Advanced Well Control
New Foam Injection Wellhead Technology

Energy lives here™
Objective / Prize

Objective
Commercialize two innovative technologies - seawater injection and polymer plugs with potential to
• Reduce probability of an uncontrolled release
• Reduce impact of an uncontrolled release relative to the well capping or relief wells

Prize
• Safety and Environment protection
Well- Control Bow Tie

Polymer Plugs & Seawater Injection potentially on both sides of bow tie

Subsurface evaluation and proper well design
Drilling fluid and cement
Competency/training
Drilling practices and oversight
BOP
Polymers
Seawater
Prevention
Mitigation
Polymers
Seawater
ROV Survey
Capping stack
Oil spill response
Relief well

Greater Benefit Smaller

ExxonMobil
Polymer Plugs

Technology Highlights

- Surface or Subsea mounted finite volume fast set resin/catalyst injection (customized to secs)
- Activated with or without riser attached
- Kill well by injecting mud below plug
- Applicable for prevention and mitigation
Polymer Plugs

- **Current Status:**
  - Demonstrated mechanical integrity for up to 20% mud contamination and piston loads of 15,000psi
  - Completed tests in a simulated BOP
Polymer Plugs

Dynamic testing at Southwest Research Institute studied development of a plug in a simulated BOP

- Kerosene, drilling mud, water used as surrogates for drilling mud / reservoir liquids
- Polymers formed in less than 2 second
- Polymers withstood 10,000 psi hydraulic pressure for over 1 week without leaking

Polymer plug formed within the BOP and stopped the flow of drilling mud into Hopper 2
Seawater Injection concept

Technology Highlights

• Injection of high rate seawater to create sufficient backpressure to allow bullheading of KWM

• Possible to pressure entire well with seawater to mitigate subsurface blowouts as well as leaks through a failed BOP
SWI: Initial Results

- **Current Status**: Steady state and transient analysis suggest that rig equipment likely sufficient to handle leak if caught early. Frac pumps available for larger leaks.

- **Next phase**: Study erosion of BOP components caused by high-velocity seawater flow.
Forward Plans

• Complete erosion analysis of high velocity seawater on BOP
• Oceaneering developing a preliminary design and cost estimate for both concepts
• Promote industry interest
  – Conferences / workshops
  – Paper in SPE Drilling & Completions journal on polymer plugs
  – Two papers on seawater injection in preparation
• Establish joint industry / government project
  – Form JIP to fund and mature concept
    ▪ OOC agreed to promote and administer
    ▪ Interest from US DOI & DOE
Summary

• Developing two technologies that could reduce the risk of a blowout
  – Proactive approach for high-risk wells could prevent an incident
  – Reactive approach to mitigate incident

• Concepts can handle all types of blowout scenarios – leaking BOP or a leak in the well

• Initiating a joint industry / government project to leverage industry expertise and facilitate more rapid acceptance
Questions?