Risk Mitigation in Extended Reach Wells – Dissolvable Frac Plugs

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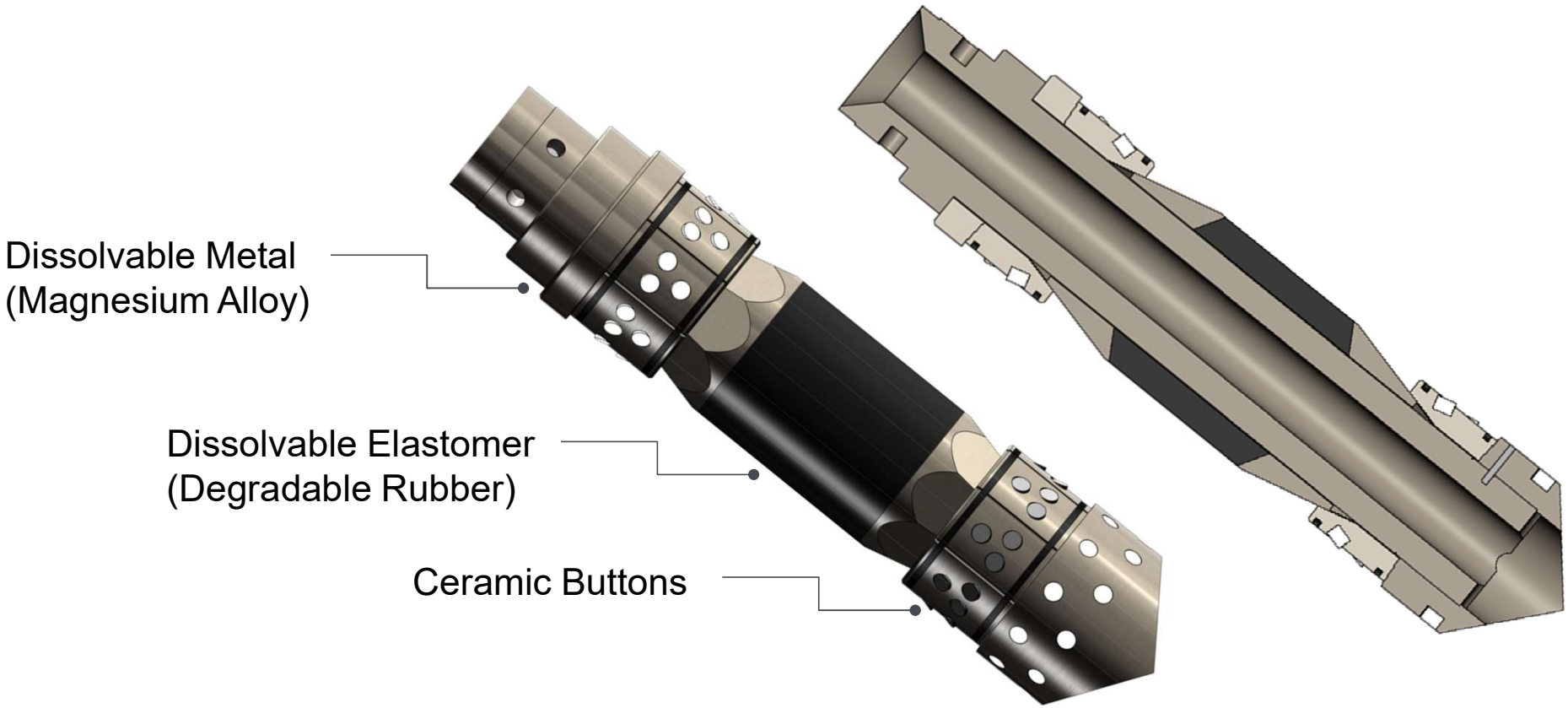
Risk Mitigation in Extended Reach Wells – Dissolvable Frac Plugs

- Introduction to Dissolvable Technology
  - Material
  - Dissolution Mechanics
- Benefits and Applications
  - Where / How DM Plugs are Used
  - Risk Mitigation for Extended Reach Laterals
- Case History
  - Canadian Run History
  - Review Recent Case Histories

Introduction to Dissolvable Technology - Material



Introduction to Dissolvable Technology - Material

Challenges in Design

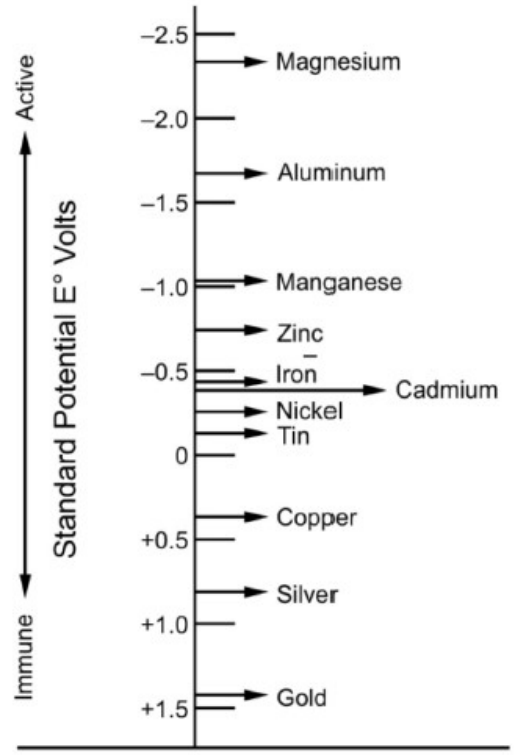
- Reliable zonal isolation (10ksi)
- Varied environments (Temperature, Salinity)
- Rapid dissolution following frac operations

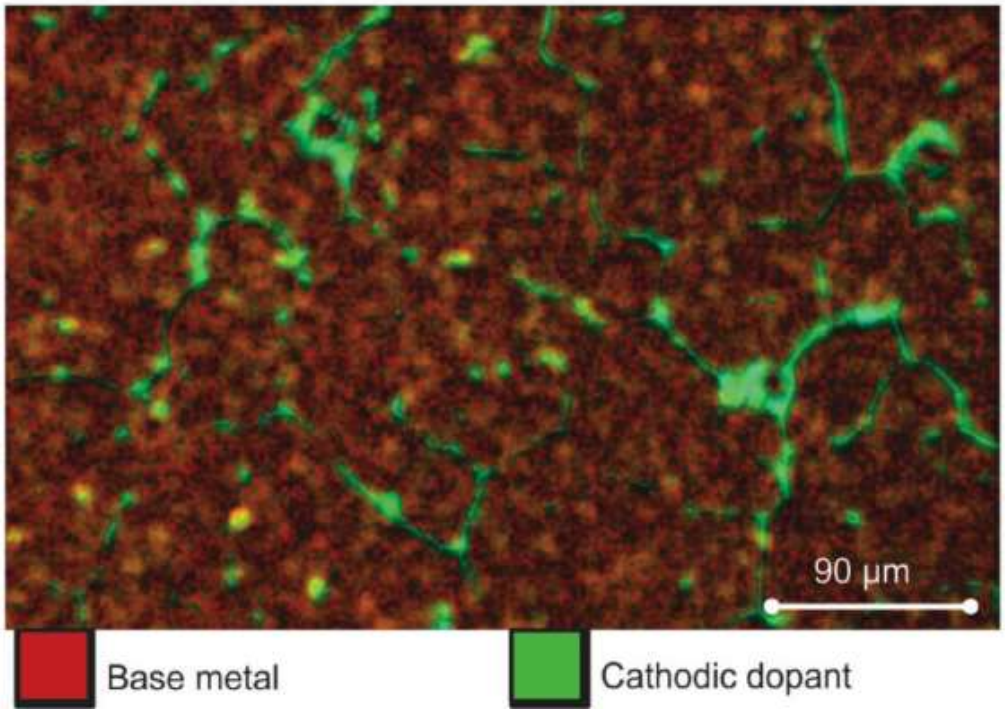
Introduction to Dissolvable Technology - Dissolution

- Dissolution based on:
  - Salinity of Fluid
  - Temperature of Reservoir

Introduction to Dissolvable Technology - Dissolution

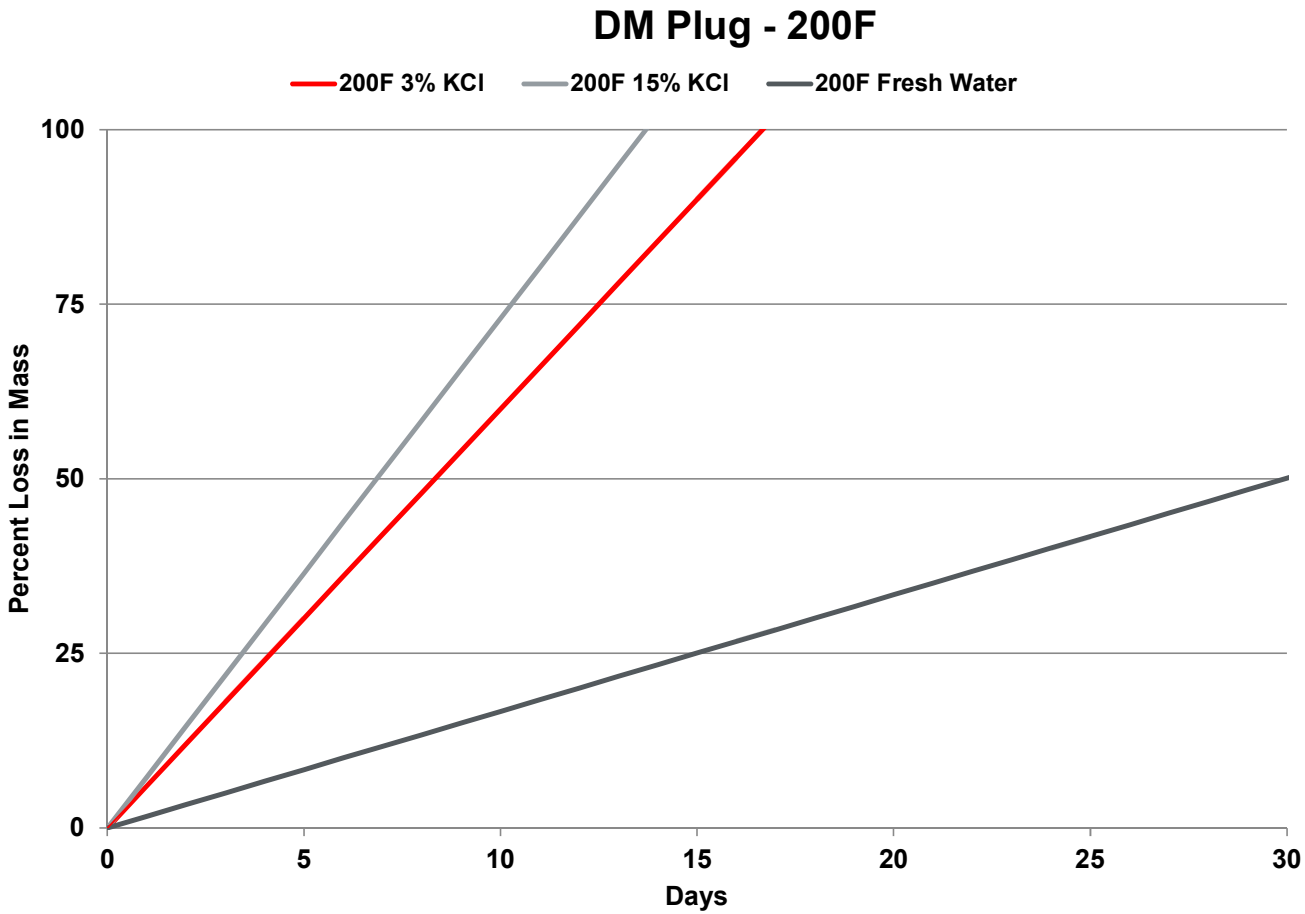
- Galvanic Reaction





Source – OTC-27187-MS, M Fripp et al

Introduction to Dissolvable Technology - Dissolution

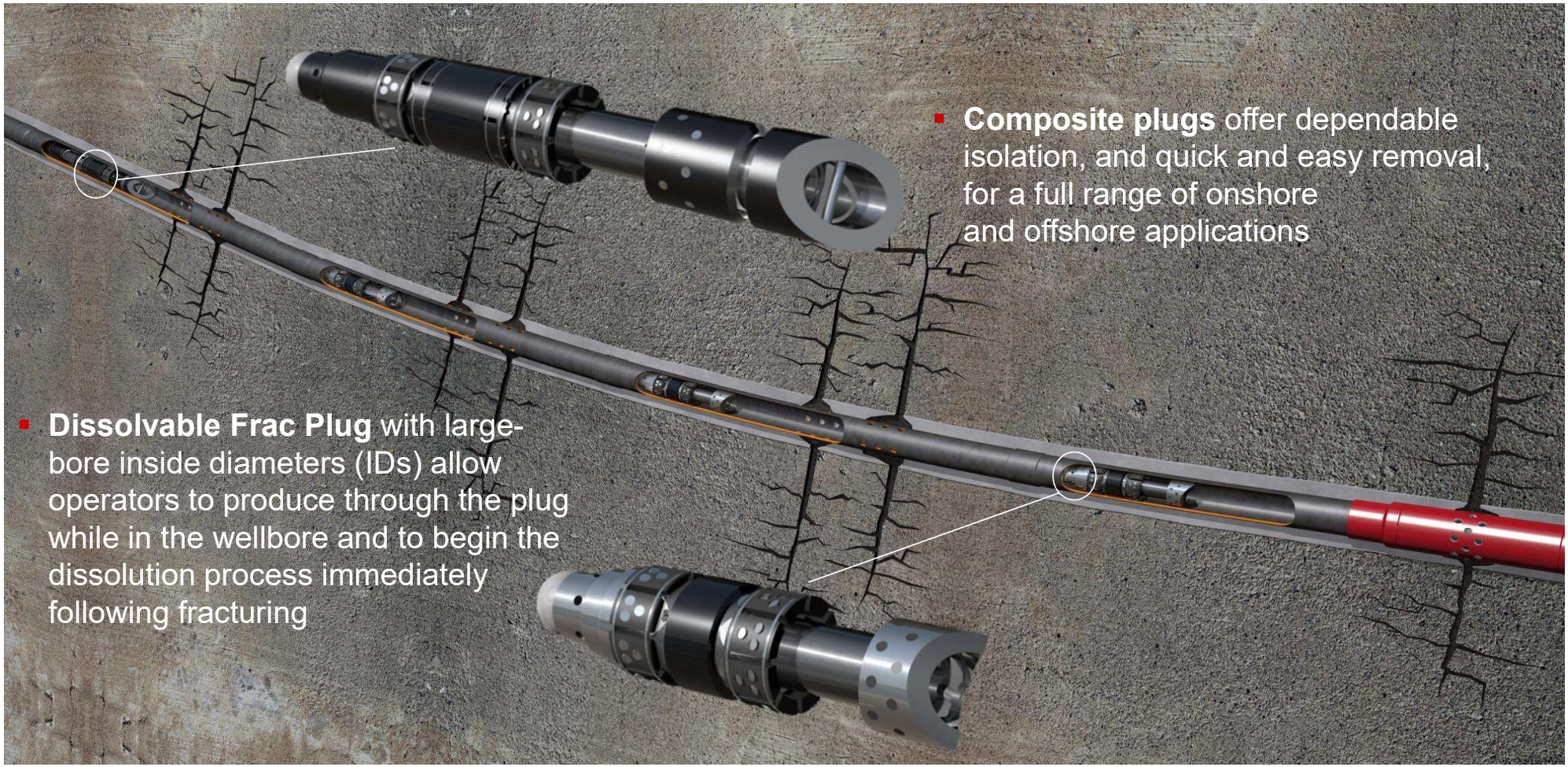


Benefits and Applications

- Fully dissolvable plugs made from advanced dissolvable metal and dissolvable rubber materials
  - HCL can be used to rapidly dissolve
- Reliable, simple design
  - Aids pump-down efficiency
- Ease of use
  - Deployed like composite plugs
  - No change to operations or setting tools
- Full wellbore ID once dissolved
  - Large flow back ID prior to dissolution

Dissolvable Frac Plug

Benefits and Applications



- **Composite plugs** offer dependable isolation, and quick and easy removal, for a full range of onshore and offshore applications

- **Dissolvable Frac Plug** with large-bore inside diameters (IDs) allow operators to produce through the plug while in the wellbore and to begin the dissolution process immediately following fracturing

Benefits and Applications – Risk Mitigation

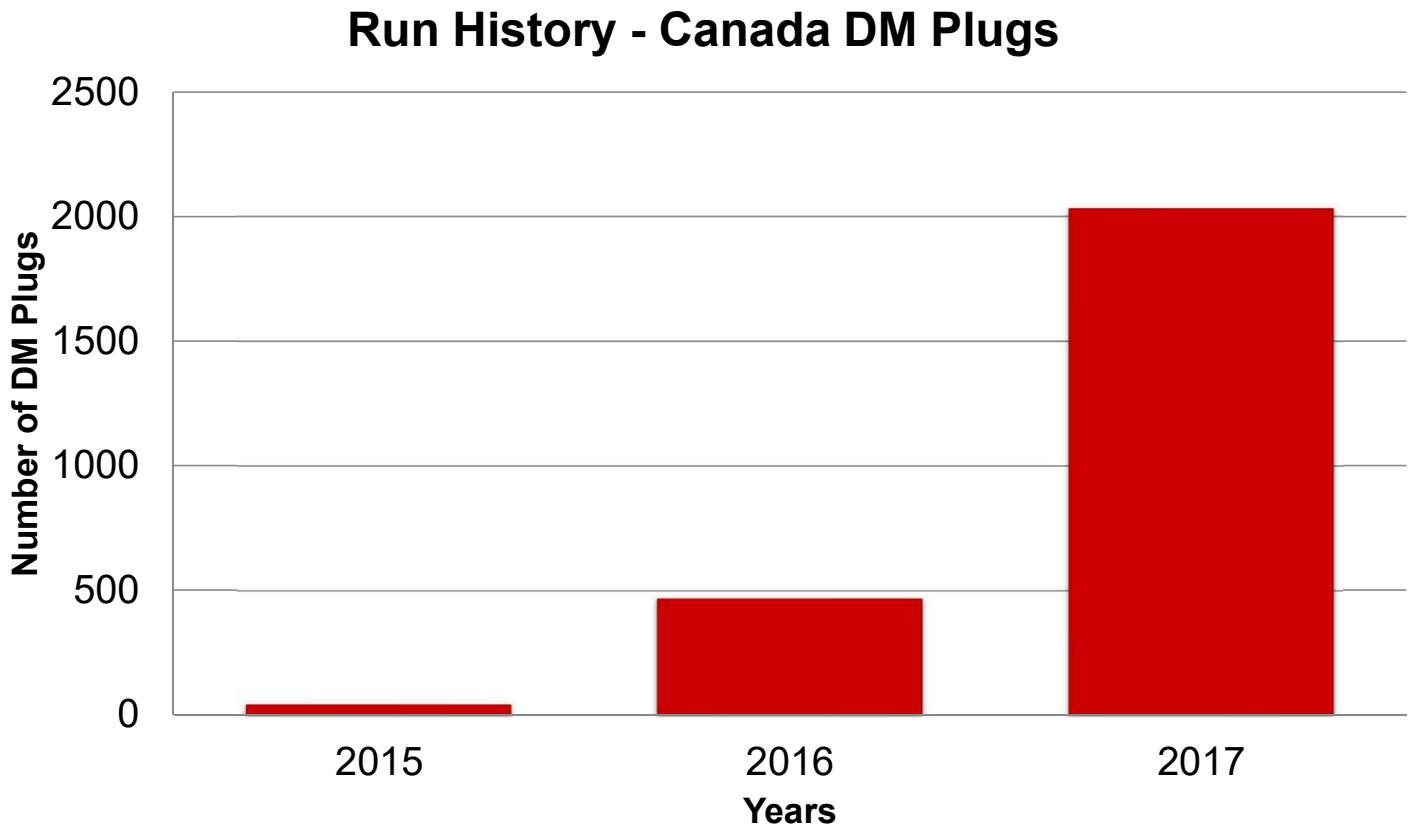
- Extended Reach Applications
  - Beyond reach of conventional coil
  - “Toe Stages” >5000m MD

- Casing Deformation
  - Difficulty milling with under gauge mills
  - Deformation in heel stages or above

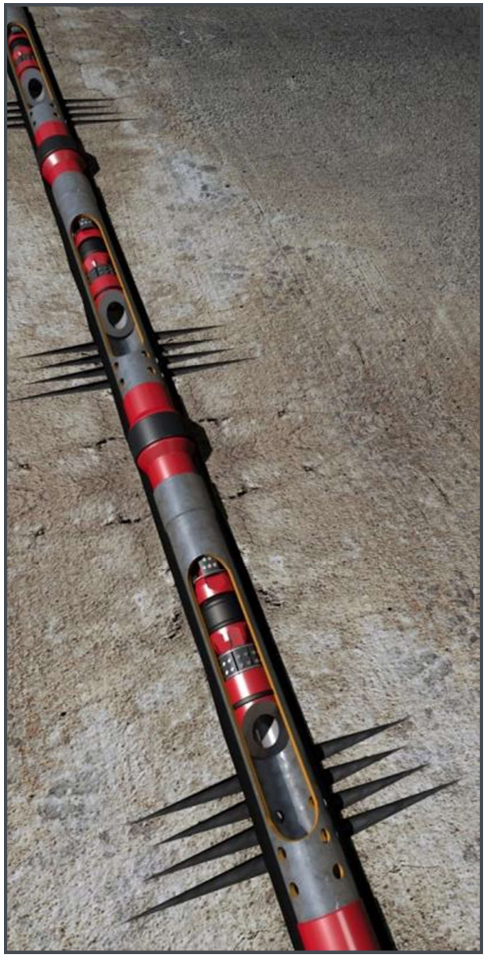
Benefits and Applications – Risk Mitigation

- Depleted Reservoir
  - Poor cuttings return, differential sticking
- Site Access
  - Difficult/unable to rig in coil tubing
  - Poor access to lease
- Delayed Production Tie-In
  - Immediate production not required

Case Histories – Canadian Run History



Case Histories - Canada



Challenge

In the Duvernay play, a local operator was planning a substantial frac program and were concerned with casing deformation which may complicate removal of Composite Plugs.

- 8x Wells, up to 80x zones per well
- Risk of casing deformation (based on offset wells)
- Significant milling time for Composite Plugs with under gauge mills

Solution

Dissolvable Metal (DM) plugs were utilized to minimize the risks associated with mill out operations.

- Coil Tubing clean out planned to ensure full ID of casing, removal of sand

Results

- 600x plugs ran over 8-well pad
- Excellent deployment, no lost zones due to plug failure
- Good dissolution results, minimal (>5 mins) clean-up time per stage


THANK YOU