



•
• **Research**
• **Partnership to**
• **Secure Energy**
• **for America**
•

Creating Fractures Past Damage More Effectively With Less Environmental Damage

09123-20

Claude E. Cooke, Jr.

EnerPol – Polymers for Upstream Energy

Onshore Production Conference

November 29, 2012

Houston Research Center

Houston, Texas

rpsea.org

Outline / Summary

- Unaddressed challenges exist in hydraulic fracturing
- Innovative product has been created to supplement or replace classical fracturing fluids
- Product is applied to wells using quick and simple process
- Lab testing and simulations have been performed to prove concept
- **Field testing of the technology is underway**

Unaddressed challenges exist in hydraulic fracturing

Overflushing of proppant at perforations

Proppant settling in low-viscosity fluids

Frac fluid damage to propped fractures

Large fluid volumes required to remove near-wellbore damage

In horizontal completions, high flow velocity near wellbore

Fracture conductivity loss near-wellbore

- **Eliminates entire production benefits of fracture**

Public concern about environmental impact of classical frac'ing fluids will continue to challenge industry

Product has been created to supplement or replace classical fracturing fluids

Solid degradable polymer pastille

Proppant embedded in polymer



2-8 mm

High viscosity gel (partially-degraded polymer)



Soluble polymer remnants and settled proppant



Soluble fluid

Proppant

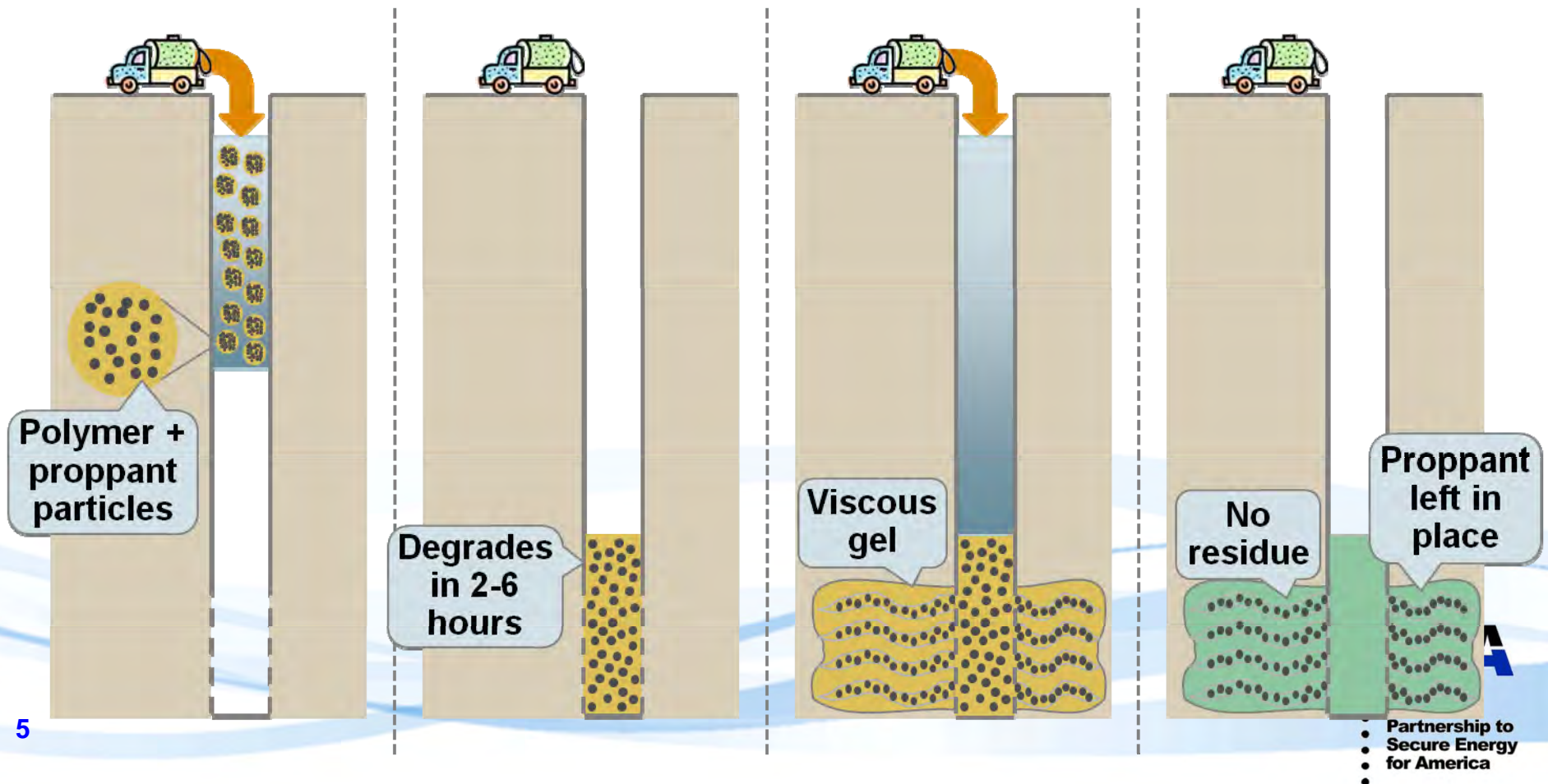
Product is applied to wells using quick and simple process

Pump solid polymer pellets / particles into well

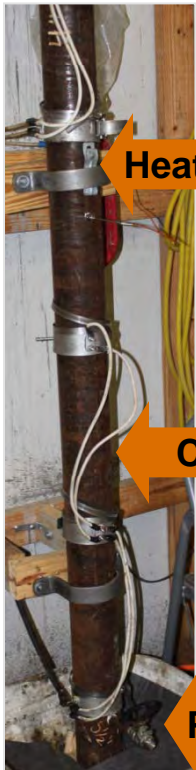
Wait for polymer to partially degrade into viscous gel

Apply pressure to squeeze gel into formation

Polymer degrades leaving proppant in place



Lab testing has been performed to prove concept



Activities

- Polymer chemistry tailored to degrade at appropriate temp
- Measured viscosity during degradation process
- Monitored occurrence of any damaging residue
- Re-created well conditions with large-scale mockup of casing
- Performed computer simulations of production and fracture properties

Outcome

- Required: fluid ~ 10%, proppant ~20% of classical minifrac
- Organic acid formed by degraded polymer completely soluble in water and brines
- Viscosity when squeezed into formation higher than frac fluids used today
- Significant reduction in water use
- Less horsepower and fewer surface units required
- Modeled 40-day production is ~1,000 barrels higher than conventional minifrac

Field testing of the technology is underway

Ideal well characteristics

- Bottom-hole temperature: 140-200F
- Productive zone up to ~20 feet thick
- Permeability at least ~1 millidarcy
- Example fields / areas: East Texas, South Texas, TX / LA Gulf Coast

Public well data indicates >5,000 wells in Texas are candidates

Treatment details

- Detailed procedure has been designed
- Typical application requires 1,000 – 2,000 lbs of polymer and 300 – 500 lbs proppant
- Fracture length expected to be 20 – 30 ft
- 200 – 300 HP pressure pump and <100 bbl water required to perform treatment

Project team capabilities

- Manufacturing facilities and supply chain are online; polymer typically made in 3-4 weeks
- Ability to perform treatment simulations and laboratory testing before / after job
- Service company partners identified to perform stimulation treatment

First field test

- Well is in Bee County, TX
- Currently dead gas well with evidence of near-wellbore damage
- Producing zone is ~4,400 ft; 8 ft thick
- Treatment will be performed in next ~7 days

Conclusion / Next steps

Conclusion:

- Viability of the product (degradable polymer pellets with embedded proppant) and process (applying with low horsepower and water requirements) has been confirmed through laboratory and early field testing

Next steps:

- Complete successful field test of technology
 - Ideal well candidates are mature assets in need of re-frac or that have near-wellbore damage
 - Target geographies are: South Texas, East Texas, and the Gulf Coast
- Further explore application of technology in unconventional wells
 - Degradable polymer can be used to place proppant at perforations and in wider frac in horizontal completions

Questions?