

## Reduced Emission Completions in DJ Basin and Natural Buttes

Producers Technology Transfer  
Workshop

May 1, 2008

Rock Springs, Wyoming

### Topics of Discussion

- ▲ Anadarko's areas of tight gas production
- ▲ Conventional completion emissions
- ▲ Reduced emission completions
  - Best Management Practices "BMP"
  - Breco skids
- ▲ Environmental and economic benefit
- ▲ Future plans

## Anadarko's Areas of Tight Gas Production



## Conventional DJ Gas Well Completion

- ▲ Pressure test of well
- ▲ Perforation of well casing and cement in production zones
- ▲ Fracture of reservoir to enhance production
  - Fracture media and proppant dependent on reservoir
- ▲ Flow back well until well pressure safe to rig up
  - Possibility of lasting weeks
  - Gas vented to atmosphere
- ▲ Run production tubing
- ▲ Connect to production equipment and gathering system
- ▲ Operate well

## Conventional DJ Completion CH<sub>4</sub> Emissions

Year	Wells Frac'd	Avg Vent Time	Estimated Gas Lost	Revenue Lost <sup>1</sup>
		Days	MMSCF	MM\$
1998	281	8	899.2	2.7
1999	374	8	1196.8	3.6
2000	387	11	1702.8	5.1
2001	491	13	2553.2	7.7
2002	538	14	3012.8	9.0
2003	447	16	2860.8	8.6
2004	379	15	2274.0	6.8
2005	473	11	2081.2	6.2
<b>Average</b>	<b>421</b>	<b>12</b>	<b>2072.6</b>	<b>6.2</b>

<sup>1</sup> Based on EPA STAR \$3 gas

## Reduced DJ Emission Completions

- ▲ Pressure test of well
- ▲ Perforation of well casing and cement in production zones
- ▲ Fracture of reservoir to enhance production
  - Fracture media and proppant dependent on reservoir
- ▲ Well flows back until gas cut
- ▲ Well shut-in and tied to production equipment
  - Basin specific due to reservoir and gathering system parameters
- ▲ Flow back well to separation equipment until well pressure safe to rig up
  - Possibility of lasting weeks
  - Gas directed to sales
  - Liquids collected in tank
- ▲ Run production tubing
- ▲ Operate well

## Reduced DJ Emission Completion CH<sub>4</sub> Emissions

Year	Wells Frac'd	Average Vent Time	Estimated Gas Lost	Revenue Lost <sup>1</sup>
		Days	MMSCF	M\$
2006	590	0.08	19.7	137.7
2007	636	0.08	21.2	148.4
2008	310	0.08	10.3	72.3
<b>Average<sup>2</sup></b>	<b>613</b>	<b>0.08</b>	<b>20.5</b>	<b>143.1</b>

<sup>1</sup> Based on EPA STAR \$7 gas

<sup>2</sup> 2006 and 2007

## Average DJ Economic Benefit

Completion Method	Wells Frac'd	Average Vent Time	Estimated Gas Vented	Revenue Lost
		Days/well	MMSCF	
Conventional	421	12	2072.6	\$6.2 MM
Green	613	0.08	20.5	\$143.1 M
<b>Comparison G vs. C</b>	<b>+192</b>		<b>-2052.1</b>	<b>+\$6.1 MM</b>

## Natural Buttes Reduced Emission Completions

- ▲ Began using Breco skid late 2005 through 3<sup>rd</sup> quarter 2006
- ▲ Designed internal system which is currently used
- ▲ Fracture materials separated from gas stream
- ▲ Gas stream directed to gathering system

## Natural Buttes Completion Benefit

Wells Completed	Flow Time Through Breco	Cumulative Gas	Breco Cost	Gas Saved Revenue <sup>1</sup>	Difference
	Avg. hrs	MMSCF	\$ p/well	\$ p/well	\$ p/well
138	80	3.9	\$6,341	\$25,710	\$19,369

<sup>1</sup> Based on traded gas price

## Environmental Benefits

- ▲ Reduction of vented VOCs and HAPs
- ▲ Reduction of GHG compounds
  - CH<sub>4</sub> 21 times more potent than CO<sub>2</sub>
- ▲ Possibility of recycling stimulation fluids
- ▲ Reduces combustion byproducts

## Reduced Emission Completion Restrictions

- ▲ Methodology employed dependent on reservoir characteristics
- ▲ Areas where nitrogen or carbon dioxide are used to enhance fracture fluid
  - Sales gas specifications
  - Flaring utilized
- ▲ Gathering system pressure
  - Gas compression may be required

## Future Plans

- ▶ Continue to utilize green completion practices
- ▶ Evaluate new green completion techniques and production methods

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**Questions or Comments?**