

School of Shale Rock: Hydraulic Fracturing and the Debate Over its Impact

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Pennsylvania PUC

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Overview of Marcellus Shale

- Extends ~600 miles across the Appalachian Basin, covering portions of 9 states
- Great potential in northeastern Pennsylvania, where shale is the thickest
- This massive field is expected to be:
 - the largest natural gas field in the U.S.
 - one of the 5 largest natural gas fields in the world





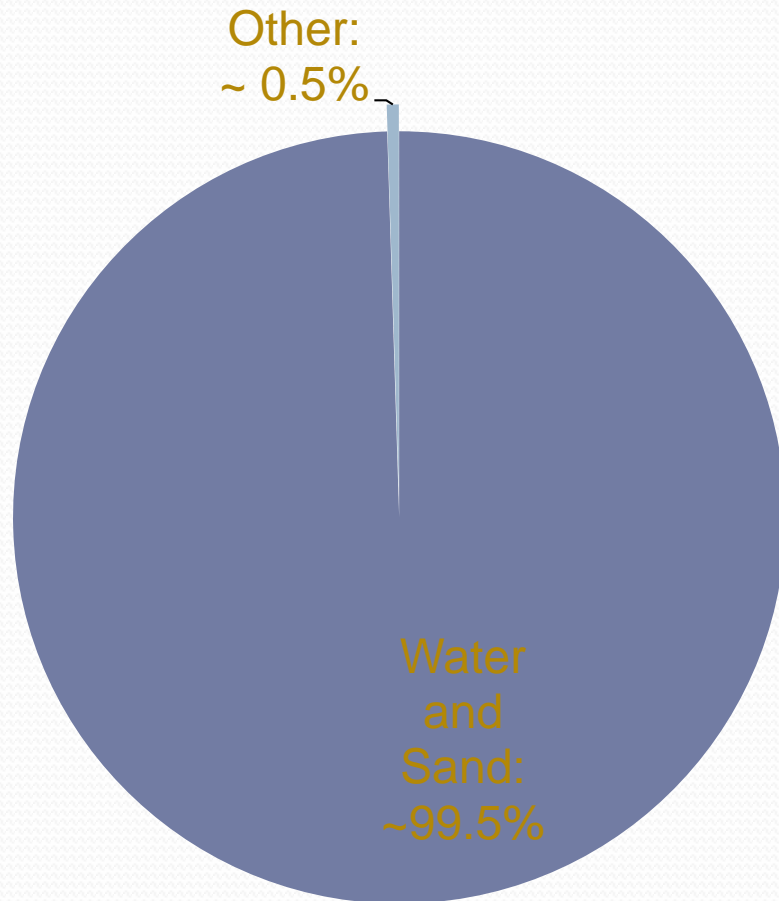
Potential of Marcellus Shale

“The Economic Impacts of the Pennsylvania Marcellus Shale
Natural Gas Play: An Update”
Pennsylvania State University, May 2010

- 2009:
 - \$4.5 billion spent by producers to develop Marcellus Shale gas resources
 - \$3.9 billion in value added to state economy
 - \$389 million in state and local tax revenues
 - 44,098 jobs created
- 2010 (expected):
 - \$8.03 billion in value added to state economy
 - \$785 million in state and local tax revenues
 - 88,588 jobs
- 2020 (estimated):
 - \$18.85 billion in value added to state economy
 - \$1.8 billion in state and local tax revenues
 - 211,909 jobs

What's in Hydraulic Fracturing Fluid?

Typical Deep Shale Gas Fracturing Mixture



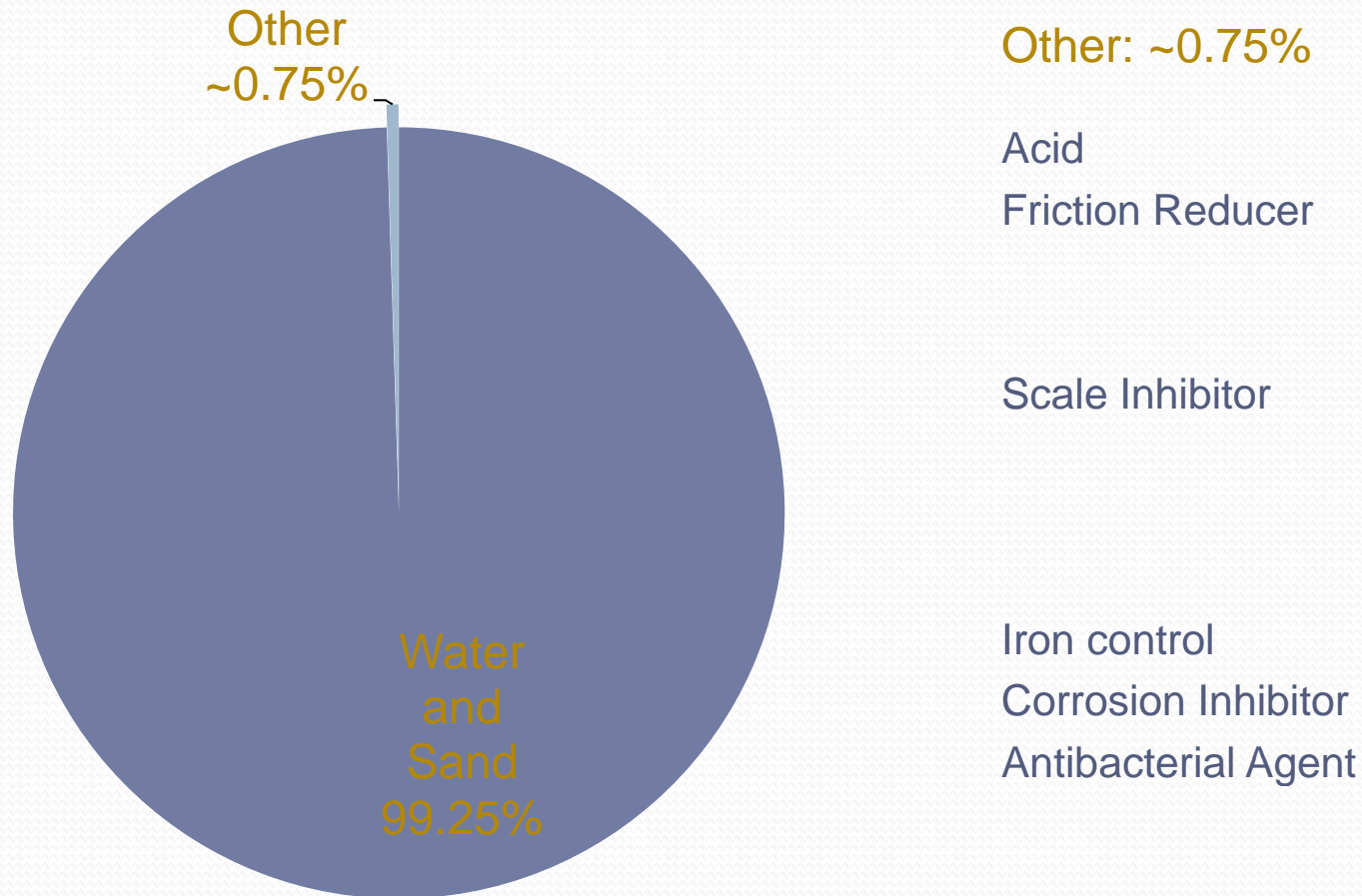
Other: ~0.5%

- Acid
- Friction Reducer
- Surfactant
- Gelling Agent
- Scale Inhibitor
- pH Adjusting Agent
- Breaker
- Crosslinker
- Iron control
- Corrosion Inhibitor
- Antibacterial Agent
- Clay Stabilizer

Rarely are all products used in one shale play.

What's in Marcellus Shale Fracturing Fluid?

Typical Northern Marcellus Shale Gas Fracturing Mixture



Regulation

- **Clean Water Act**
 - Regulates surface discharges of water associated with drilling and production
 - Storm water runoff from drilling and production sites
- **Underground Injection Control program of the Safe Drinking Water Act**
 - Regulates the underground injection of wastes from all industries including oil and gas
- **Clean Air Act**
 - Limits air emissions from engines, gas processing equipment, and other sources associated with drilling and production
- **Resource Conservation and Recovery Act**
 - Requires industry to handle and dispose of its waste or refuse according to specific guidelines
- **Natural Environmental Policy Act**
 - Requires that exploration and production on federal lands be thoroughly analyzed for environmental impacts
- **Occupational Safety and Health Act**
 - Protects the health and safety of oil and gas workers, as well as other industries



Conclusions

- The Marcellus Shale represents the largest economic boon Pennsylvania has seen in over a century and affects numerous sectors of the economy.
- The production of natural gas from the Marcellus Shale formation is important because it is a clean-burning, affordable, and abundant energy source.
- All involved parties must work together to ensure safe, responsible, and economically sound development of this resource.