

# Challenges (Mud Management)

- **Excessive solids (ultra fine solids)**
  - Dilution economics & waste volume disposal
  - Differential sticking, stuck pipe, casing running issues
  - Cement placement & gas migration
- **Rheology control**
  - Solids control equipment performance
  - Viscosity control, hydraulics modeling, ECD control
- **Gains & losses**
  - Influx/kick, ballooning, loss circulation
- **Insufficient onsite oversight**
  - Mud mgmt function left to ServCo rep who's objective is to use/sell more mud

# Status Quo

- Mud balance & marsh funnel **data every hour**
- Oil/water ratio & solids analysis **once per day** using a retort
- Dilution volume KPIs **may not be optimized**
- Solids control equipment **may be under utilized**
- Waste volume generated **may not be minimized**
- Key performance indicators **may not be realized**
- Saving mud costs **controlled by mud sellers**

# Objectives

- Optimize **mud dilution volume** needed to complete the well
- Timely tuning of **solids control equipment** performance
- Minimize the **volume of waste** being generated
- **%LGS** real time monitoring **towards drilling performance** (ROP, ECD, MSE, Viscosity, Hydraulics)
- Identify wellbore **anomaly warning signs**
- Empower onsite drilling ops supervisors with better auditor tools (ie, **mud mgmt data and know-how**)

# Achieving Objectives

## Real-time measurements and calculations

- Density
- Retort (O/W Ratio, LGS)
- Mud report

## Effective onsite oversight on drilling fluid managers

- Mud mgmt training/mentorship for drlg operations supervisors

# Density (and Viscosity, Temp)

- *unprecedented ease of site installation*



**Resonant Freq and Damping Detectors** - mud density & viscosity; recent (2018Q2) successful deployment in Texas, accuracy @ 0.5% and very repeatable.

Frequency shifting internal minute vibrations achieve resonant frequency at different mud weights and viscosity (independent frequencies)

Significantly more robust single-rod assembly vs. 2-tine “fork” type; requires minimum preventative maintenance and can easily be managed by the rig crew, no cutting, no welding requirements

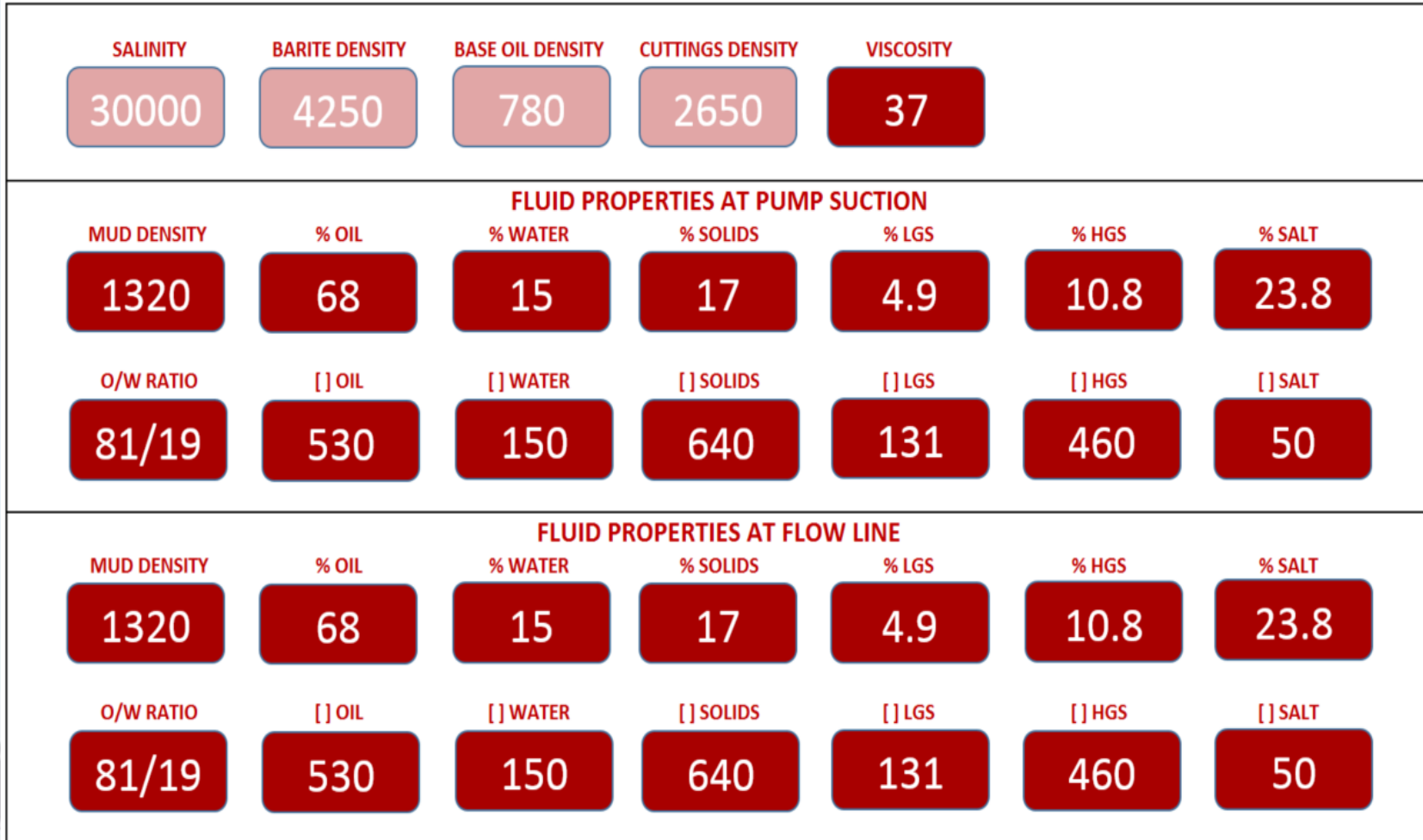
# Simultaneous Concentration (SiCon)



Submersible diaphragms “Stray Field Capacitance” **ultrasound technology**. Patented sensing and algorithm allow differentiation of between oil and water concentrations while attenuating amplitudes of all other mud additives.

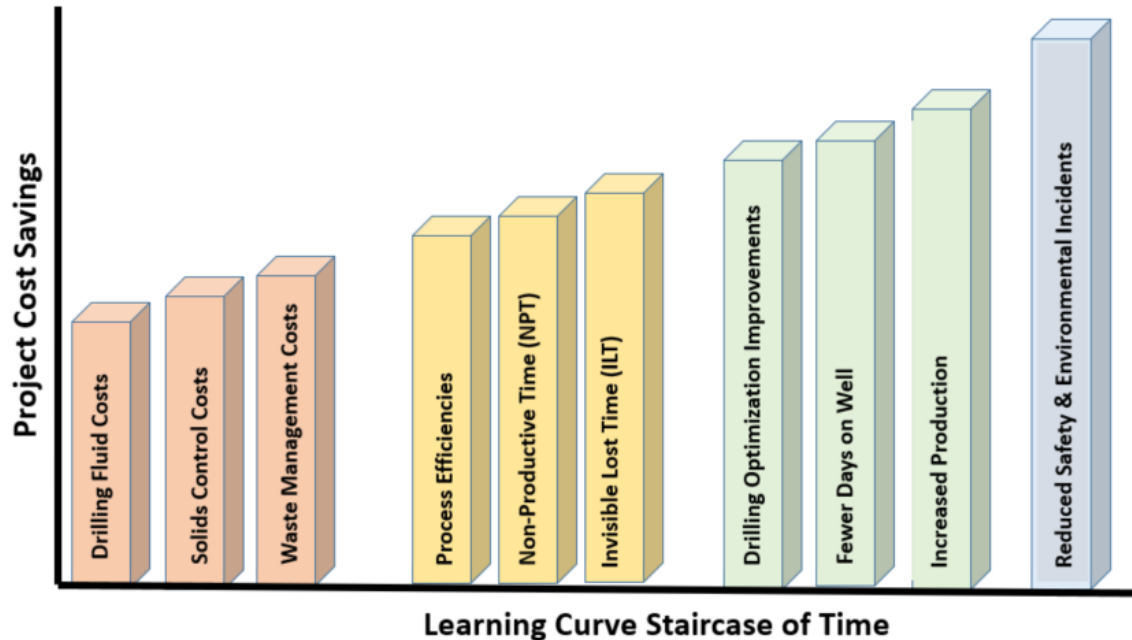
Combined with precise **Density** measurement, **%Oil**, **%Water**, **LGS**, **HGS** and **Dissolved Solids** parameters become real time information (calc via API R13 method) to display **actionable outputs**.

# Real-time Display



# Training / Mentorship Programs

Building Value – One step at a time



Training program director qualifications:

- Masters of Petroleum Engineering
- **20+ Years Drilling Fluids Engineering**, Solids Control & Drilling Waste Management
- **10+ Years Drilling Fluids Instrumentation R&D** - various drilling operators
- Several patents and patents pending related to drilling fluids instrumentation