# Reduced Emission Completions (Green Completions)

## Lessons Learned from Natural Gas STAR


**Producers Technology Transfer Workshop**

**Marathon Oil and**
**EPA's Natural Gas STAR Program**
**Houston, TX**
**October 26, 2005**

# Green Completions: Agenda

- Methane Losses
- Methane Recovery
- Is Recovery Profitable?
- Industry Experience
- Discussion Questions

# Methane Losses During Well Completions

- It is necessary to clean out the well bore and formation surrounding perforations
  - **After new well completion**
  - **After well workovers**
- Operators 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 there is no fire hazard or nuisance**

# Methane Losses: Well Completions and Workovers

- An estimated 45.5 Bcf of natural gas lost annually due to well completions and workovers[1]
  - **45,000 MMcf in losses from high pressure wells**
  - **319 MMcf in losses from low pressure wells**
  - **48 MMcf in losses from workovers**
- An estimated total of 480,000 Bbl condensate lost annually due to venting and flaring
- This amounts to over $145 million lost due to well completions and workovers

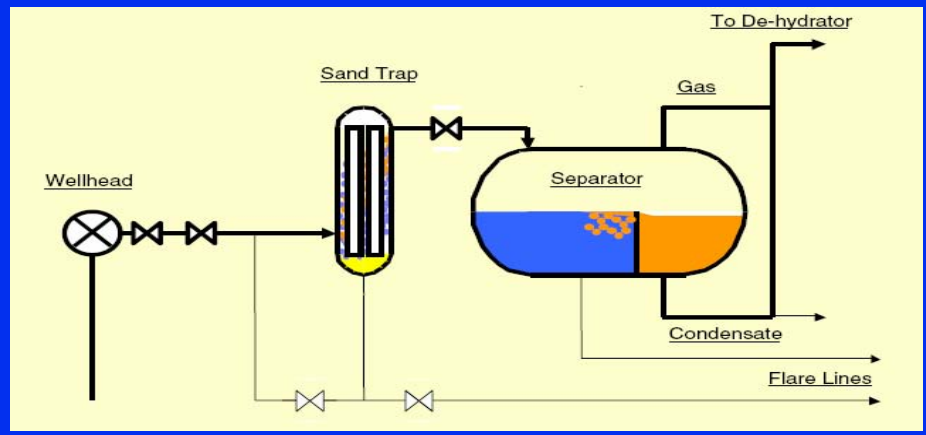
Note:
- [1]Percentage that is flared and vented unknown
- Value of natural gas at $3/Mcf
- Value of condensate at $22/bbl

# Methane Recovery by Green Completions

- Green completions recover natural gas and condensate produced during well completions or workovers
- Use portable equipment to process gas and condensate suitable for sales
- Direct recovered gas through permanent dehydrator and meter to sales line, reducing venting and flaring
- An estimated 25.2 Bcf of natural gas can be recovered annually using Green Completions
  - **25,000 MMcf from high pressure wells**
  - **181 MMcf from low pressure wells**
  - **27 MMcf from workovers**

# 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

- Must have permanent equipment on site before cleanup
  - **Piping from well-head to sales line**
  - **Dehydrator**
  - **Lease meter**
  - **Stock tank**
- Sales line gas can be used for fuel and/ or gas lift in low pressure wells

# Green Completions: Low Pressure Wells

- Can use portable compressors to start-up the well when reservoir pressure is low
  - **Artificial gas lift to clear fluids**
  - **Boost gas to sales line**
- Higher cost to amortize investment in portable equipment


Portable Compressors, Separator and Other Equipment on a trailer

Source: Herald

# Is Recovery Profitable?

- Partners report recovering 2% - 89% (average of 53%) of total gas produced during well completions and workovers
- Estimate 7- 12,500 Mcf (average of 3,000 Mcf) of natural gas can be recovered from each cleanup
- Estimate 1- 580 Bbl of condensate can be recovered from each cleanup

Note: Values for high pressure wells

# 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

# 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 MMcf/year
- Total condensate recovered ~ 6,700 Bbl/year

# BP Experience

- Total value of natural gas and condensate recovered ~ $840,000 per year
- Investment recovered in 2+ years


Portable Three Phase Separator, Source: BP

Note:

- Value of natural gas at $1.99/Mcf
- Value of condensate at $22/bbl

# 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 pipeline gas with proprietary foaming agent as compressible fluid to initiate cleanout
- System includes
  - **Wet screw compressor when well pressure is less than 80 psig**
  - **Booster compressor, three phase separator and sand trap**
- Estimate cleanup pressure of 300 to 400 psig at a well depth of 8000 feet
- Suggest 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?