Topics

• What is Hydraulic Fracturing?

• Brief History of Hydraulic Fracturing

• Laws and Regulations

• Overview:
  BLM Proposed Hydraulic Fracturing Rule
What is Hydraulic Fracturing

Figure 1

Shale Fractures

Drinking Water Aquifers

Fracture Stages

Municipal Well

Private Well
What is Hydraulic Fracturing?

- Fracturing fluids are injected at high pressure into the targeted formation, fractures the rock and creates fissures that are propped open which allow oil and gas to move freely into the wellbore.
History of Hydraulic Fracturing

- Roots can be traced back to the 1860s:
  - Initially, black powder explosives were dropped down well bore and ignited
  - Nitroglycerin was later used, extremely dangerous
History of Hydraulic Fracturing

• 1947
  • Stanolind Oil Company conducts first experimental fracturing in the Hugaton Field, Kansas, USA
    • Utilized 1000 gallons gelled gasoline (napalm)
    • Nearby river sand was used as proppant
    • Fractured a Limestone FM. at 2,400 ft. depth
History of Hydraulic Fracturing

• 1949
  • First commercial hydraulic fracture treatment
    • Duncan, Oklahoma, USA

• Late 1980s/early 1990s
  • Horizontal drilling and hydraulic fracturing combined successfully
    • Barnett Shale – north Texas, USA

• Today
  • Over 2.5 million fractures worldwide
Federal hydraulic fracturing regulations:

43 CFR Section 3161 Jurisdiction and Responsibility

43 CFR 3161.1(a):
“All operations (including hydraulic fracturing operations) conducted on a Federal or Indian oil and gas lease are subject to the regulations in this part.”
Laws and Regulations

Continued:

• Hydraulic Fracturing is recognized as a standard well completion practice.
• No prior approval required unless additional surface disturbance will occur.
Laws and Regulations

Other statutes and regulations are in place to help ensure protection of the surface and subsurface environment:

• Onshore Order #2 (Drilling Operations)
  • Provides for proper well casing and cementing techniques to prevent unwanted fluid migration

• The Federal Oil and Gas Royalty Management Act
  • Provides authority for BLM to inspect fracking operations

• Clean Air Act

• Clean Water Act
Public Outreach for Hydraulic Fracturing

Several meetings were held throughout the country

Purpose of meetings:

- Explain hydraulic fracturing techniques
- Listen to public comments/concerns
- Discuss the draft proposed rule
Public Concerns

- Amount of surface disturbance involved
- Potential impacts to surface and groundwater quality
- Water consumption
- Wellbore integrity
- Public disclosure of chemicals used
- Who should regulate (federal or state government)
Why is a Hydraulic Fracturing Rule Necessary?

• 90 percent of all wells drilled on Federal and Indian lands use hydraulic fracturing

• BLM’s regulations are over 30 years old

• The regulations do not address modern hydraulic fracturing methods and techniques

• BLM needed to modernize and establish baseline environmental safeguards for hydraulic fracturing on all public and Indian lands

• Public concern about the chemicals being used
Major Environmental Concerns

1. Protect groundwater and surface water from contamination

2. What kind of chemicals and additives are being used in the fracturing fluid

3. Large volumes of water needed for hydraulic fracturing operations

4. How and where to dispose fracturing fluid after it is used
1. Protection of Groundwater and Surface Water from Contamination

Proposed Rule:
Requires protection of all “usable” water
  – Up to 10,000 ppm of total dissolved solids

Cement evaluation logs required on new wells
  – Confirm that the casing string is properly cemented and usable water zones are isolated (prevent fluid migration from fracture zone to usable water horizons)
1. Protection of Groundwater and Surface Water from Contamination (cont.)

Proposed Rule:
A well casing mechanical integrity test is required prior to well stimulation

— Ensure integrity of casing under anticipated maximum injection pressure
2. Disclosure of Chemicals and Other Additives used in the Fracturing Fluid

Proposed Rule:
Operator is required to identify the composition of the fracturing fluid
- Trade name and purpose of chemical used
- Percent mass (volume) of each ingredient
- Provides chemical trade secret protection
- However, BLM maintains the right to acquire trade secret information, if necessary
2. Disclosure of Chemicals and Additives in the Fracturing Fluid

Water and Sand: ~98%

Other: ~2%
- Acid
- Friction Reducer
- Surfactant
- Gelling Agent
- Scale Inhibitor
- pH Adjusting Agent
- Oxygen Scavenger
- Breaker
- Crosslinker
- Iron Control
- Corrosion Inhibitor
- Antibacterial Agent
## 2. Disclosure of Chemicals and Additives in the Fracturing Fluid

<table>
<thead>
<tr>
<th>Product</th>
<th>Main Ingredient</th>
<th>Purpose</th>
<th>Other Common Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td></td>
<td>Expand fracture and deliver sand.</td>
<td>Municipal, agricultural, manufacturing, etc.</td>
</tr>
<tr>
<td>Sand</td>
<td></td>
<td>Props the fractures open so that oil/gas can escape.</td>
<td>Drinking water filtration, play sand, concrete and brick mortar.</td>
</tr>
<tr>
<td>Acid</td>
<td>Hydrochloric acid or muriatic acid.</td>
<td>Helps dissolve minerals and initiate cracks in the rock.</td>
<td>Swimming pool chemical and cleaner.</td>
</tr>
<tr>
<td>Antibacterial agent</td>
<td>Glutaraldehyde</td>
<td>Eliminates bacteria in the water that produces corrosive by-products.</td>
<td>Disinfectant; Sterilizer for medical and dental equipment.</td>
</tr>
<tr>
<td>Breaker</td>
<td>Ammonium persulfate</td>
<td>Allows a delayed breakdown of the gel.</td>
<td>Used in hair coloring, as a disinfectant, and in the manufacture of common household plastics.</td>
</tr>
<tr>
<td>Corrosion inhibitor</td>
<td>N, n-dimethyl formamide</td>
<td>Prevents the corrosion of the steel pipe.</td>
<td>Used in pharmaceuticals, acrylic fibers and plastics.</td>
</tr>
<tr>
<td>Crosslinker</td>
<td>Borate salts</td>
<td>Maintains fluid viscosity as temperature increases.</td>
<td>Used in laundry detergents, hand soaps and cosmetics.</td>
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## 2. Disclosure of Chemicals and Additives in the Fracturing Fluid

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<tr>
<td>Friction Reducer</td>
<td>Petroleum distillate</td>
<td>“Slicks” the water to minimize friction.</td>
<td>Used in cosmetics including hair, make-up, nail and skin products.</td>
</tr>
<tr>
<td>Gel</td>
<td>Guar gum or hydroxyethyl cellulose</td>
<td>Thickens the water in order to suspend the sand.</td>
<td>Thickener used in cosmetics, baked goods, ice cream, toothpaste, sauces and salad dressings.</td>
</tr>
<tr>
<td>Iron control</td>
<td>Citric acid</td>
<td>Prevents precipitation of iron oxides.</td>
<td>Food additive, food and beverages; lemon juice.</td>
</tr>
<tr>
<td>Clay stabilizer</td>
<td>Potassium chloride</td>
<td>Creates a brine carrier fluid.</td>
<td>Used in low-sodium table salt substitute, medicines and IV fluids.</td>
</tr>
<tr>
<td>pH adjusting agent</td>
<td>Sodium or potassium carbonate</td>
<td>Maintains the effectiveness of other components, such as crosslinkers.</td>
<td>Used in laundry detergents, soap, water softener and dishwasher detergents.</td>
</tr>
<tr>
<td>Scale inhibitor</td>
<td>Ethylene glycol</td>
<td>Prevents scale deposits in the pipe.</td>
<td>Used in household cleaners, de-icer, paints and caulk.</td>
</tr>
<tr>
<td>Surfactant</td>
<td>Isopropanol</td>
<td>Used to increase the viscosity of the fracture fluid.</td>
<td>Used in glass cleaner, multi-surface cleaners, antiperspirant, deodorants and hair color.</td>
</tr>
</tbody>
</table>
3. Water Consumption Concerns

Pre-fracture operation proposal must include the following information:

- Estimated total volume of water to be used
- Estimated volume of frac fluid to be recovered during flow-back, swabbing, and production operations
- Proposed method of disposing the recovered fluids
Post-fracture operations report must include the following information:

- Source of water used in the frac fluid
- Actual volume of fluid used
- Actual volume of fluid recovered during flow-back, swabbing, and production operations
- Method used to dispose the recovered frac fluids
Opportunities for a Variance from the Proposed Rule

- Some states already have a fracking rule
- The Federal rule may allow the BLM to defer to the state’s rule (a variance) if:
  - The state rule meets or exceeds the requirements of the Federal rule
The BLM draft fracking rule was issued on May 11, 2012, for a 90-day public comment period.

BLM received 177,000 comments from the public and the oil and gas industry.

After review and consideration of all the comments, BLM decided to revise portions of the draft rule.
Key differences between the initial and the revised draft rules

Updated Rule:

- Allows use of expanded set of cement evaluation tools
- Introduces a “type well” concept
- Provides trade secret protection
- Relies on the state to identify usable water formations that need protection and which formations that do not need protection
BLM released revised draft fracturing rule for public comment on May 16, 2013

• 1.35 million comments received

• BLM is currently analyzing the comments and plans to issue a final rule in 2014
The End