What’s the Fracking Problem?

Solutions for Hydraulic Fracturing Wastewater

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Pensacola, Florida
A Brief History of Hydraulic Fracturing
In 1947, Stanolind Oil conducted the first experimental fracturing in the Hugoton field located in southwestern Kansas. The treatment utilized napalm (gelled gasoline) and sand from the Arkansas River. – Society of Petroleum Engineers
Hydraulic Fracturing: A 60 Year History

1948
- The first recorded use of hydraulic fracturing was in 1948.
- Hydraulic fracturing has been in near continuous commercial use since 1949.

1997
- The first successful use of modern “slickwater” or “light sand” fracturing was in 1997 in the Barnett Shale of Texas.

2011
- Unconventional natural gas plays, i.e. hydraulic fracturing, represent 60% of the growth in technically recoverable domestic natural gas reserves.
Why the boom of the past decade?

Advancements in Hydraulic Fracturing.

High natural gas prices in the late 1990s and early 2000s spurred the boom.

Advancements in Horizontal Drilling.

Six to eight horizontal wells = sixteen vertical wells. Horizontal drilling made unconventional plays economically feasible.

This includes improvements to proprietary frack fluid formulas, including the refinement of “slickwater” or “light sand” fracking.
Basic Facts
Hydraulic Fracturing: Technical Basics

- Testing for Gas
- Siting of well pad, well, pits, disposal sites.
- Construction: Well Pad & Road Access
- Fracturing the Well
- Withdraw or truck in water for fracturing: Avg. 3 million gallons per well.
- Drilling and Casing
- Permits, Pollution Control: Air Emissions Preventing and Report Spills Chemical Disclosure
- Testing and Replacing Water Supplies
- Waste Storage and Disposal, Site Restoration
- Permits, Pollution Control: Air Emissions Preventing and Report Spills Chemical Disclosure
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Economic and National Benefits
Cleaner Energy: Natural gas is cleaner burning, with fewer greenhouse gas emissions. It is a bridge fuel to a cleaner energy future.

Jobs: 1 in 20 US Jobs is supported by the oil and natural gas industry. Fracked gas was directly responsible for 600,000 jobs in 2010. Fracked natural gas supports an additional 1,000,000 jobs in non-energy sectors.

States: There are 19 shale gas plays in the US. 16 states were active shale gas or shale oil producers as of January 2012.
Hydraulic Fracturing: Economic and National Benefits

“The US is the Saudi Arabia of natural gas.”
T. Boones Pickens

In 2010, NG provided 21% of America’s electricity needs.

Unconventional gas plays represent 60% of technically recoverable reserves.

2,214 trillion CF of technically recoverable NG nationwide as of 2010. This is enough NG to meet American energy needs for a 100 years.
177.9 Trillion CF of recoverable NG in the Marcellus Shale alone.

90% of US natural gas is domestically produced. It plays a critical role in energy security.

Fracking is responsible for 45% of current domestic production of Natural Gas (NG).
Water Issues and Challenges
Hydraulic Fracturing: Water Issues and Challenges

Each fractured well requires an average of 2-4 million gallons of fresh water. Water is usually extracted on site from nearby streams or rivers.

For example, in 2009 projected total daily demand for fracking is 8 million gallons in the Marcellus region.

Also in 2009, water usage for electrical generation is 150 million gallons per day in the Susquehanna River Basin region, which includes Marcellus Shale states.
Hydraulic Fracturing: Water Issues and Challenges

Composition of Fracking Fluid:
- Acid
- Sodium chloride
- Polyacrylamide
- Isopropanol
- Glutaraldehyde
- Ethylene glycol
- Sodium or potassium carbonate
- Borate salts
- Guar gum
- Citric acid
- Produced water often contains NORM, high levels of TDS.
- Roughly 100 chemicals commonly used in frac fluid.
- 99% water and sand
- 1% Chemicals

Roughly 100 chemicals commonly used in frac fluid.
Hydraulic Fracturing: Water Issues and Challenges

Wastewater Management and Disposal: “Produced” or “Flowback” Water

Lined Pits, Tanks – Storage on site

Recycled – Used to fracture other wells

Class II Injection Wells – a common disposal method
Hydraulic Fracturing: Water Issues and Challenges

State Specific Wastewater Issues

Treatment and Discharge (PA) – This practice has been discontinued following pressure from the EPA and concerns about the ability of POTWs to adequately treat produced water.

Land Application (OK): Oklahoma only, requires a permit.

Banned? (VT, NJ): The VT and NJ State legislatures have both considered bans on the storage or treatment of fracking produced water in their state.
Public Perception and EPA Backpedaling
Hydraulic Fracturing: Public Perception and the Recent EPA Backtrack

Ground and Drinking Water At Risk?

Clark Hill
Protection of groundwater and underground sources of drinking water is required by state and federal law.
## Pavillion, Wyoming

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
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<tbody>
<tr>
<td>12/08/11</td>
<td>Draft with preliminary finding of contamination</td>
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<tr>
<td>03/12/12</td>
<td>Statement noting need for additional testing, decision to continue to accept public comment on the draft</td>
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<tr>
<td>06/01/12</td>
<td>Final report expected in June</td>
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- US EPA Office of Research and Development: Groundwater Investigation Report
- EPA Office of Enforcement and Compliance Assurance: Multi-Media and CERCLA Investigations
- Groundwater vs. drinking contamination
- Coalbed methane vs. Shale gas
- Congressional Research Service limited the findings – unconventional drilling, outside of API standards, geographic limit
Hydraulic Fracturing:
Public Perception and the Recent EPA Backtrack

The Pavillion, Wyoming Draft Study Controversy

EPA found no evidence of oil & gas impacts and no connection to hydraulic fracturing in Pavillion residents’ drinking water.

EPA drilled two deep monitoring wells into a known natural gas reservoir. It is therefore unsurprising that elements of natural gas were found.

EPA released preliminary findings without independent, qualified third-party review.

Due to in part to criticism of the draft study, EPA has since announced that it will conduct additional testing.
Hydraulic Fracturing: Public Perception and the Recent EPA Backtrack

Dimock, Pennsylvania

- EPA Office of Enforcement and Compliance Assurance
- CERCLA and multimedia investigations

01/19/12 – Action Letter

March and April 2012 – EPA releases the results well tests in Dimock. All show that water is safe to drink.

The center of fracking publicity, controversy is ongoing. Dimock was featured in the anti-fracking documentary, Gasland.
Eagle/Fort Worth, Texas – Range Resources

- **EPA Office of Enforcement and Compliance Assurance**
- **Safe Drinking Water Act, Unilateral Order**
- **EPA bypasses the Texas Railroad Commission, files unilateral order alleging drinking water contamination.**
- **RR ordered to provide water to residents.**
- **EPA filed an enforcement order in federal district court.**
- **RR sued EPA.**
- **03/30/2012, EPA withdrew its enforcement order.**
Hydraulic Fracturing: Public Perception and the Recent EPA Backtrack

EPA
National Drinking Water Impacts Report, cases include Marcellus, Bakken, Barnett, and Haynesville Shales
Final report due 2014.

DOI – USGS
2013 Budget Proposal includes $45 million for research to “understand and minimize” impacts of shale gas development

Department of Energy
Study of environmental impact and safety of fracking. Final report 11/18/11
State and Federal Regulation
The Oil and Gas Industry is traditionally regulated at the state level, usually by state oil and gas boards.

All oil and gas states regulate natural gas exploration and production. States also oversee permits and programs required by the CAA, the CWA, etc., that oil and gas producers must also comply with.

Current hot topics in regulation at the state level include chemical disclosure, casing and pressure standards. One state, Vermont, recently banned fracking.
The newly proposed DOI rule will be the first federal regulation specific to hydraulic fracturing – proposed rule published on 05/04/2012.

The new White House Inter-Agency Task for Hydraulic Fracturing may lead to comprehensive regulation. API recently announced it would prefer any federal fracking regulations to be consolidated into one agency.

After 60 years, is the move for federal regulatory layer that will likely be duplicative of state regulations motivated by public perception, or by science and facts?
Hydraulic Fracturing:

Federal Regulatory Activities

Agencies
- EPA
- Interior
- Energy
- USDA
- White House
- Labor
- River Basin Commissions

Examples of Legal Authority
- Executive Order
- CWA
- CAA
- TSCA
- RCRA
- SDWA
- UIC
- ESA
- NEPA

Examples
- Air emissions
- Effluent guidelines
- Moratoriums on oil & gas leasing or drilling on certain land
- Impact of fracking considered in ESA listing decisions
- Chemical disclosure
- Task force, working group, or study
Challenges Ahead: Technical, Environmental, Regulatory & Economic
Hydraulic Fracturing: The Challenges Ahead

Water
- Availability in time of drought
- Reduced Instream Flows – impact to aquatic species, agriculture community
- Impact of trucking in water in water-scarce shales
- Impact on endangered species

Wastewater
- Capacity for proper disposal
- Spills, accidental exposure
- Class II Wells and Earthquakes?
- Pre-treatment requirements

Noise
- Wells often operate 24/7
- Noise from compressors, pumping stations, vehicle traffic, flares
- Urban wells require noise abatement
- Noise from rural wells impacts wildlife

Air
- Greenhouse Gasses
- Benzene
- Ozone
- VOCs
- Air aggregation controversy

Environmental Challenges
Hydraulic Fracturing: The Challenges Ahead

- **Water Supply** – Access and Volume
- **Drilling** – Casing and Cement Standards Sufficient to Protect Groundwater
- **Technical Challenges**
- **Hydraulic Fracturing** – Required to release gas from porous areas of tight-shale formations.
- **Frac Fluid Composition** – Varies based on unique characteristics of that shale

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*Image of a rocky surface*
Hydraulic Fracturing: The Challenges Ahead

Regional Differences:
Geology, Topology, and Geography vary from shale to shale. What is appropriate in one shale may be reckless in another. Flexibility is required for effective regulation.

Clean Water Act:
POTW issues, particularly in PA. High Salinity and TDS in produced water a particular concern for POTWs. Oil & Gas producers must obtain permits to discharge – like everyone else.

Safe Drinking Water Act:
Excludes hydraulic fracturing unless diesel is used in frack fluid, but, likely a broad definition of diesel. Authority for the order in the Range Resources Case.

Clean Air Act:
Brand New NESHAPS and New Source Standards for the Oil & Gas Industry Air Aggregation/Single Source Determination Controversy

Regulatory Challenges
### Economic Challenges

**Pricing:**
Significant drop in natural gas prices due to increased supply.

Cost of new regulations combined with low prices for NG will make some wells economically unfeasible.

**Leases:**
Thousands of leases signed over the last few years. 12%-20% royalties + lease price up to $5,000/acre.

USDA has moratoriums on loans for properties with leases, wells in some states.

**Jobs:**
Natural gas production boom supports hundreds of thousands of jobs. Bans on fracking or cost-prohibitive regulations will cost jobs.

**Cost of Drilling:**
$3-$5 million per well, much higher for very deep wells.

Water scarcity and new regulations may increase costs.
What comes next?
Questions and Comments?

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