Cementing Program Objectives

- Zonal Isolation
- Casing Support
- Casing Protection
- Borehole Support
- Demonstrate mechanical integrity

https://www.epa.gov/uic/class-i-industrial-and-municipal-waste-disposal-wells#non_haz
Cement Program Considerations

• Injection Fluid Compatibility
• Design of the Injection Well
• Subsurface Depth and Temperature
• Lithology
HOPEFULLY...
More Often...
unfortunately...
Remedial Cementing

When primary cementing objectives have not been achieved, or when the cement or casing has failed over time

Two general methods of remedial cementing

1. Plug cementing
   • Cement placement to create a wellbore seal or plug

2. Squeeze Cementing
   • Correction process specifically designed to fill a void
Plug Cementing

A remedial technique involving placement of a volume of cement in a wellbore, casing or tubing

• Solving a lost-circulation problem
• Sidetracking or to initiate directional drilling
• Provide an anchor for an open hole test
• Plugging a zone or abandonment of a well
Squeeze cementing is the process of using pump pressure to inject or squeeze cement into a problematic void space at a desired location in the well.

- Repair primary cement job
- Repair improper zonal isolation
- Eliminate fluid intrusion
- Repair casing leaks
- Shut-off Injection interval

https://www.halliburton.com/content/dam/ps/premium/common/PWC_Book/PWC11.PDF
Squeeze Cementing Techniques

**Low Pressure Squeeze**
- Injection of cement slurry into zones at pressures below the fracture pressure of the formation
- Fill perforations or channels
- Typically small volumes
- Must take caution to ensure the formation is not fractured

**High Pressure Squeeze**
- Used when it is not possible to inject slurry at pressures below the fracture pressure
- Cement is placed at high pressure to displace the cement and seal off the formation or injection points
- Slurry volumes are typically high
Squeeze Cementing Techniques

Running Squeeze

https://www.halliburton.com/content/dam/ps/premium/common/PWC_Book/PWC11.PDF
Squeeze Cementing Techniques

Hesitation Squeeze

https://www.halliburton.com/content/dam/ps/premium/common/PWC_Book/PWC11.PDF
Squeeze Cementing Techniques

Bradenhead Squeeze

• Performed by circulating cement slurry down to the squeeze interval, then pulling the work string above the top of the cement column

• The backside of the wellbore is closed in, and pressure is applied through the work string to force cement into the squeeze interval

• Casing and surface equipment are exposed to squeeze pressure, therefore they must have sufficient burst resistance
Squeeze Cementing Techniques

Packer/Retainer Squeeze

• Tool that are implemented to isolate the squeeze interval and place the cement as close to the squeeze target as possible before applying pressure

• Retainers or bridge plugs create a squeeze interval bottom, set just below the squeeze target inside the casing or tubing, and sealing off the wellbore below the target interval

• Isolates the upper portion of the casing or tubing and surface equipment from the cement and squeeze pressures

• Improves the placement and control of fluids during squeeze jobs

• Reduces the volume of cement needed
Injection Wells UIC 1 & 2

- Injection wells in the Illinois Basin
- Drilled depth – Over 12,000 feet bgs
- Open hole from bottom of longstring to total depth

Condition of well when we were retained:
- UIC 1: 7” tubing with a 9 5/8” longstring casing and a 9 5/8” compression packer at the casing shoe
- UIC 2: 5 ½” tubing with a 7” longstring casing and a 7” compression packer at the casing shoe
- Incomplete set of CBL, cores and imaging logs
- UIC 1: Well would not pass MIT (APT)
5 ½", 20.3 #/ft, L-80 tubing with CPVC liner from Surface to 4,255.82'

Perforations set in 9 ¾” casing at ± 2,207’ to 2,209’

Annulus filled with water and 2% solution of corrosion inhibitor

7” DV Tool at ± 4,585 to 4,891 feet
Perforation from 4,586’ to 4,596’

12 ½” borehole to 5,200’

4 ½”, 11.6 #/ft, J-55 tubing with PVC liner from 4,261.12’ to 7,458.66’

26” borehole w/ 22” galvanized steel culvert for conductor casing set at 42 feet, cemented from bottom to surface

17 ½” borehole to ± 900 feet

Surface Casing: 13½”, 54#/ft, set at 895 feet, cemented from bottom to surface

37’ Metal Skin Patch set at 4,560’ to 4,597’

Intermediate Casing: 9 ¾”, 40#/ft, L-80 STC, 8rd, set at ± 4,890 feet, cemented from bottom to surface
37’ Metal Skin Patch set at 5,769’ to 5,806’, Perforation at 5,790’ to 5,800’

35’ Metal Skin Patch set at 6,835’ to 6,870’, Perforation at 6,830’ to 6,840’