Advancing Technology in Well Completions & Stimulations

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Anadarko’s mission is to provide a competitive and sustainable rate of return to shareholders by exploring for, acquiring and developing oil and natural gas resources vital to the world’s health and welfare.

- Integrity and Trust
- Servant Leadership
- People and Passion
- Commercial Focus
- Open Communication
Anadarko Petroleum Corporation (NYSE: APC)

One of the World’s Largest Independent Exploration and Production Companies

- Total Employees: 6,000
- Total Proved Reserves (Year End 2014): 2.86 Billion Barrels Oil Equivalent
- 2015 Sales Volumes: 305 MMBOE
- 2015 Capital Investment: $5.8 Billion
- 2015 Reserves Added: 407 MMBOE (133% of 2015 Production)

For More Information Please Visit: www.anadarko.com
Reasons why we need to advance technology

- APC has long held safety & environment protection as high priorities
- As we continue to grow operations in urban settings, it requires continuous evolution
  - *Specifically in the drilling and completion practices*
- Strive to further minimize impacts through technology and innovation
- Work with our vendors & other operators to take on these challenges as a collective industry
New Technologies: Progress and Benefits

- Two technologies established in 2013 and 2014
  - *Stim (stimulation) Centers*
    - First one utilized in August 2013
  - *Dual Fuel Fracturing Equipment*
    - First one utilized in April 2014

- Both have several benefits
  - *Reduce noise, light, & truck traffic for surrounding communities*
    - Achieved by strategically isolating the Stim Center in a less-populated area
  - *Preserve air quality*
  - *Reduce surface use space*
  - *Reduce emissions*
What is Stim Center?

- Stim center uses above ground steel pipelines that are built to withstand high pressures, to remotely hydraulic fracture wells from a central location up to a mile away.

- Anadarko uses this technology as a means to increase our distance and reduce the disturbance the equipment and traffic may cause to a nearby community.
The Stim Center is the centralized location that contains the fracturing equipment, materials, water, and crews.

Fluid is mixed with sand, then pumped through specially designed welded pipe to the remote pad locations, where it is then injected into the well to hydraulically fracture the formation.
Safety of the Pipe

- Safeguards are taken to ensure integrity of the treating lines that connect the pads.

- Treating lines have the same specification structural competency as the pipe that is used on the ocean floor in the Gulf of Mexico.

- Specialized high-integrity welds are used to connect the piping and prevent leaks:
  - After the pipe is welded, it is x-rayed to ensure its integrity.
  - The entire piping system must pass an 8-hour, 10,000 psi pressure test prior to use.
A 50 ft. “Red Zone” is used to restrict personnel from entering the area when the pipe is pressurized.

- Multiple cameras are installed along the pipe to monitor all lines and to ensure personnel safety.
Other Safety Standards

- All high pressure threaded pipe, on pad, uses pipe restraints as an additional safety provision

  - *The restraints are made with Kevlar*

    - The same material the military uses to make bullet-proof vests and helmets
Environmental Benefits

- Stim center compliments Anadarko’s previous environmental conservation efforts like “Water on Demand”

- “WOD” is an innovative technology that transports and delivers the water used in hydraulic fracturing via underground pipeline directly to pad

- Since its start in 2012 we have moved over 62 million barrels of water, eliminated over 50,000 truck trips and over 10,000,000 miles of truck traffic
Water-On-Demand

- The use of this technology has allowed Anadarko to reduce our surface impact by reducing pad size by 25%

- The number of water and sand storage tanks on location has been reduced from approximately 200 tanks down to 25 tank
What is Dual Fuel

- Natural gas and diesel (dual) powered fracturing equipment
- Anadarko piloted the use of Dual-Fuel using field gas in the Wattenberg field in April 2014
- The objective was to improve air quality by replacing a significant portion of diesel fuel with cleaner processed natural gas (NG) from nearby field operations
  - *For our Wattenberg operations we have been able to achieve up to 70% substitutions rates*
Dual Fuel Environmental & Safety Benefits

- To date, dual fuel has been used on 5 stim centers, totaling:
  - 23 pads, 70 wells, 2,586 treatment stages
  - Replacing 1,333,290 gal of diesel with natural gas

- Completing 2,586 stages with Dual-Fuel has significant environmental & safety benefits:
  - Reduced CO₂ emissions by over 24.5 million lbs since 2014
  - Reduced Nox emissions
  - Reduced visible air emissions
  - Reduces fuel truck traffic, natural gas is delivered via pipeline
  - Decreases the potential for diesel spill
  - Eliminates hot fueling
Conclusions

- Stim Center and Dual-Fuel are excellent examples of Anadarko’s continued commitment to social responsibility, pioneering and implementing greener technologies.

- These enhancements have significant benefits for communities near oil and natural gas operations.

- Safety always remains at the forefront with operating procedures:
  - Kevlar high-pressure iron restraints
  - 50 ft. protective “Red Zones”
  - x-ray validated high-integrity welds
  - Remote-camera monitoring
  - 8-hour pressure test of the entire system

- These investments and advancements demonstrate that Anadarko continues to hold true to its core values and works to ensure that everyone goes home safely.
Questions?