CAELUS Energy Alaska

Fracturing Overview: Fact vs. Fiction

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OIL & GAS: FUELING ALASKA'S ECONOMY

AOGA Alaska Oil and Gas Association

Agenda

- Brief History of Hydraulic Fracturing
- Why is Hydraulic Fracturing Used?
- Alaska Regulations
- Fracturing Fluid Ingredients
- Fracturing Process
- Conclusions & Questions

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Hydraulic Fracturing History

First commercial hydraulic fracturing job was at Velma, Oklahoma in 1949

(Courtesy of Halliburton, 2010)

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Hydraulic Fracturing History

- Fracturing has been ongoing for nearly 70 years
- Alaska fracturing has a ~ 40 year history
  - Approximately >25% of Alaska wells have been fractured
- Technology in equipment and materials has improved dramatically since the first treatments in the 1950's
- Millions of treatments have been performed worldwide without any documented groundwater contamination
- Fracturing has come into public view due to the huge increase in development of unconventional (shale) reservoirs in the Lower 48

Why is Hydraulic Fracturing Used?

- Establish or improve well productivity
  - Low quality reservoirs (shale) – required to achieve economic flow
  - Medium quality reservoirs – bypass drilling damage, accelerate oil/gas recovery
  - High quality reservoirs – bypass drilling damage, contact more formation

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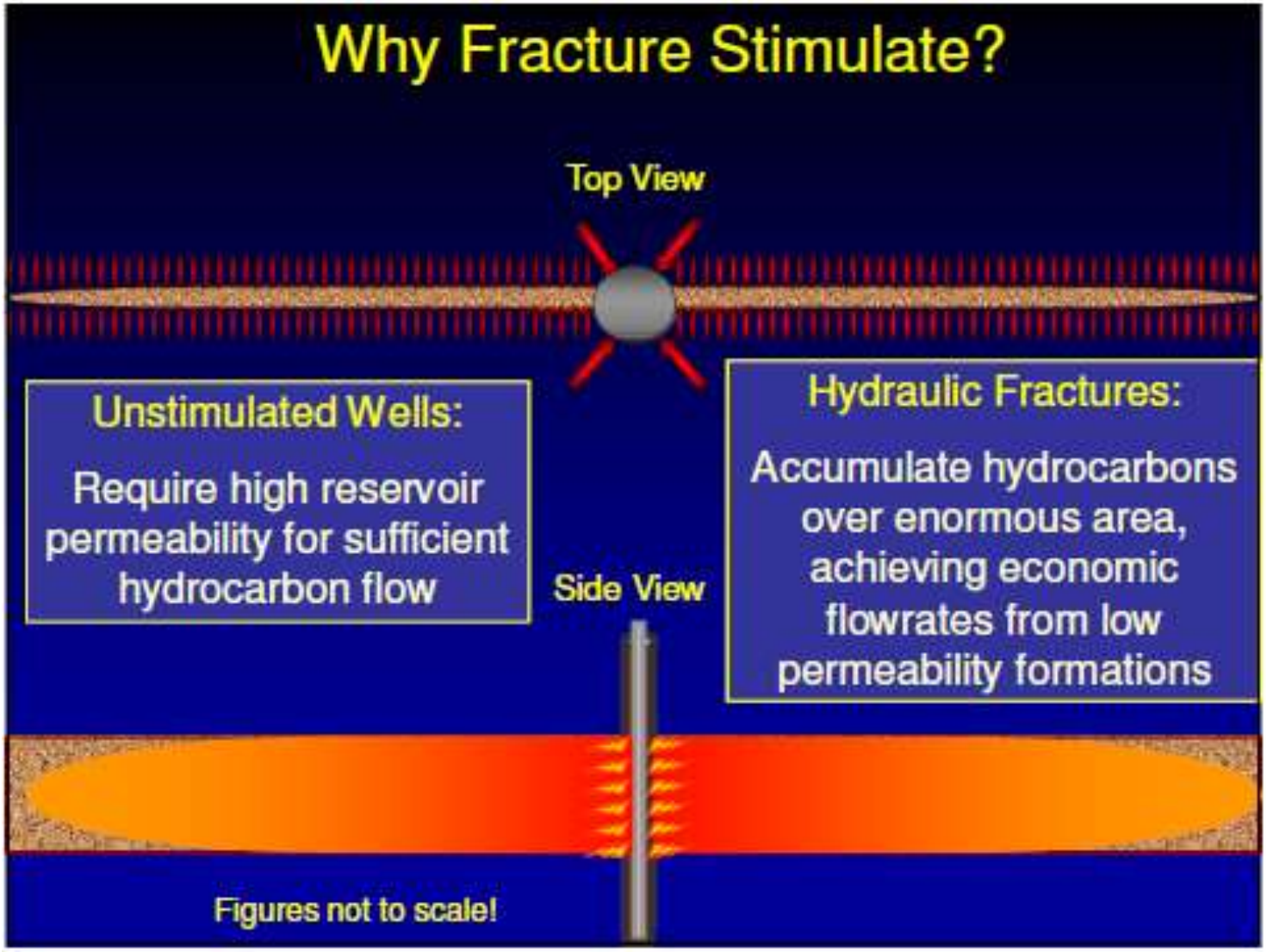
Why is Hydraulic Fracturing Used?



Why is Hydraulic Fracturing Used?

Wellbore Area of 6.125” diameter by 8,000 ft long ≈ 13,000 ft2

Ideal fractured area: 80’ft thick * 8,000 ft * 2 sides = 1,280,000 ft2

Nearly 100 fold increase in exposure area

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AOGCC Regulations

- Chapter 5 of Title 31 of the Alaska Statues
- Title 20, Chapter 25 of Alaska's Administrative Code
  - Recently revamped the regulations with additional data required
  - Stringent well construction requirements
  - Designed to protect underground sources of water
  - Ensure mechanical integrity during production and injection operations

> *"In over fifty years of oil and gas production, Alaska has yet to suffer a single documented instance of subsurface damage to an underground source of drinking water. As long as each well is properly constructed and its mechanical integrity is maintained, hydraulic fracturing should have no potential to damage any freshwater."*
>
> *Alaska Oil and Gas Conservation Commission (AOGCC) Hydraulic Fracturing White Paper*

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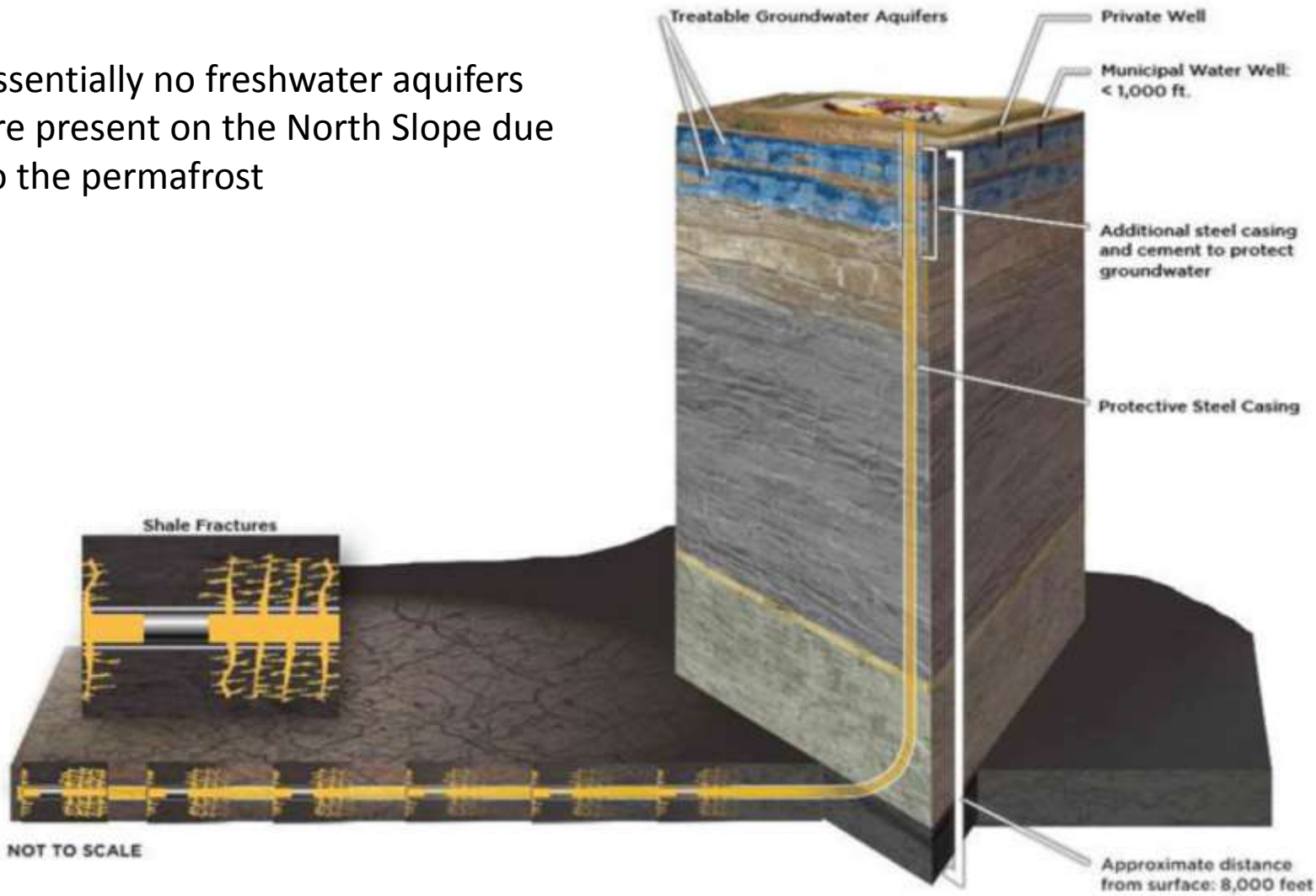
Groundwater Protection

Essentially no freshwater aquifers are present on the North Slope due to the permafrost



Frac Water Composition

- Materials

99%
Water & Sand

1%
Additives

.007% Crosslinker Also in:
Soaps, Laundry Detergent

.09% Friction Reducer Also in:
Water Treatment, Candy, Make-up Remover

.09% Surfactant Also in:
Glass Cleaner, Antiperspirant, Hair Color

.12% Diluted Acid Also in:
Household Cleaner, Swimming Pool Cleaner

.06% Gelling Agent Also in:
Toothpaste, Baking Goods, Ice Cream, Sauces, Cosmetics

.04% Scale Inhibitor Also in:
Household Cleansers, Deicing Agent

larch 2009

.004% Iron Control Also in:
Food Additive, Lemon Juice, Flavoring in Food & Beverages

.002% Corrosion Inhibitor Also in:
Pharmaceuticals, Plastics

.01% Breaker Also in:
Hair Cosmetics, Household Plastics

.06% KCl Also in:
Low Sodium Table Salt Substitute

.0001% Biocide Also in:
Disinfectant, Used to Sterilize Medical Equipment

.01% pH Adjusting Agent Also in:
Detergents, Washing Soda, Water Softener, Soap

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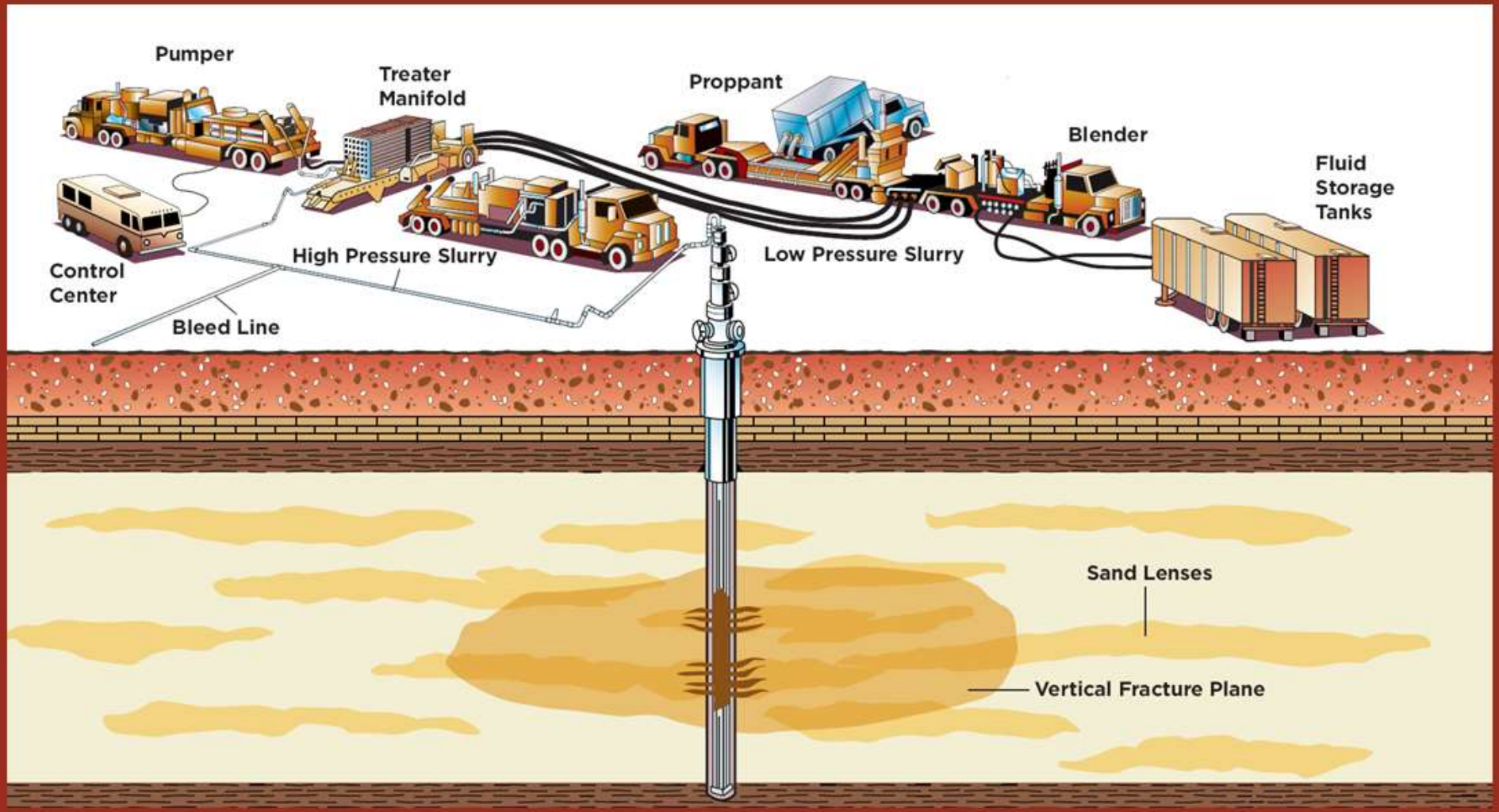
American Petroleum Institute Drilling/Frac Video



PUMPING THE FRAC

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Fracturing Process

- Pump fluid at high rate (20 to 100 BPM) and pressure (5,000 to 15,000 psi)
- The rock “cracks” or fractures (fractures are vertical below ~ 2,000’ depth)
- The fracture propagates hundreds of feet with continued fluid injection
- Proppant (sand or ceramic) is then pumped to fill the created fracture
- After pumping stops, the fluid in the fracture “leaks off” into the formation and the fracture closes
- The proppant pack remains and allows oil/gas to flow more easily to the wellbore

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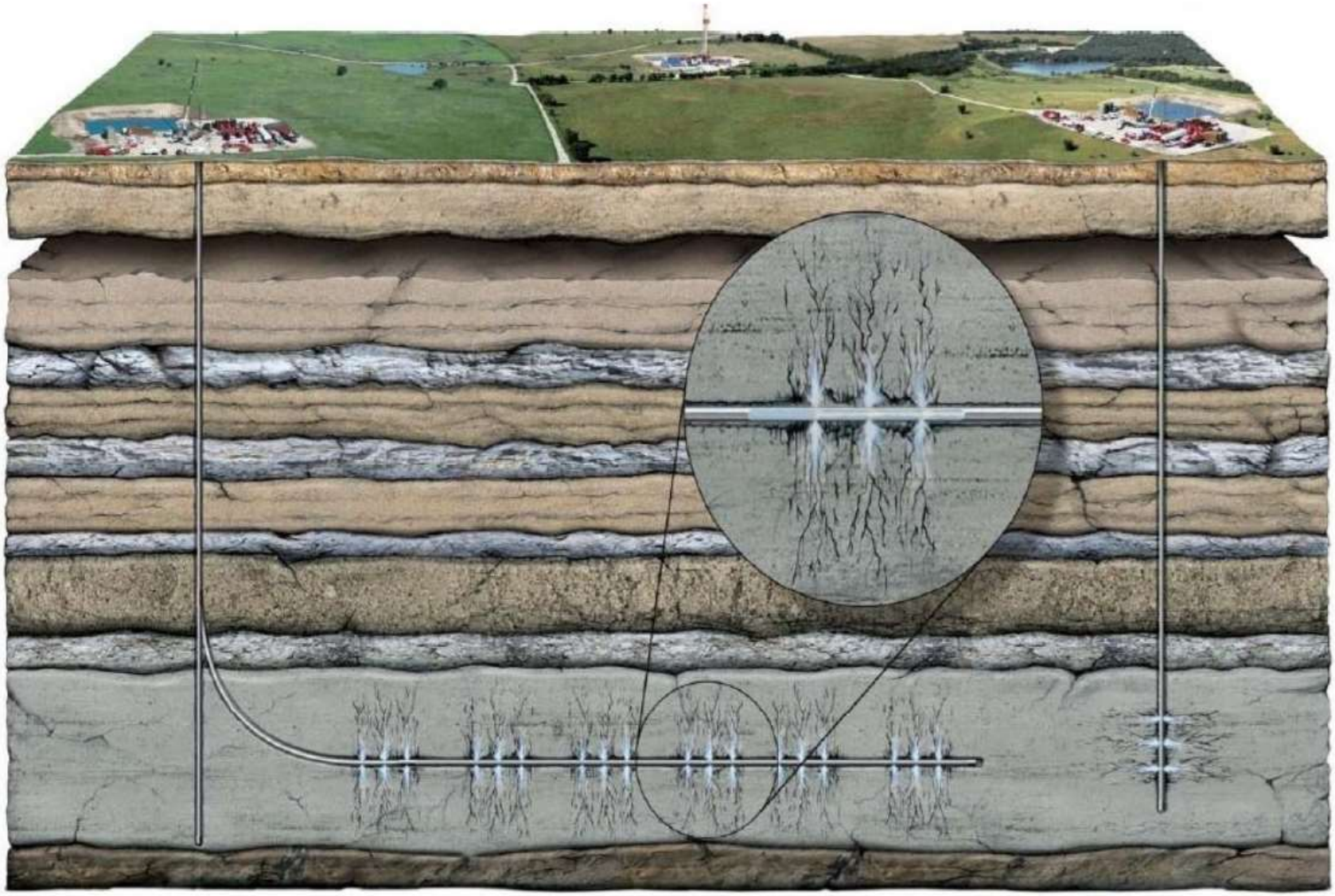
Horizontal Wells vs. Vertical Wells



North Slope Frac at Oooguruk Island

Typical Nuiqsut Frac: 40 BPM (1,680 gallons per minute), 5,000 PSI surface pressure
2,500,000 pounds of ceramic proppant, maximum concentration of 12 pounds per gal

Fracturing is Critical for Future Caelus Projects

- Horizontal drilling and multistage fracturing is planned for all future wells
- We are now fracturing our injection wells in addition to producing wells
- The optimization of fracture design comes at a cost as job sizes increase


Society of Petroleum Engineers
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HOUSTON, TEXAS, USA
George R. Brown Convention Center

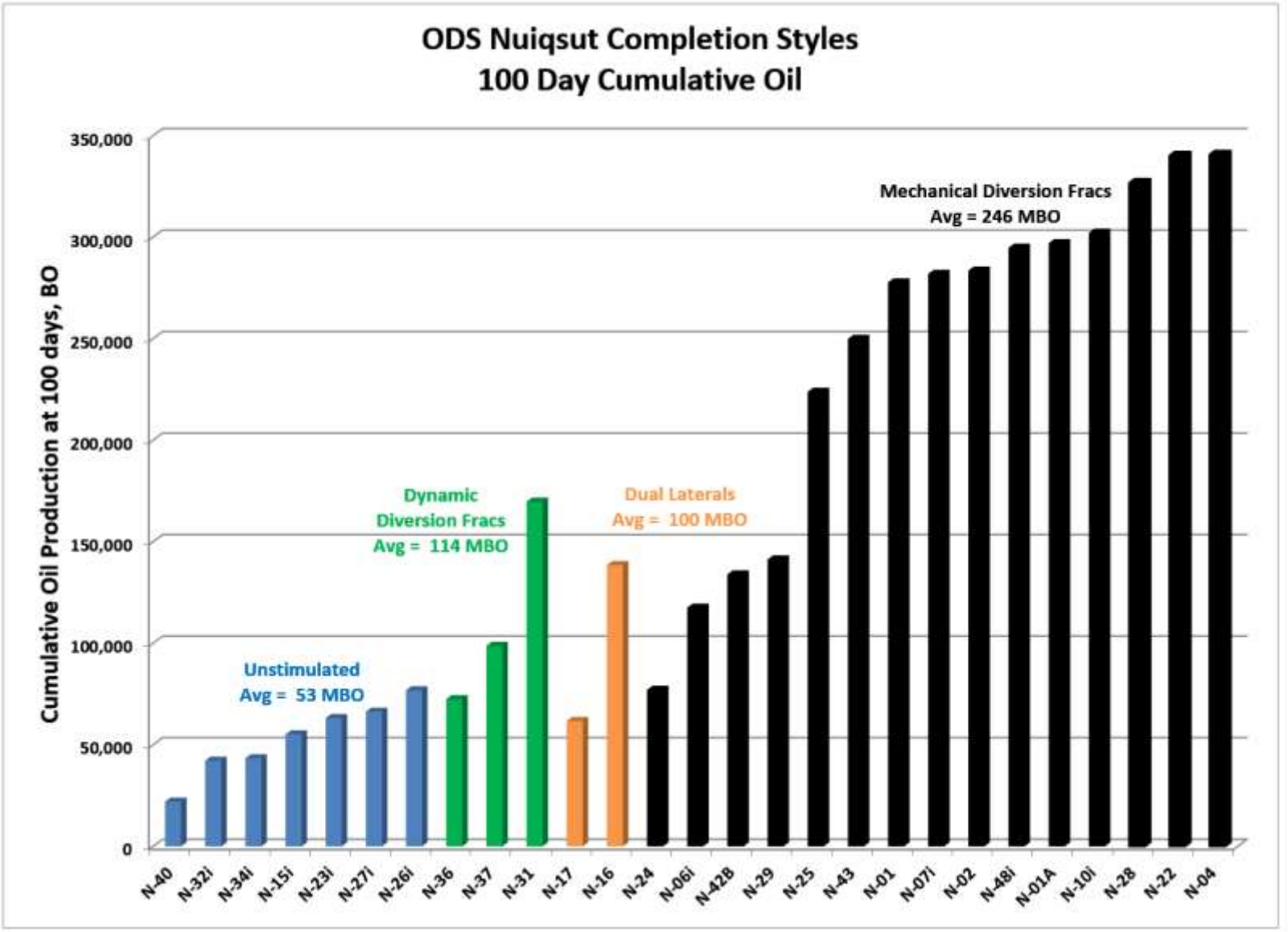
SPE 174743

Completion Optimization Provides Step Changes in Horizontal Well Performance in the Nuiqsut Formation – an Oooguruk Field (Alaska) Case History

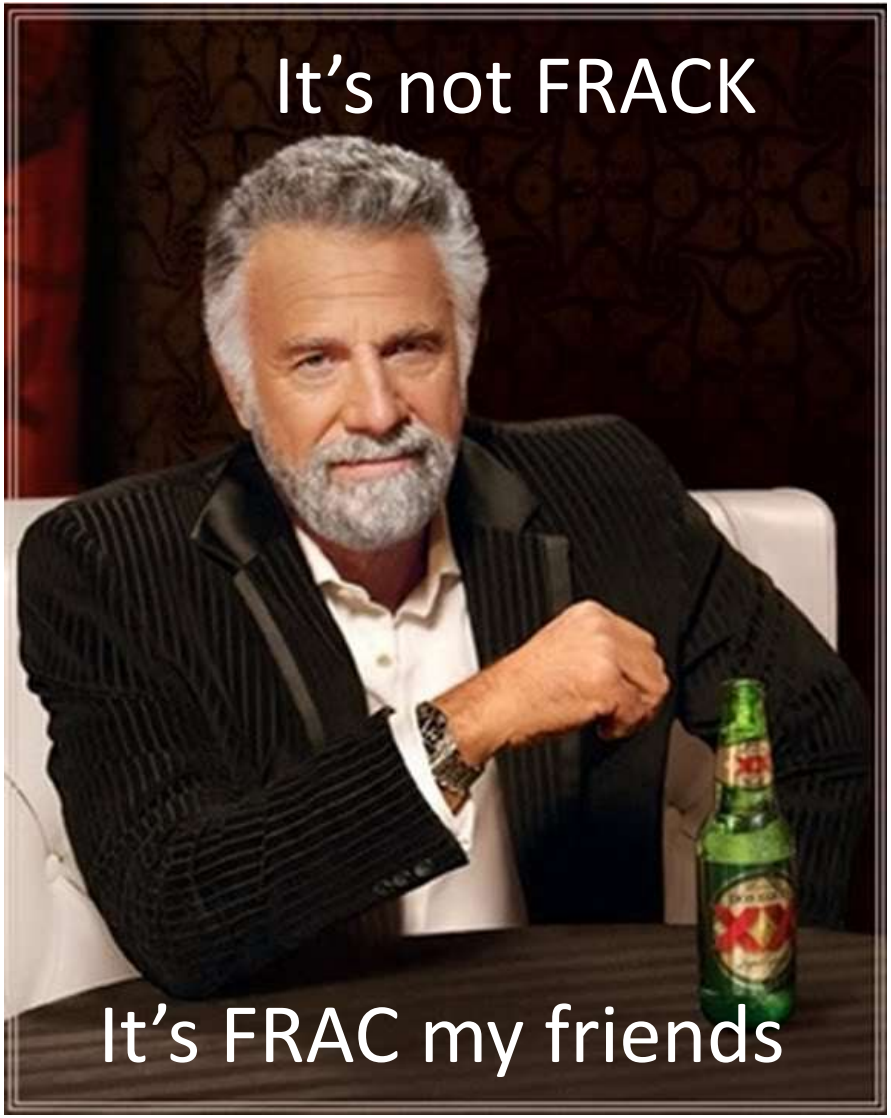
CARBO CAELUS Energy Alaska RESMAN WIRELESS RESERVOIR SURVEILLANCE

Andy Bond, Rami Jasser, Vern Johnson, Mike Morgan, Caelus Energy Alaska, Mike Martin, Northern Solutions, Terry Palisch, CARBO Ceramics, Brock Williams, Resman

Fracturing is Critical for Future Caelus Projects



There is no “K” in Frac



There is no “K” in Hydraulic Fracturing.

It was recently added by the media in part because it makes it look like another word that starts with f and ends in k.

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Conclusions

- Hydraulic Fracturing has been ongoing for 70 years and is a key component in the huge new oil and gas resources from shale
- Fracturing plays a key role in many North Slope developments
- There are no documented cases of groundwater contamination from fracturing
- Fracs consist mainly of water and sand or ceramic proppant
- The AOGCC closely regulates the fracturing process in Alaska
- There is no “K” in frac

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