw compressor in addition to the booster, three phase separator and sand trap.
  - Wet screw compressor used when well pressure is less than 80 psig.

- Estimate a clean up pressure of 300 to 400 psig at a well depth of 8000 feet.

- Suggests use in all kinds of completion and workover cleanup operations.
Discussion Questions

- To what extent are you implementing this opportunity?
- Can you suggest other approaches for reducing well venting?
- 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, manpower, etc.) that are preventing you from implementing this practice?