SQUEEZE CEMENTING

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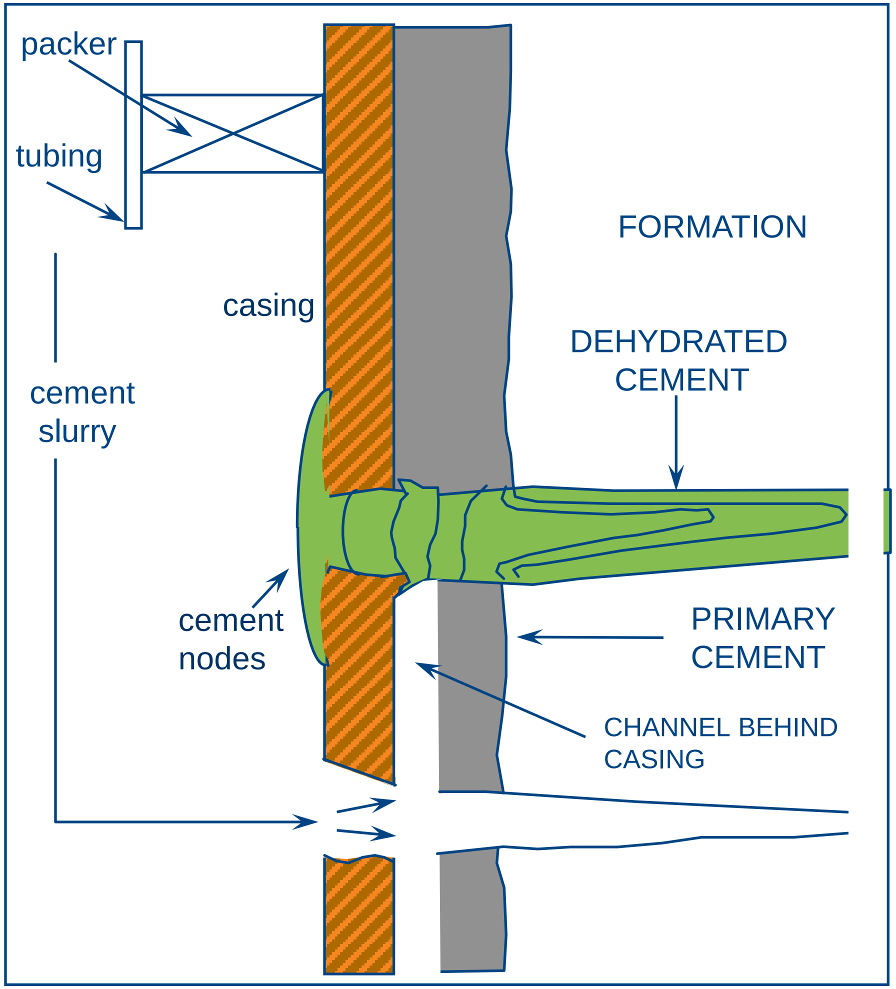
Squeeze Cementing - Definition

Injection of Cement Slurry into the voids behind the casing or into permeable formations

Dehydration of cement requires: fluid-loss, porous (permeable) matrix, differential pressure, time.

Injection below or above fracture pressure



Effect of Fluid Loss Control

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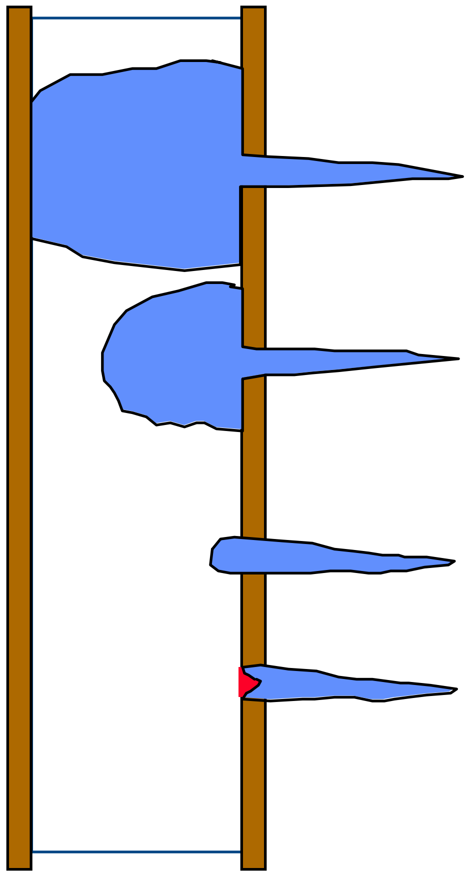
Node build-up after 45 min, slurries with different fluid-loss, dP=1000psi



Squeeze Cementing - Applications

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Formation Losses

Insufficient cement top

Repair Improper Zonal Isolation

Eliminate Intrusion of Unwanted Fluids

Repair Casing Leaks

Abandon Nonproductive or Depleted Zones

Squeeze Cementing - Applications

Repair cement channels

Liner-Top Leaks

Injection Profile Modification

- In injection wells

Block Squeeze

- Above and below the production zone

Remediate Improper Zonal Isolation

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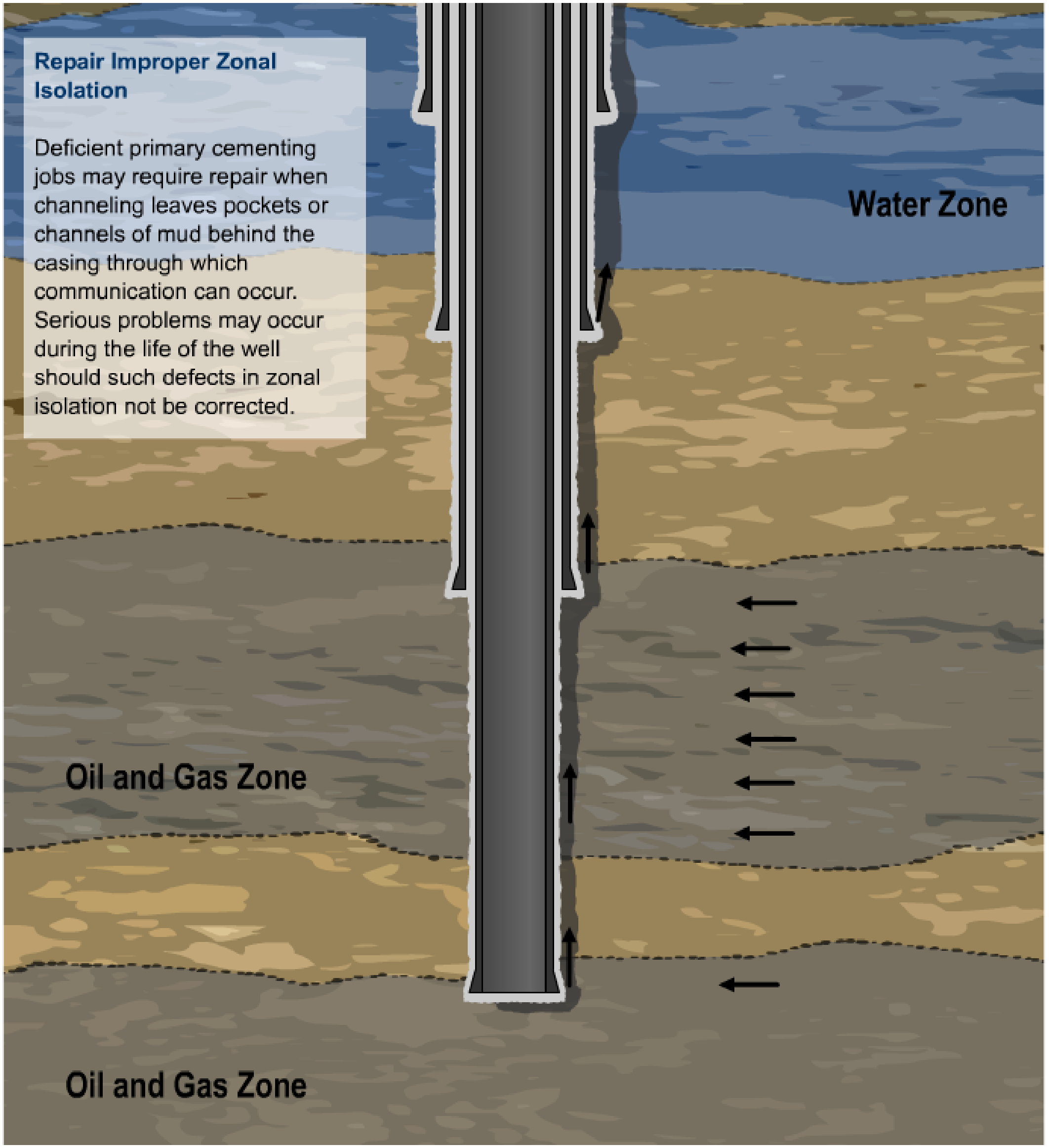
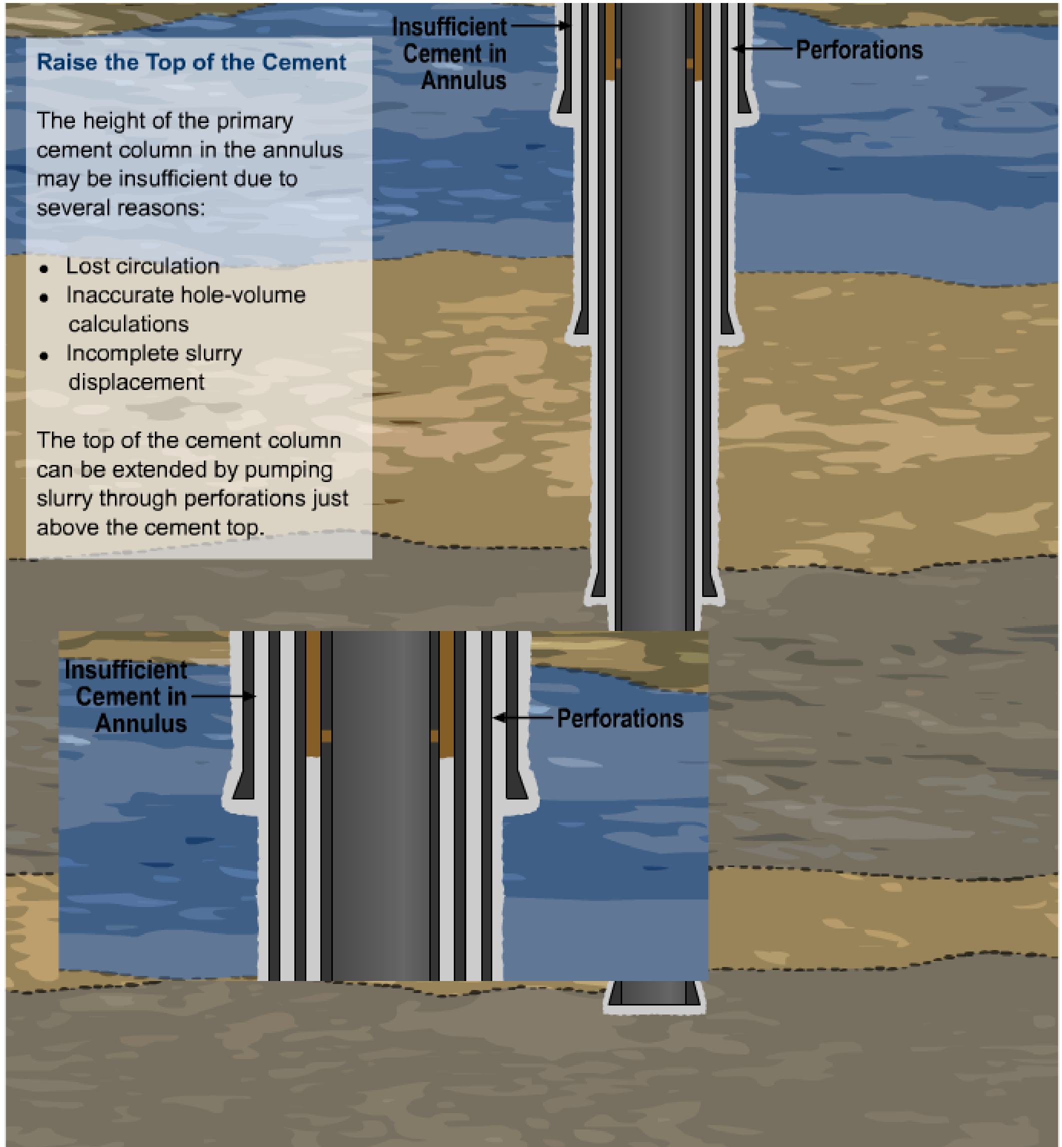


Raising the Top of the Cement



Eliminating Water Intrusion

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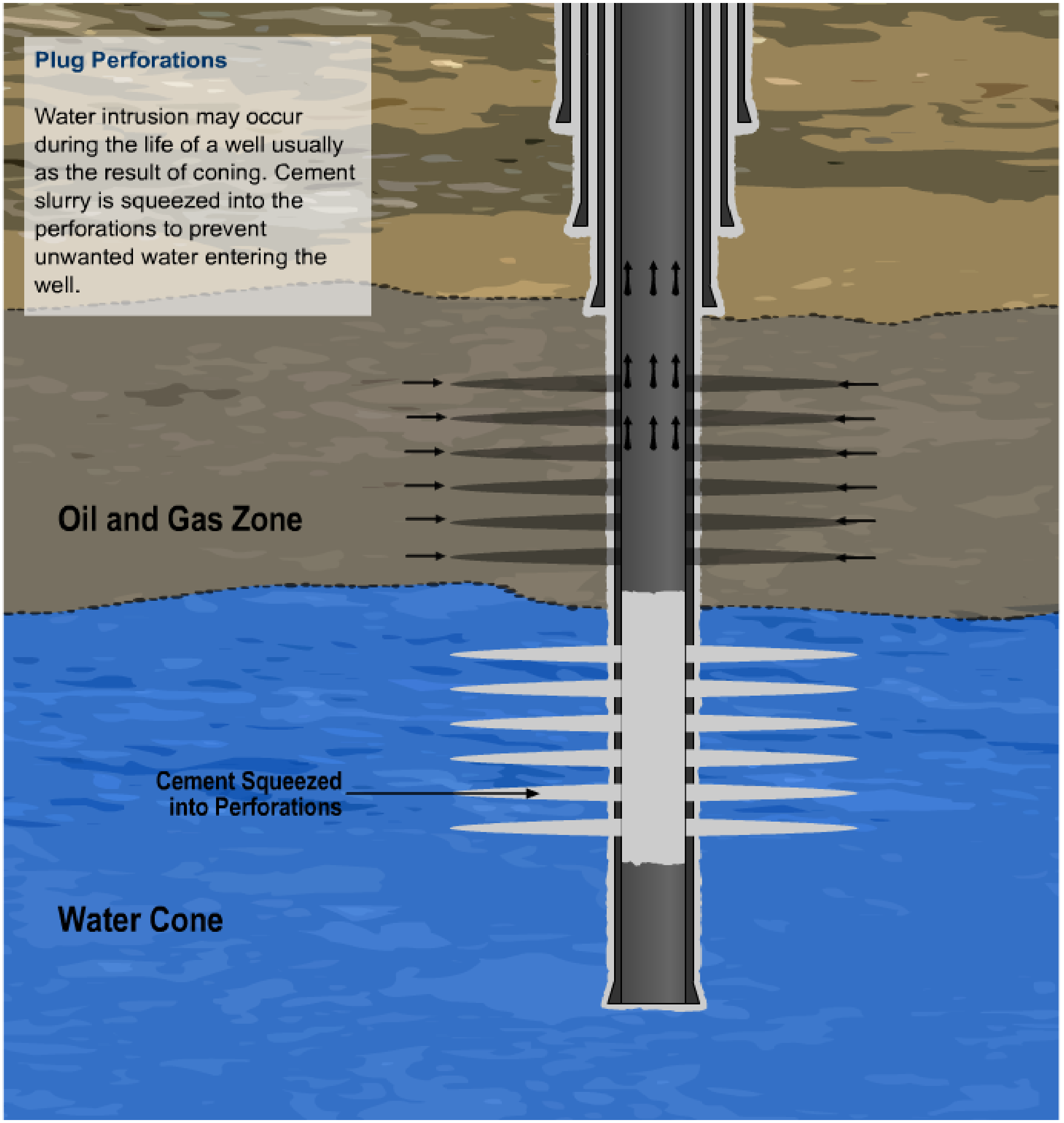

Repairing Corroded Casing

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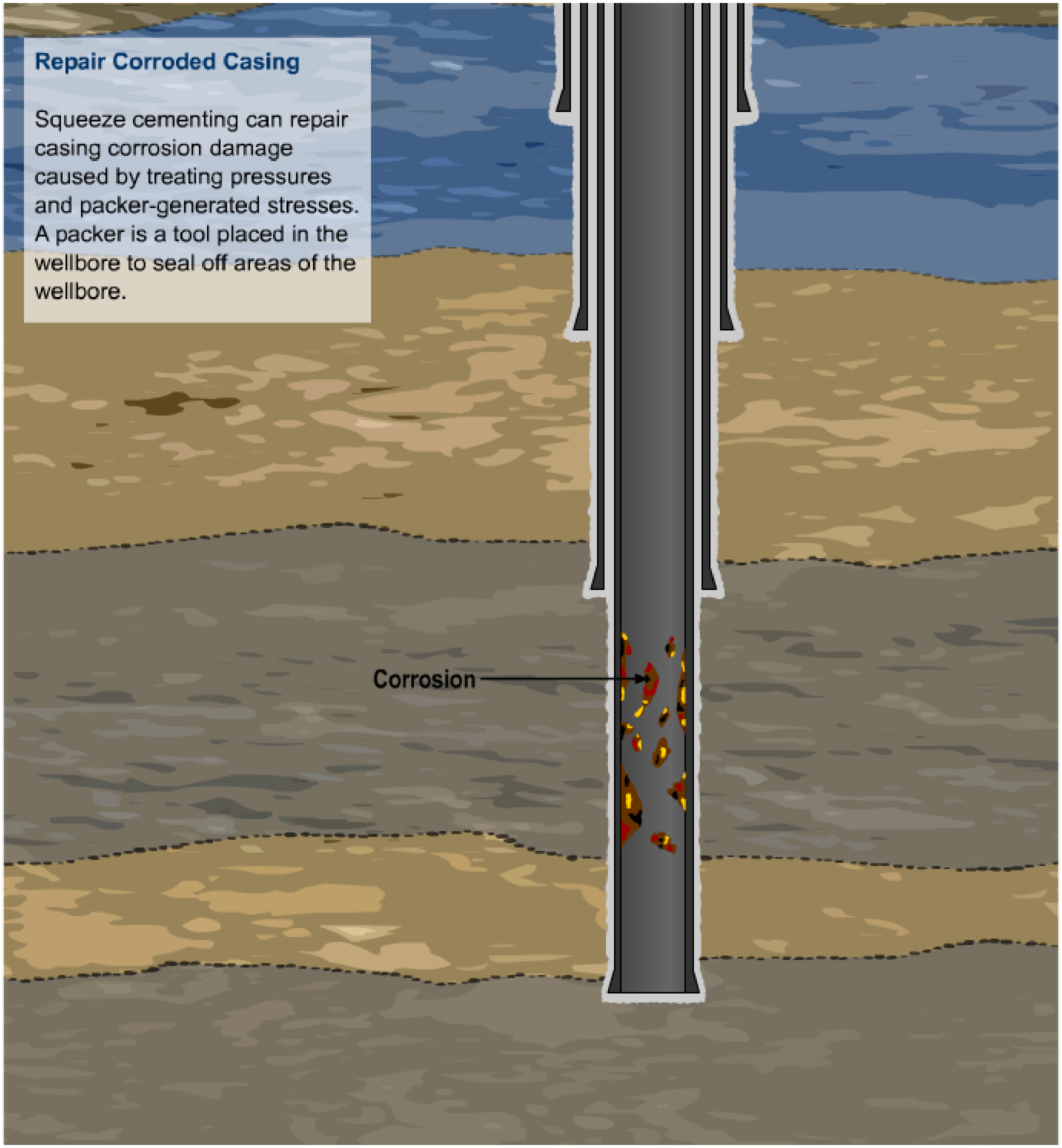


Squeeze Cementing - Methods

Pumping technique

- Hesitation
- Running
- Circulating

Placement technique

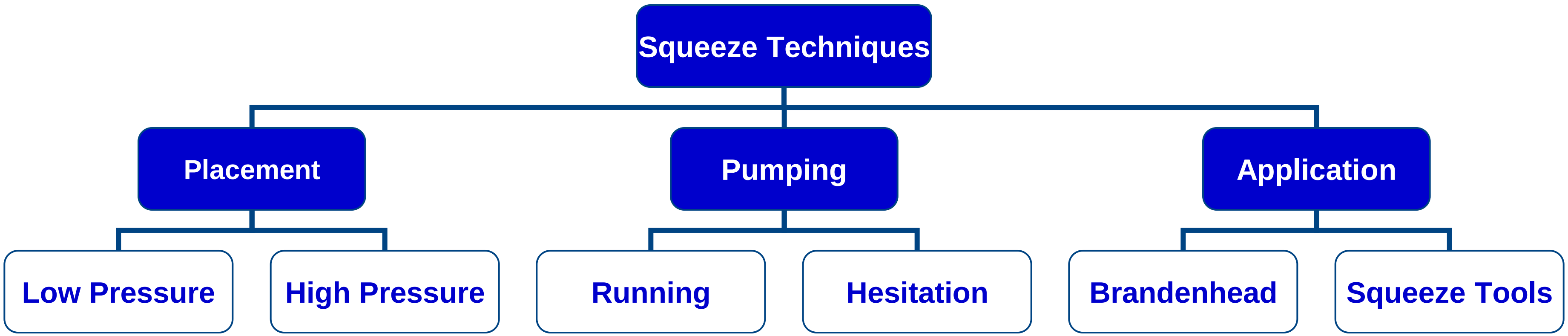
- High pressure - *above* formation frac pressure
- Low pressure - *below* formation frac pressure

Tools

- Packer/Retainer
- Bradenhead

Coiled tubing

Squeeze Techniques



Low Pressure Squeeze

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Squeeze pressure below fracture pressure

Best way to squeeze the pay zone

Use small volume of slurry

Common applications include but not limited to

- Multiple zones
- Long intervals
- Low BHP wells
- Naturally fractured formations

High Pressure Squeeze

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Fracturing is necessary to place cement in the void

Requires placement of large volumes of slurry

Common applications include but not limited to

- shoe
- liner top
- block squeeze

Wash or acid ahead to minimize pump rates required to initiate fracture

Running Squeeze

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Continuous pumping until final squeeze pressure is attained

Clean fluid in the hole

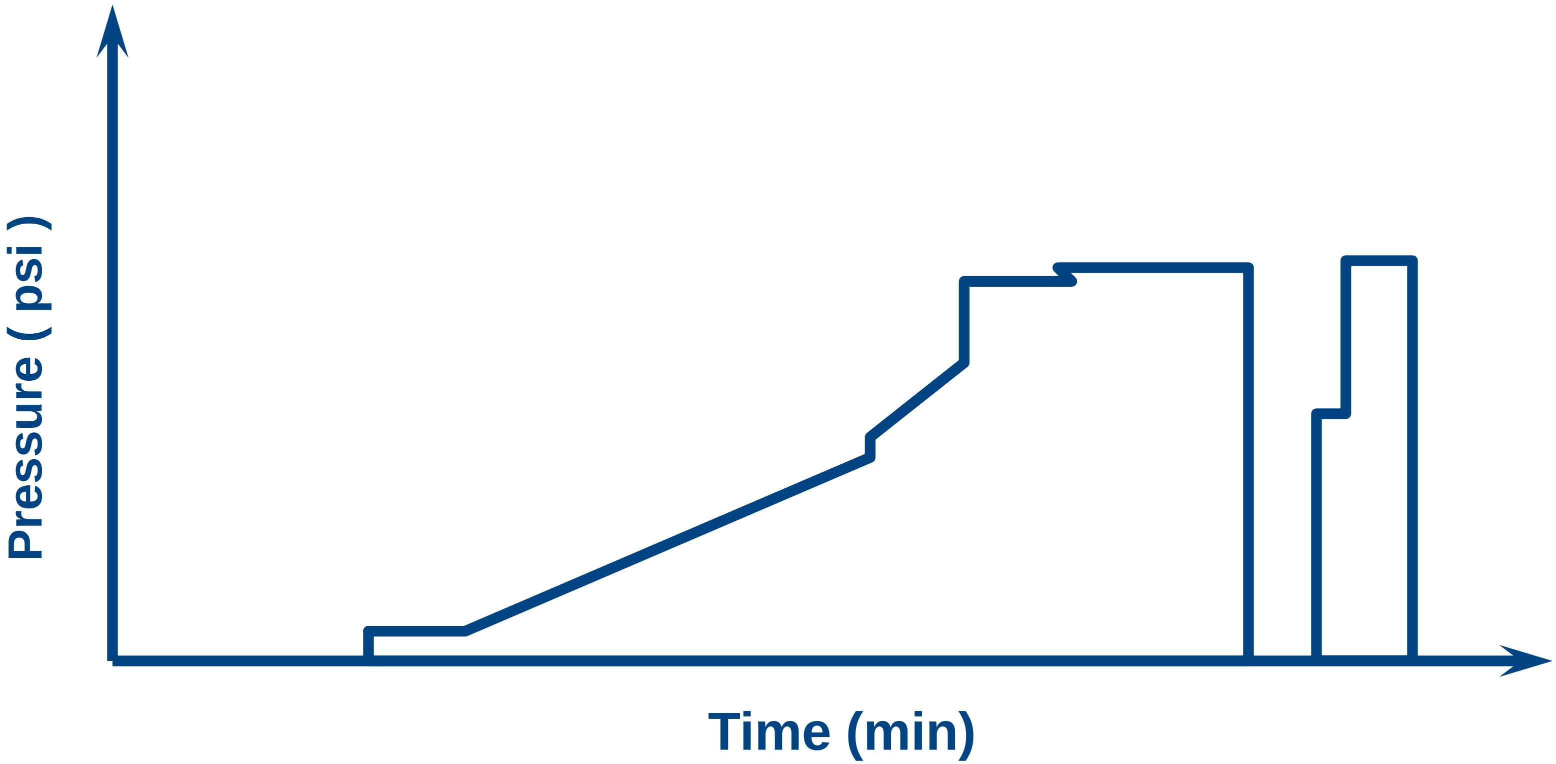
Large slurry volumes with less fluid loss control

Low or high pressure squeeze

Common applications include but not limited to

- Water flow
- Abandon perforations
- Increase cement top
- Casing shoes
- Liner tops
- Block squeeze
- Lost circulation zones

Running Squeeze



- Usually a large volume of slurry is pumped with this technique

Hesitation Squeeze

Intermittent pumping

Low pump rates

Small slurry volumes

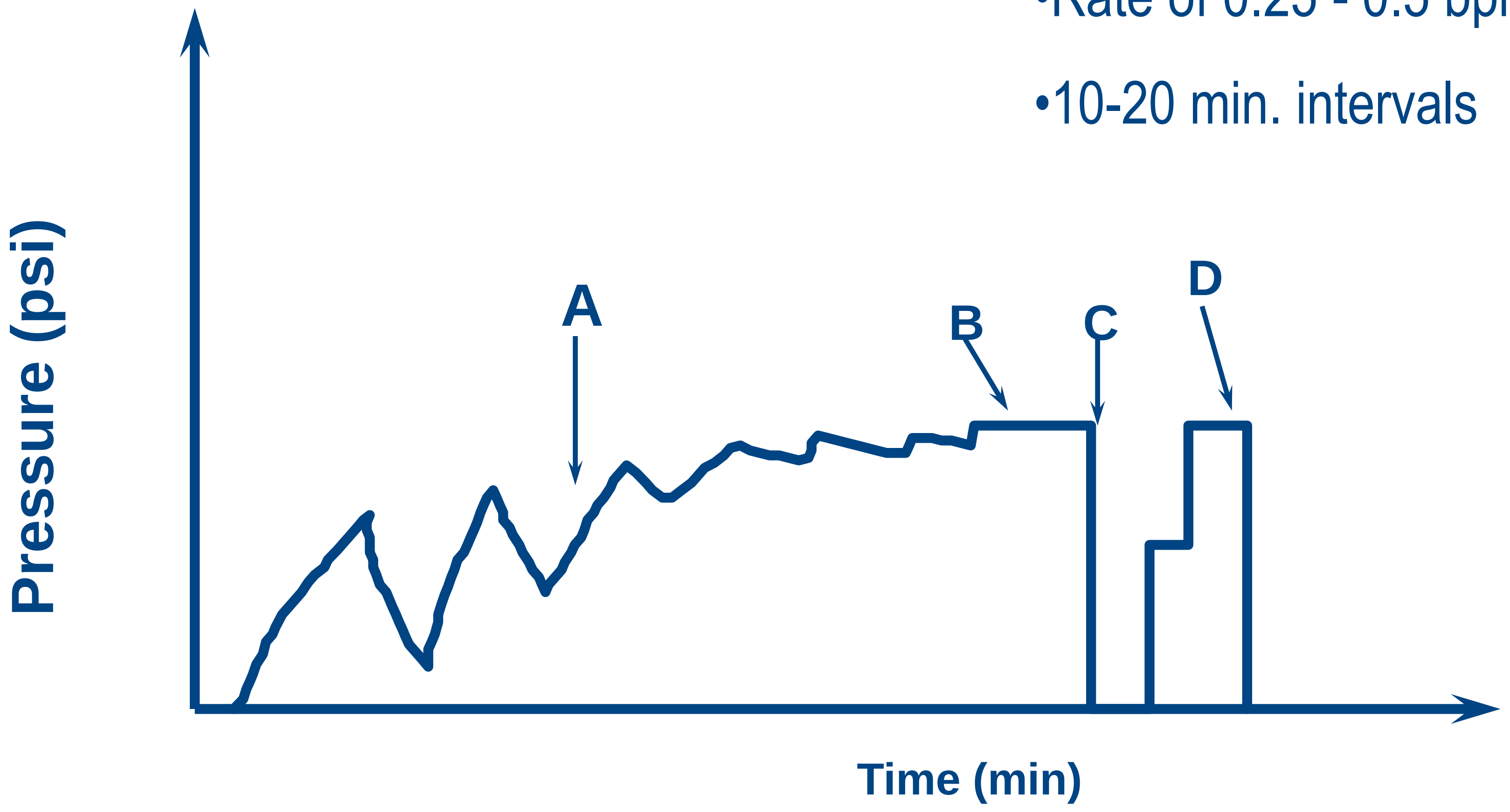
Long job times

Common applications include but not limited to

- Channel repair
- Long perforated interval
- Long splits in casing
- Lost circulation

Hesitation Squeeze

- Rate of 0.25 - 0.5 bpm
- 10-20 min. intervals



Planning the Squeeze Job

Problem determination
- Temperature log
- CBL/CET/USI
- Noise log
- Water-flow log
- Tracer survey

Select tools and location
- Casing integrity
- Type of squeeze
- Volume of the slurry

Fluid in the well

Well conditions (pre-squeeze clean-up, if necessary)
- Formation lithology
- Formation permeability
- Squeeze temperature

Slurry design and amount

Pressure limitations
- Pore and frac

Plan the injection test

Injection Test

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Perforations are open and ready to accept fluid

Estimate of the proper cement slurry injection rate

Estimate the pressure during squeeze

Estimate the amount of slurry to be used

Low Injection rates may require pumping an acid / solvent treatment ahead

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Three main roles in squeeze cementing:

Prevent contamination of the cement slurry

Help clean voids and perforations to be filled with cement

Remove rust and debris from tubular and push them ahead of cement slurry

Wash/Spacer Selection

Compatible with hole fluid and squeeze treatment

Effectiveness in mud removal

Size of gap to squeeze

Maintains overbalance during placement

Squeeze Slurry Requirement

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Three critical squeeze slurry properties

The slurry must:

Allow proper placement from surface to downhole

Allow fluid placement behind casing / perforations

Attain the desired set properties

General Attributes for Squeeze Slurry

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Low viscosity

Low gel strength during placement

Appropriate cement particle size

No free water

Appropriate fluid loss control

Proper thickening time

Slurry Properties to Consider

Fluid loss & filtercake development

Rheology & sedimentation

Density

Size of particles in the slurry

Thickening time and temperature

Chemical resistance

Slurry Volume Selection

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Best Practices and Local Experience

Type of repair planned

Length of the interval and number of perforations to be squeezed

Placement technique to be used

- Low pressure
- High pressure

Injection Rate

Slurry Volume Limiting Factors

Cement column too high to breakdown formation

Volume should not exceed the string capacity

Volume limited to ensure reverse circulation is possible

In case of placement thru CT, the weight of CT filled with cement not to exceed CT tensile strength

Bradenhead Squeeze

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Done through tubing or drill pipe without packer

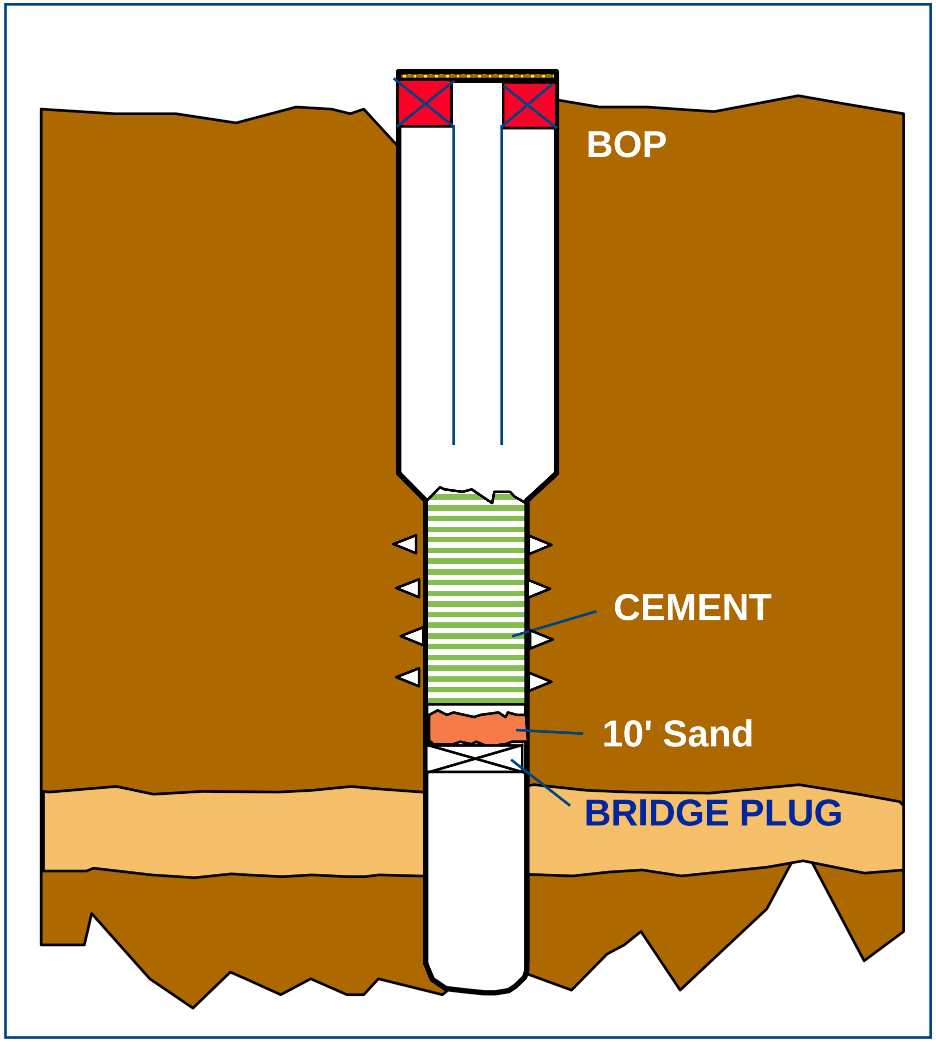
Referred as “Poor Boy Squeeze”

Advantages

- No tool are used (simplicity)
- Cost
- Used in open hole

Disadvantages

- Casing and wellhead are exposed to pressure
- Old casing



Squeeze Tool Technique

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Retrievable tools

- Positrieve Packer
- Hurricane Packer
- Shorty Squeeze Tool
- RBP
- DLT

Drillable tools

- Cement Retainer
- Drillable Bridge Plug

Packer with Tailpipe Squeeze

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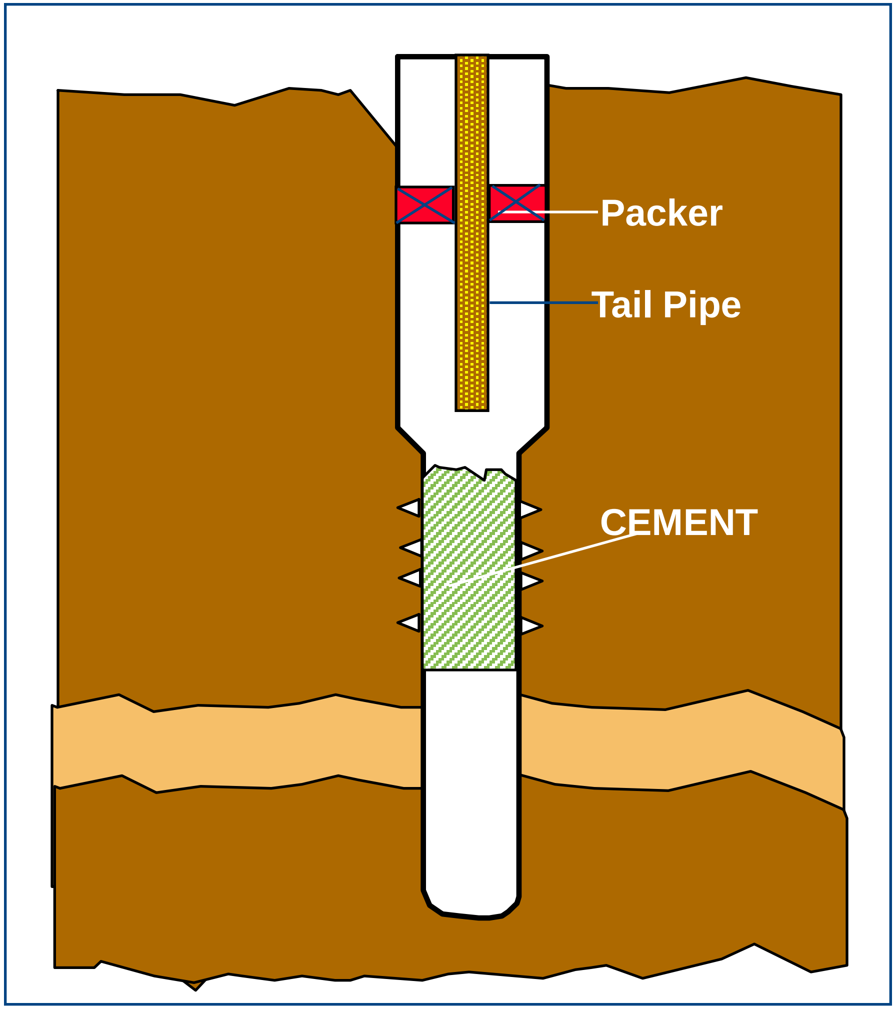
- Downhole Isolation tool
- Casing and wellhead protection
- Tailpipe for placement
- Long intervals
- Multiple setting of packer



Other Considerations
(Brandenhead & Packer with Tailpipe)

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Decision to reverse circulate OR circulate excess slurry

Excessive pressures during circulation may over-displace slurry below perforations

Excessive pressures may frac formation

Plug Post Placement Circulation module MUST always be run to evaluate dynamic security

Packer without Tailpipe Squeeze

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Downhole Isolation tool

Casing and wellhead protection

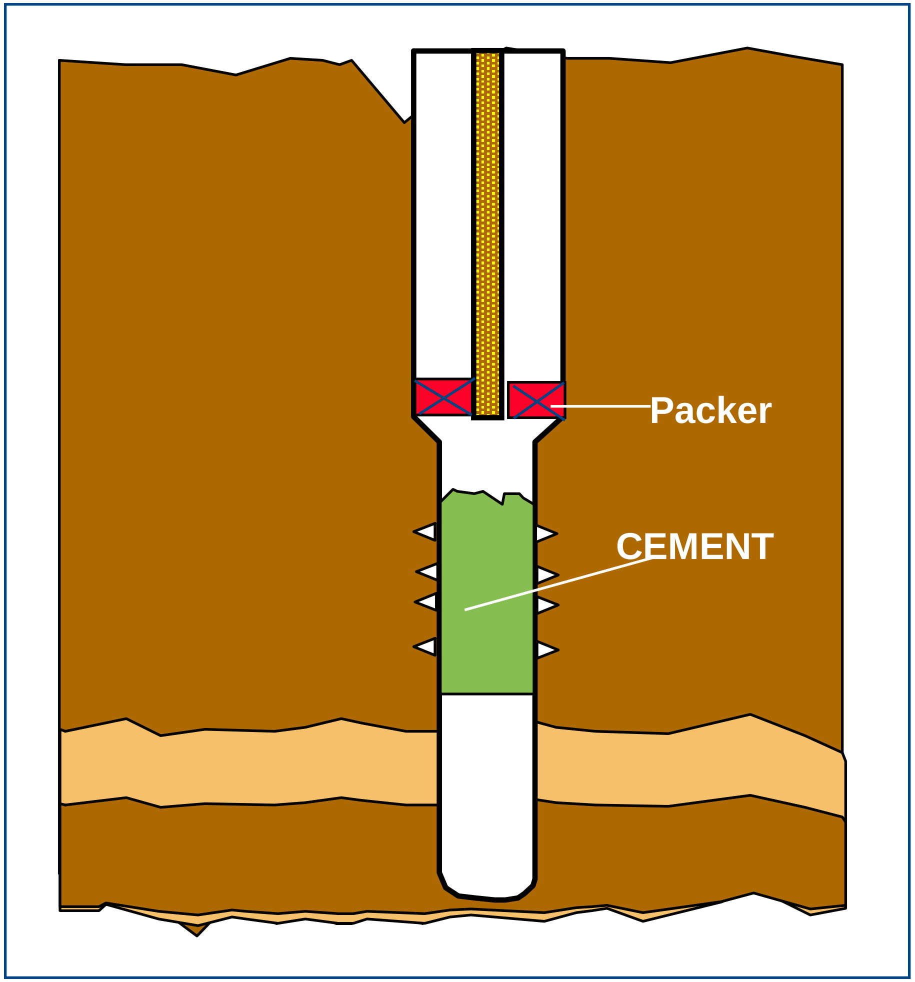
Short intervals

No tailpipe

Suicide squeeze

- Continuous pumping
- Running squeeze

Annulus needs close monitoring for leak



Cement Retainer Squeeze

Drillable Isolation Tool

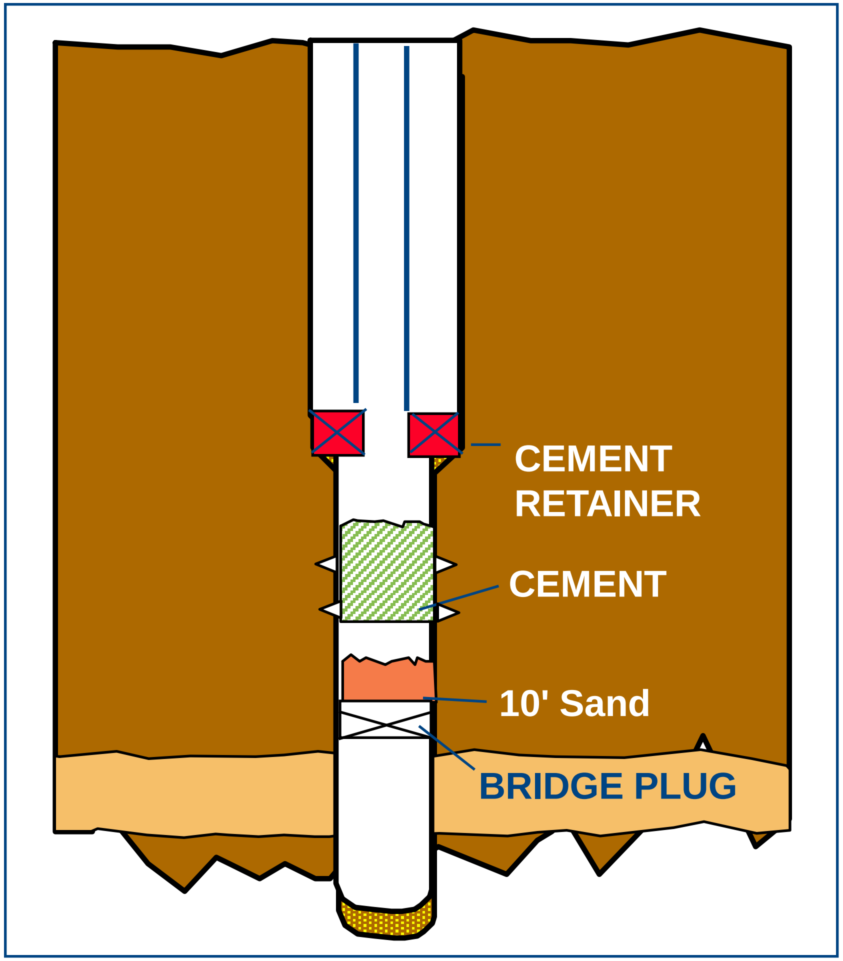
Similar to packer without tailpipe

Squeeze pressure trapped

- Internal control valve

No pressure exerted on perforations during post squeeze circulation.

Annulus needs close monitoring for leak



Coiled Tubing Squeeze

Applications

- Producing wells
- Through tubing

Advantages

- Cost
- Accurate placement

Critical slurry design parameters

- Slurry Stability
- Rheology
- Fluid Loss
- Thickening Time

Squeeze Cementing - Job Cycle

Design
- Well conditions
- Slurry properties

Execution
- Slurry placement
- Surface pressures
- Equipment

Evaluation
- Final squeeze pressure
- Positive Pressure test
- Inflow test
- Logs (CBL/Temp)

Other Materials

- Resins
- Micro-fine cements
- Polymers
- Slurry oil
- NRT (Novel Remedial Technologies)
  - Nano particles activated by set cement
  - Biominerialization

Questions??????