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Hydraulic Fracturing 101

The State of Alaska Resources Committee

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Overview

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- The Early Days of Hydraulic Fracturing
- Why Hydraulic Fracturing is Used?
- Creation of Growth “Opening New Doors”
- Fluid Ingredients
- Well Types
- The Process (animation)
- Alaska Regulations
- Frac Focus
- Conclusions

The Early Days of Frac

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- Developed in the 1940s
- Helped produce more than 600 trillion cubic feet of natural gas and 7 billion barrels of oil
- A proven technology used safely for more than 60 years
- Utilized in more than a million wells
- Used to create spaces in the rock pores to release oil and natural gas

Hydraulic Fracturing Job Circa 1950

Source: fracfocus.org: A Historic Perspective

Why Hydraulic Fracturing is Used?

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To improve well production

Low quality reservoirs – required to achieve economic production rates

Medium quality reservoirs – accelerate recovery from wells

High quality reservoirs – bypass drilling damage, increase reservoir contact contributing to fluid production

- Add reserves
- Make production of low-rate reservoirs economic
- Improve recovery
- Contact larger drainage areas

Opening New Doors

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- Recovery of oil and natural gas from formations that geologists once believed were impossible to produce
- Extended production in older oil and natural gas fields (West Texas)
- Experts believe 60 to 80 percent of all wells drilled in the United States in the next ten years will require hydraulic fracturing
- 25 percent of all wells to date in Alaska have been hydraulically fractured

Frac Fluid Ingredients

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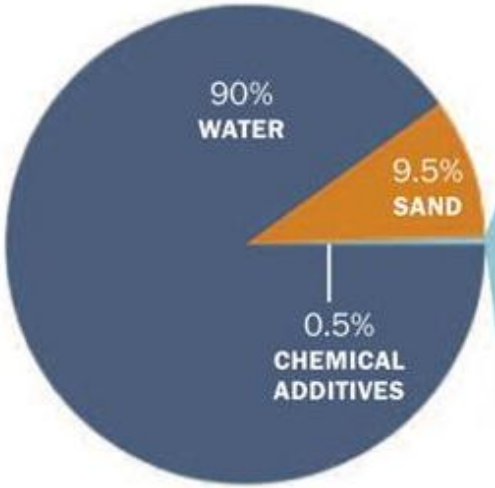

Compound	Purpose	Common application
Acids	Helps dissolve minerals and initiate fissure in rock (pre-fracture)	Swimming pool cleaner
Sodium Chloride	Allows a delayed breakdown of the gel polymer chains	Table salt
Polyacrylamide	Minimizes the friction between fluid and pipe	Water treatment, soil conditioner
Ethylene Glycol	Prevents scale deposits in the pipe	Automotive anti-freeze, deicing agent, household cleaners
Borate Salts	Maintains fluid viscosity as temperature increases	Laundry detergent, hand soap, cosmetics
Sodium/Potassium Carbonate	Maintains effectiveness of other components, such as crosslinkers	Washing soda, detergent, soap, water softener, glass, ceramics
Glutaraldehyde	Eliminates bacteria in the water	Disinfectant, sterilization of medical and dental equipment
Guar Gum	Thickens the water to suspend the sand	Thickener in cosmetics, baked goods, ice cream, toothpaste, sauces
Citric Acid	Prevents precipitation of metal oxides	Food additive; food and beverages; lemon juice
Isopropanol	Used to increase the viscosity of the fracture fluid	Glass cleaner, antiperspirant, hair coloring

Source: DOE, GWPC: Modern Gas Shale Development in the United States: A Primer (2009)

Well Types

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Vertical Wells

- Single well from a surface location
- Applicable for multiple vertical reservoir targets, multi-layer sands

Horizontal Wells

- Primary drilling technique for oil and gas reservoirs
- Multiple directional wells from a surface location: Smaller footprint
- Applicable for single reservoir targets

Vertical & Horizontal Well Comparison

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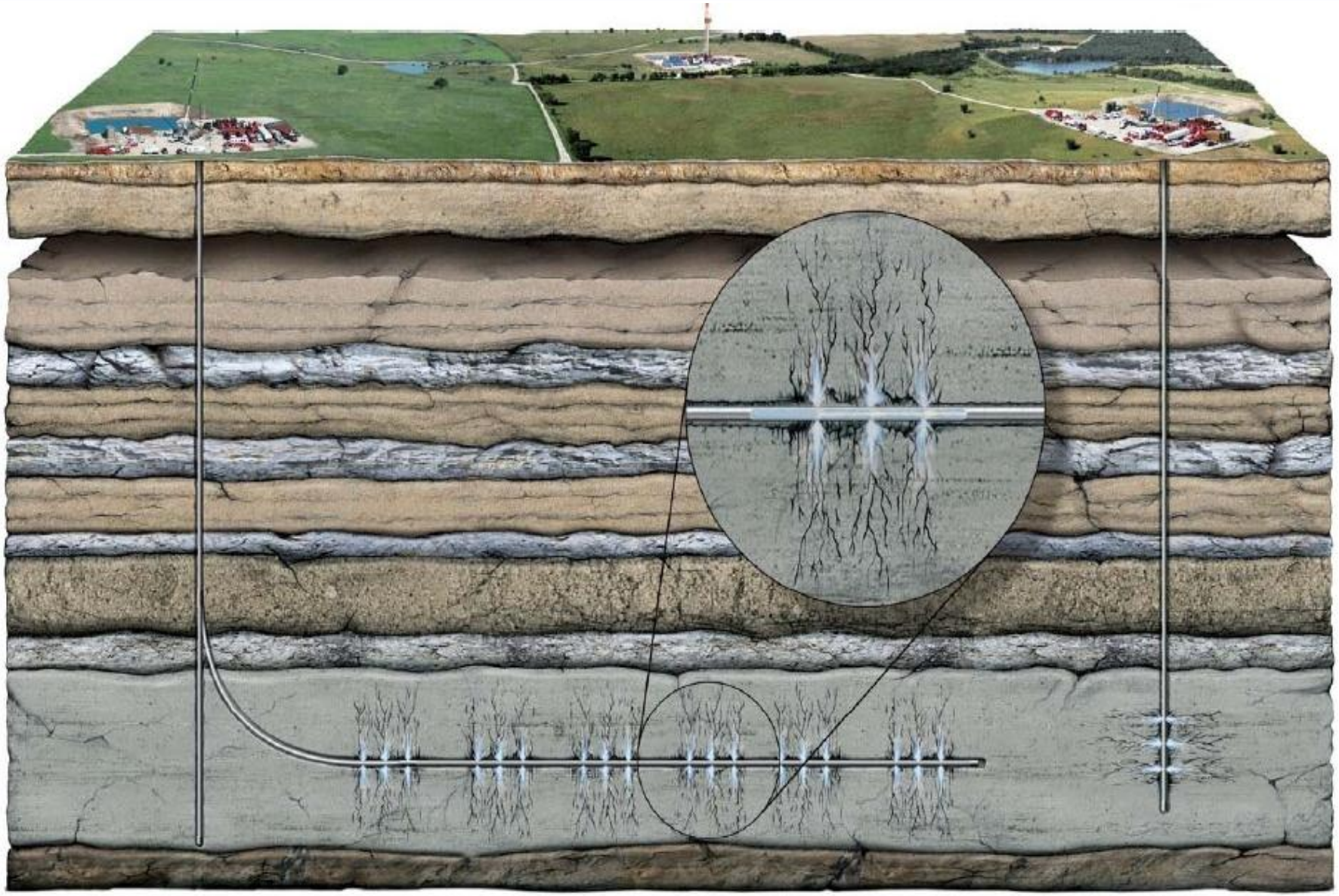

Source: American Petroleum Institute

The Process

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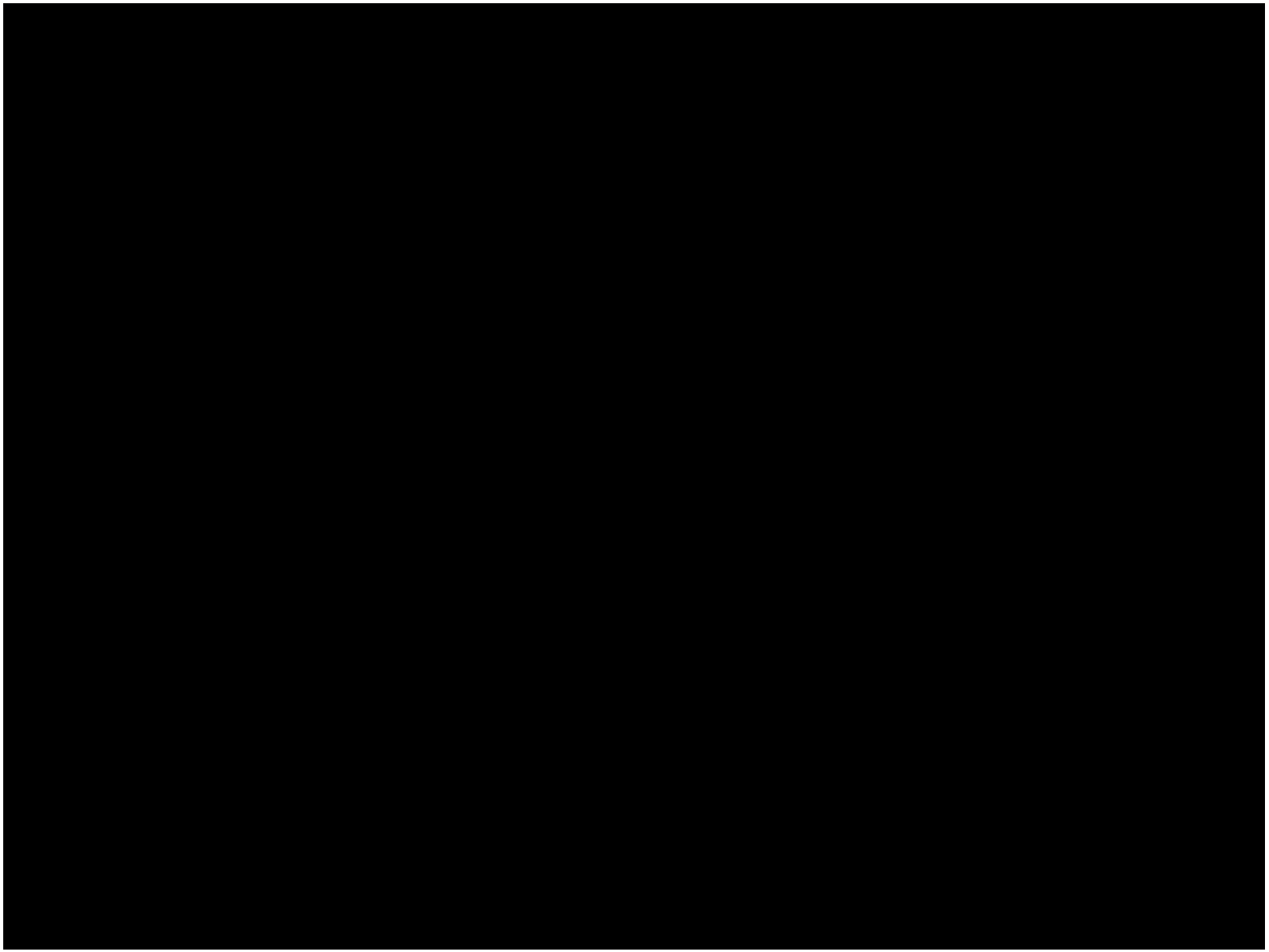

Source: American Petroleum Institute

Alaska Regulations

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The AOGCC's statutes and regulations

- Chapter 5 of Title 31 of the Alaska Statues
- Title 20, Chapter 25 of Alaska's Administrative Code

These statutes and regulations include:

- Stringent well construction requirements
- Designed to protect underground sources of water
- Ensure mechanical integrity during production and injection operations

The AOGCC is required by statute to take extra measures to protect underground sources of drinking water in "nonconventional gas" operations, including hydraulic fracturing operations.

Source: http://doa.alaska.gov/ogc/reports-studies/HydraulicFracWhitePaper.pdf

Frac Focus (www.fracfocus.org)

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Pioneer is a participating company

What is Frac Focus?

National hydraulic fracturing chemical registry

Managed by:

- **The Ground Water Protection Council**
- **Interstate Oil & Gas Compact Commission**

What is the purpose of Frac Focus?

To provide factual information concerning hydraulic fracturing and groundwater protection.

Source: www.fracfocus.org/welcome: About Us

Conclusion

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History:

- A proven technology used safely for more than 60 years

Why is it used?

- To improve well production

Frac fluid ingredients:

- Water and sand make up 98 to 99.5 percent of the fluid
- Everyday common household goods

Regulations:

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Frac Focus *(www.fracfocus.org)*

To provide factual information concerning hydraulic fracturing and groundwater protection

References

- American Petroleum Institute. (2011, October 21). *Overview of Industry Guidance/Best Practices on Hydraulic Fracturing (HF)*, Retrieved March 14, 2012, from http://api.org/~/media/Files/Policy/Exploration/Hydraulic_Fracturing_InfoSheet.ashx
- http://fracfocus.org
- http://api.org
- Alaska Oil and Gas Conservation Commission. (2011, April 6). Hydraulic Fracturing in Alaska, White Paper, Retrieved March 14, 2012, from http://doa.alaska.gov/ogc/reports-studies/HydraulicFracWhitePaper.pdf