

NMB Sand Management Sharing

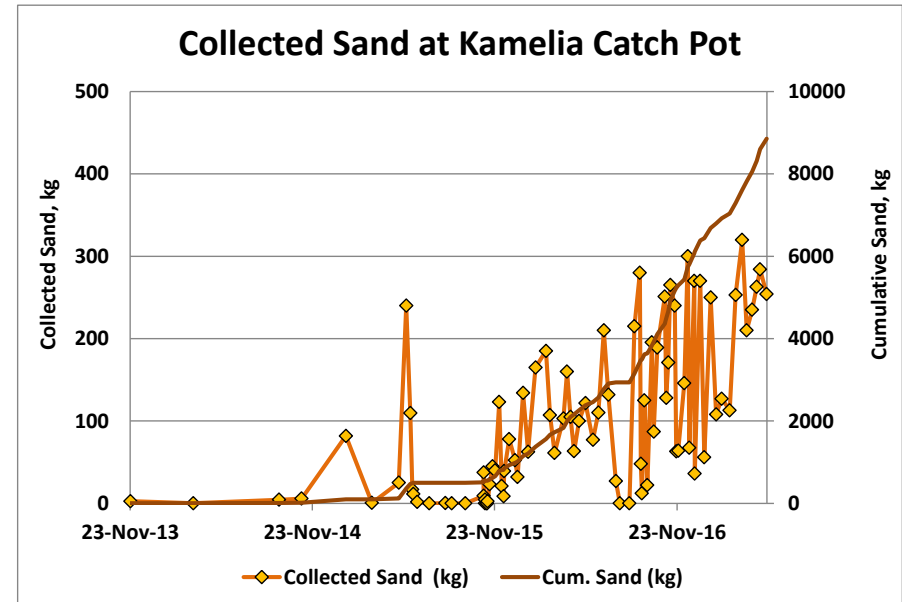
30th November 2018

Meeting Room 302 & 303, Level 3, KL Convention Centre

NMB Sand Management Experience

1) Early Production System (2013 – 2016):

- Cased & perforated completion
- Deviated wells with 10 degree oriented perforation and drawdown constraint (<300 psi) as recommended by Sand Failure Model
- Sand catchpot installed @WHP
- Started producing sand after 1.5 years, 250 kg on average collected from bi-weekly catchpot flushing



2) Phase I (2017 – current):

- Cased & perforated completion
- Selective perforation with 60 degree phasing instead of oriented perforation, achieve similar drawdown to EPS wells despite perf length reduction by almost half
- No sand catchpot at individual WHP; Desander at Central Processing Platform
- No sand production after 1.5 years of production

Phase 2 Development: Open Hole Stand Alone Screens (OHSAS)

- **Openhole Stand Alone Screens (OHSAS)** selected as sand control method for Phase 2 wells given:
 - Relatively low gas rate/velocity (< 35 MMscf/d)
 - Marginal field with short production life (10 years)
 - Simple installation procedure, especially for zonal isolation which facilitate future Water Shut-Off
 - Considerably cheaper compared to OHGP (Openhole Gravel Pack)
- It is recognized that key failure mechanism of OHSAS is **'hotspot' erosion** due to screen plugging by solids (weighting materials and drilled solids) in Drill-In Fluid (DIF). **Preventive measures** are:
 - Select sand screen slot opening large enough to mitigate screen plugging yet provide sufficient good sand retention
 - DIF design and proper conditioning
 - Investigate options to clean-up DIF including core flooding tests
 - Clean-up well immediately after completion, avoid suspending well for more than a month
 - In-situ Gas Tracers integrated to sand screens as diagnostic tool (alternative to PLT) to identify screen plugging

Experience in Sand Management

- **Geomechanical Model (sometimes) not reliable** - wells still produced sand despite Oriented Perforation and controlled drawdown
- **Sand removal from sand catchpot**
 - Require frequent platform visits; manpower intensive and may not be practical for distant platforms
 - Only small portion of coarse sand collected from sand catchpot; large amount of finer sand carry over to intra-field pipeline and may cause excessive pressure drops.
- **Sanding increases when reservoir pressure drop below certain level**
 - Sand loading wells result in loss of productivity / killing well eventually
 - Increases number of well Interventions/ OPEX for sand clean-out
 - CTU sand clean-out challenging in highly deviated (designed for oriented perforation) wells. Liquid introduced by CTU sand clean-up often causes formation impairment and requires costly N₂ lifting to kick-off the wells following sand clean-out. CTU sand cleanouts not an option on mini WHP.
- **Erosion less of an issue than thought for relatively low gas rates (< 30 MMSCF/d) wells and sufficiently large 6" flowlines.**