Well Design: Improving Well Integrity
Solving the Challenge of Sustained Casing Pressure

Paul Hazel

Welltec®
We Know the Problem
Cement failure is a common cause of barrier failure

- Cement failures are well understood and have many causes
  - Poor job execution, channelling, micro annulus, thermal or hydraulic shock, contamination, poor sealing to casing and / or to formation etc.
- There are many documented reports with frequency of occurrence
  - e.g. 96 cement operations reviewed where the objective was to establish a min of 200m hydraulic isolation
Do we Know the Limitations?

- Cement has only recently been exposed to functional testing – evaluation of seal integrity
- Ref 3rd Annual Well Integrity Cong 1st July 2015 Uk

- Functionally test cement under controlled downhole conditions to evaluate cement within the annulus and cement as a cement plug
  - Is there a relationship between strength and sealing capability?
  - Is there a relationship between shear bond and sealing capability?
  - Is there a relationship between hydraulic bond and sealing capability?
  - Is there a relationship between shrinkage and sealing capability?
  - Ultimately the sum of these parameters is measured in a functional test
  - Downside functional test is difficult and costly

- Cement alone s not adequate to met the industry needs
- Combined solutions will deliver improved well integrity
Improving Integrity

- Subsurface challenges and limited ECD windows requiring multiple casing strings
- Failure of primary cement jobs resulting in squeeze jobs or sidetracks (channeling, contamination, centralization, cross flow etc)
- Micro-annuli due to pressure and temperature cycling with subsequent migration of gas
- Life of field reliability due to gas migration in nearby wells, subsidence and anti-collision requirements
- Verification and independence of barrier elements

- ISO 14310 Qualified metal expandable well barrier, compliments or substitutes cement
- Delivers B (or C) Annulus protection
  - Positioned within the open hole below the 9 5/8” casing OR
  - Positioned within the 13 3/8” casing above top of cement
- Position above and below future side track depth
- Positioned deeper than the well abandonment depth
Securing the Primary Barrier

- Pick up 9 5/8” liner with WAB and Port Collar.
- Run liner, rotating and circulating as required
- Set liner hanger, Pump cement, Bump plug
- Pressure up and expand WAB in wet cement
- Set top packer
- Evaluate primary cement barrier (records, CBL etc).
- Pressure test shoe, if good, drill ahead.

Log evaluation indicates poor cement and the cement barrier has not been established

Perform second stage cement tool operation.
Drilling Into a Depleted Zone

- Heavily depleted reservoir
- DP with 12 ¾” drill bit
- 9 5/8” drill in liner
- Clutch – in locked position
- Remote activation port collar – closed position
- Welltec Well Annular Barrier (WAB) – pre expansion
- Welltec Data Monitoring (WDM) wireless Press / temp
- Ball dropped to shut off losses through the liner shoe
- Drill in Liner Shoe
WELL INTEGRITY APPLICATIONS
REDUCE RISK

LOWER COMPLETION APPLICATIONS
MAXIMIZE PRODUCTION

WAP® set in liannula to eliminate sustained casing pressure (SCP)

WAP® set in cap rock for later well abandonment. A cement collar run above can combine with the WAP® to improve cement placement.

WDM® provides angular P & T, to confirm setting and provide reservoir data.

Full bore completion increases production and allows for future re-entry and optimization.

No control lines means smaller hole sizes, smaller risers, less time to drill and complete.

Cementless completion reduces skin, maximizes production and lowers cost.

WAP® used for reservoir compartmentalization and reduction of geological uncertainty.

Drilling optimization supported by a mast er shoe, which allows fluid circulation, rotating while drilling and mud clean-out.

Compartment can be created in any size at any depth facilitating well testing.

WFV® for injection or production.

Questions?