Modern Shale Gas Development in the United States: Water Issues

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Presented at:
Groundwater Protection Council
Water/Energy Symposium
Salt Lake City, Utah
September 13, 2009
Project Funding and Cooperators

Funding for this project was provided the DOE’s National Energy Technology Laboratory.

The Ground Water Protection Council direct the project with ALL Consulting serving the lead researcher.

Thanks to Everyone!
Shale Gas History

• Shale formations have produced natural gas in small, but continuous volumes since the earliest years of production
• The first gas well in the U.S. was completed in Devonian shale near Fredonia, NY in 1821
• By the 1930s the Antrim Shale was being developed for natural gas
Unconventional Gas

Increases in natural gas reserves have been led by production from unconventional sources.

Unconventional sources now account for 46% of total U.S. natural gas production.

Source: EIA, 2008
Shale Gas Outlook

- Shale gas is becoming a significant contributor
- EIA estimates:
  - By 2011 most reserves growth will be from shale gas reservoirs
  - By 2030, 18% to 28% of domestic natural gas production will come from shale gas reservoirs
The Rise of Shale Gas

Advances in horizontal drilling and hydraulic fracturing have been the key technologies which have allowed for increased development of the nation’s natural gas reserves from shale.

Source: John Perez, Copyright ©, 2008
Shale Gas Basins of the U.S.

Source: ALL Consulting based on EIA 2009
Drilling and Fracturing

- Hydraulic fracturing uses more water than drilling.
- Fracturing fluid is >98% water and sand.
- The remainder of the fracturing fluid is additives, each with an engineered purpose.
Fracture Fluids and Additives

Volumetric Composition of a Fracture Fluid

- Water 99.53%
- Other 0.47%
- KCl 0.09%
- Acid 0.12%
- Crosslinker 0.001%
- Surfactant 0.002%
- Friction Reducer 0.004%
- Biocide 0.007%
- pH adjuster 0.010%
- Corrosion Inhibitor 0.011%
- Iron Control 0.06%
- Gelling Agent 0.06%
- Breaker 0.02%

Source: Compiled from Data collected at a Fayetteville Shale Fracture Stimulation by ALL Consulting 2008.
Water Use In Major Shale Plays

• **Barnett Shale**
  10,000 BBLs used for Drilling
  70,000 BBLs used for Fracturing
  80,000 Total BBLs Used
  **Assumed** Wells per Year: 600
  Projected Total Water Use per Year:
  **48 Million BBLs**

• **Fayetteville Shale**
  1,500 BBLs used for Drilling
  70,000 BBLs used for Fracturing
  71,500 Total BBLs Used
  **Assumed** Wells per Year: 250
  Projected Water Use per Year:
  **18 Million BBLs**

• **Haynesville Shale**
  25,000 BBLs used for Drilling
  65,000 BBLs used for Fracturing
  90,000 Total BBLs Used
  **Assumed** Wells per Year: 200
  Projected Total Water Use per Year:
  **18 Million BBLs**

• **Marcellus Shale**
  2,000 BBLs used for Drilling
  90,000 BBLs used for Fracturing
  92,000 Total BBLs Used
  **Assumed** Wells per Year: 600
  Projected Total Water Use per Year:
  **55 Million BBLs**

Basin-wide activity based on one operator’s peak year projections.
Water Management Lifecycle

• Phases of water management for shale gas development:
  – Withdrawal
  – Transport
  – Storage
  – Use (drilling and fracturing)
  – Treatment and reuse/recycle
  – Treatment and disposal
• Each involves challenges

Today’s focus will be on Water Withdrawal Issues

Fresh Water Storage Tanks
Source: ALL Consulting
Water Withdrawal

• Primary water needs are for drilling fluids and hydraulic fracturing.
• Other water needs can include dust suppression and cleaning/flushing of the rig and equipment.
• Sources of water and water volumes are needed at sufficient volume and timing.
Water Withdrawal: Challenges

- Even in the relatively wet Marcellus Shale region, water supply is a concern.
- The public may perceive shale gas water use as a threat to local supplies and competing uses.
- Governments and regulatory bodies are worried about cumulative impacts resulting from withdrawal. Ultimate disposal is also a concern.
- Timing and location of withdrawals may be sensitive, especially in drought years.
- Multiple watershed-related jurisdictions complicate the issues.
Water Withdrawal: Sources

- **Surface water** is a primary source of water for drilling and hydraulic fracturing fluids. Lakes and streams are commonly used. Private stock ponds are also a possible source.

- **Groundwater** is a potential source if surface water is not available. Groundwater availability is limited in some areas.

- **Municipal water** suppliers can also be a source where available.
Sustainable Development

- Sustainable shale gas development will require a toolbox approach to both water supply and wastewater management.
- Producers will have to track and manage water withdrawal issues (volumes, costs, and impacts): source, transport, storage, use, treatment, and disposal, along with permitting and compliance.
- Overall, the quantity of water needed for shale gas development is small and temporary compared to long term uses such as electrical power generation.
- Management of the shale gas water may dictate the pace of development in some areas.
Reuse/Recycling

- In some basins, there is a movement by producers toward recycling flowback or produced water.
  - Addresses limitations on UIC wells and commercial or municipal treatment plants.
  - Reduces transport costs.
  - Driven by current and future regulatory limits.
  - Reduces withdrawal demands.
MODERN SHALE GAS
Development in the United States:
A Primer

April 2009
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