

Class II Well Inspections

Class II well classification

Class II well construction requirements

Types of inspections

Operating and Monitoring requirements



Class II Well Classification

IIR – Enhanced recovery wells

- Used for the secondary or tertiary recovery of oil and gas and for the maintenance of reservoir pressure

Class II Well Classification

IID – Salt water disposal wells

- Disposal of salt water (brine) produced from oil and gas production wells
- Disposal of other waste streams associated with oil and gas production

Class II Well Classification

IIH – Hydrocarbon storage wells

- Inject hydrocarbons that are liquid at standard temperature and pressure.

IID - Bevill Amendment



Exemption of Oil and Gas Exploration and Production Wastes from Federal Hazardous Waste Regulations

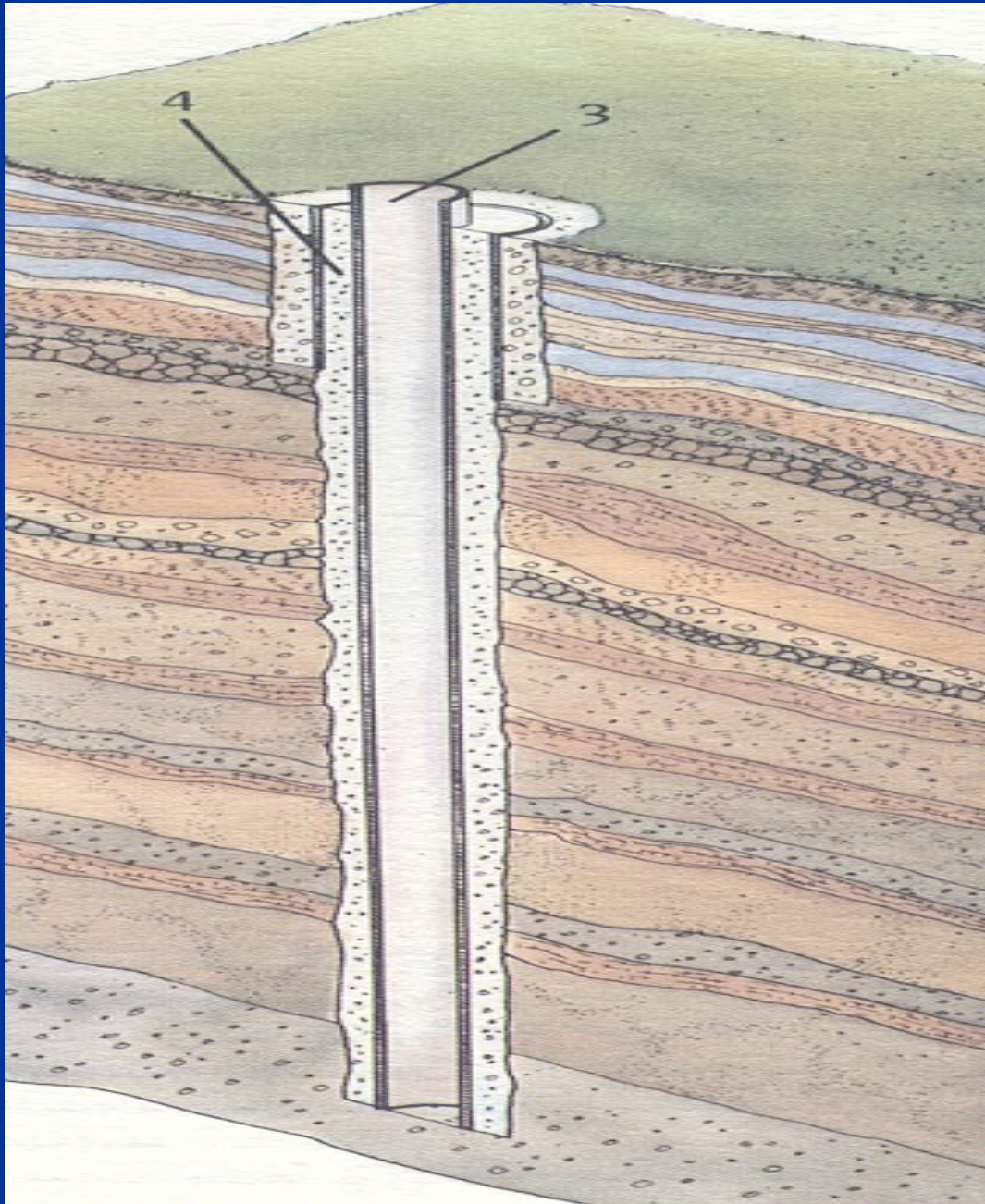


Class II Well Construction Requirements

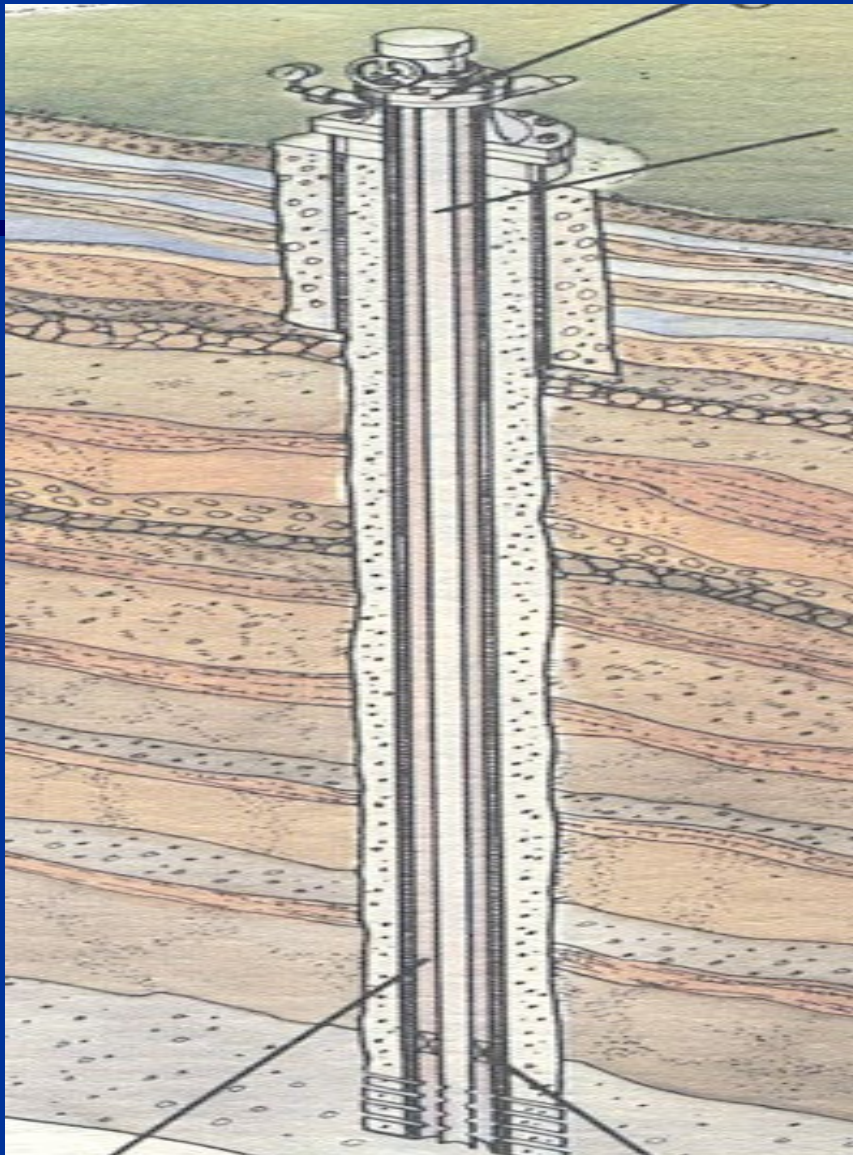
- New Class II wells inject into a formation separated from any USDW by confining zones free of faults and fractures.
- All Class II wells are cased and cemented to prevent movement of fluids into or between USDWs.
- Casing and cement for newly drilled wells shall be designed for the life expectancy of the well.
- Casing and cement programs shall consider factors such as: location of USDWs, pressures, formation fluids, lithology.



Well Construction Technology 1st Step: Surface Casing



**2nd Step:
Intermediate
or Long
String Casing**



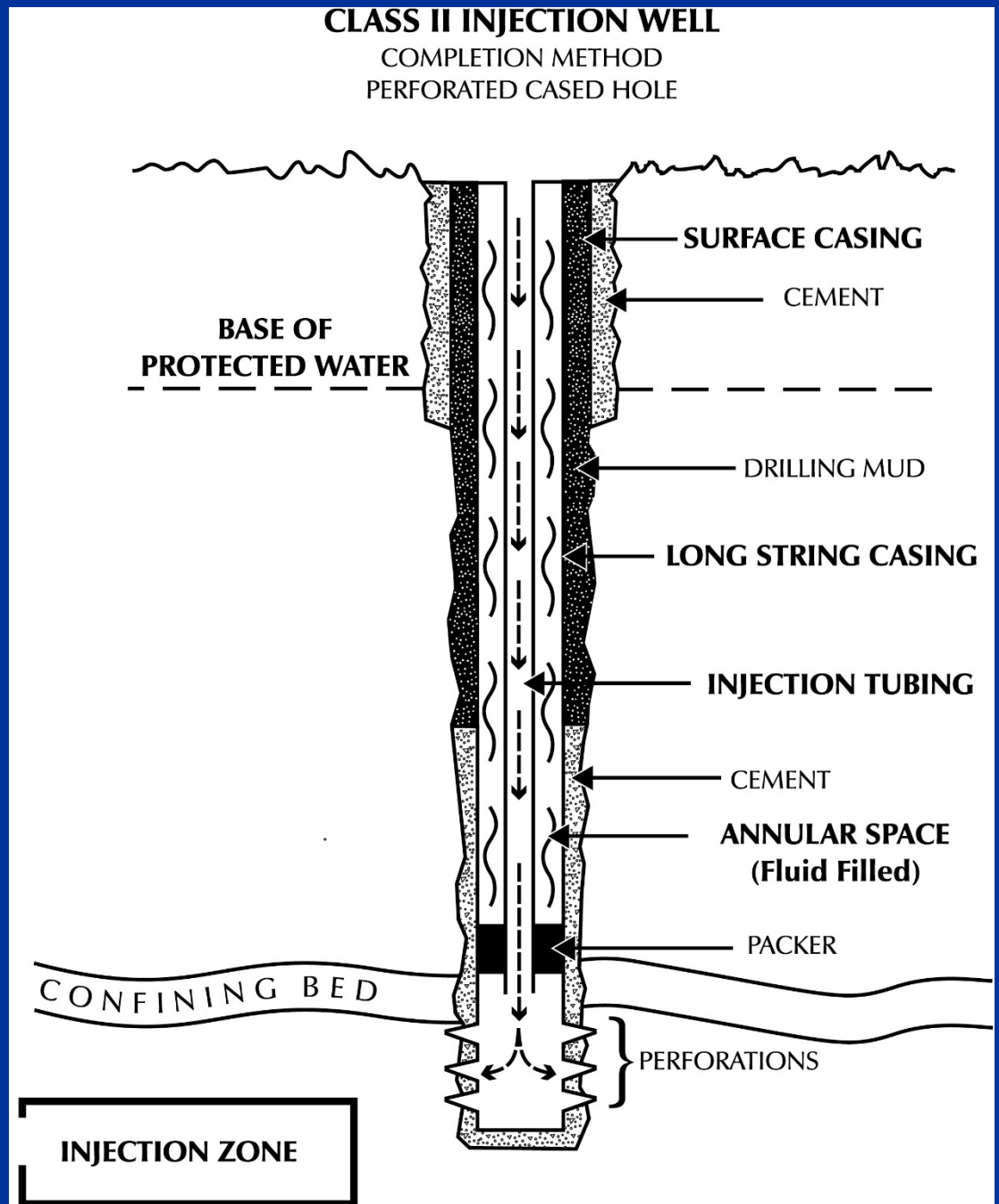
3rd Step: Well Perforation

Tubing and Packer

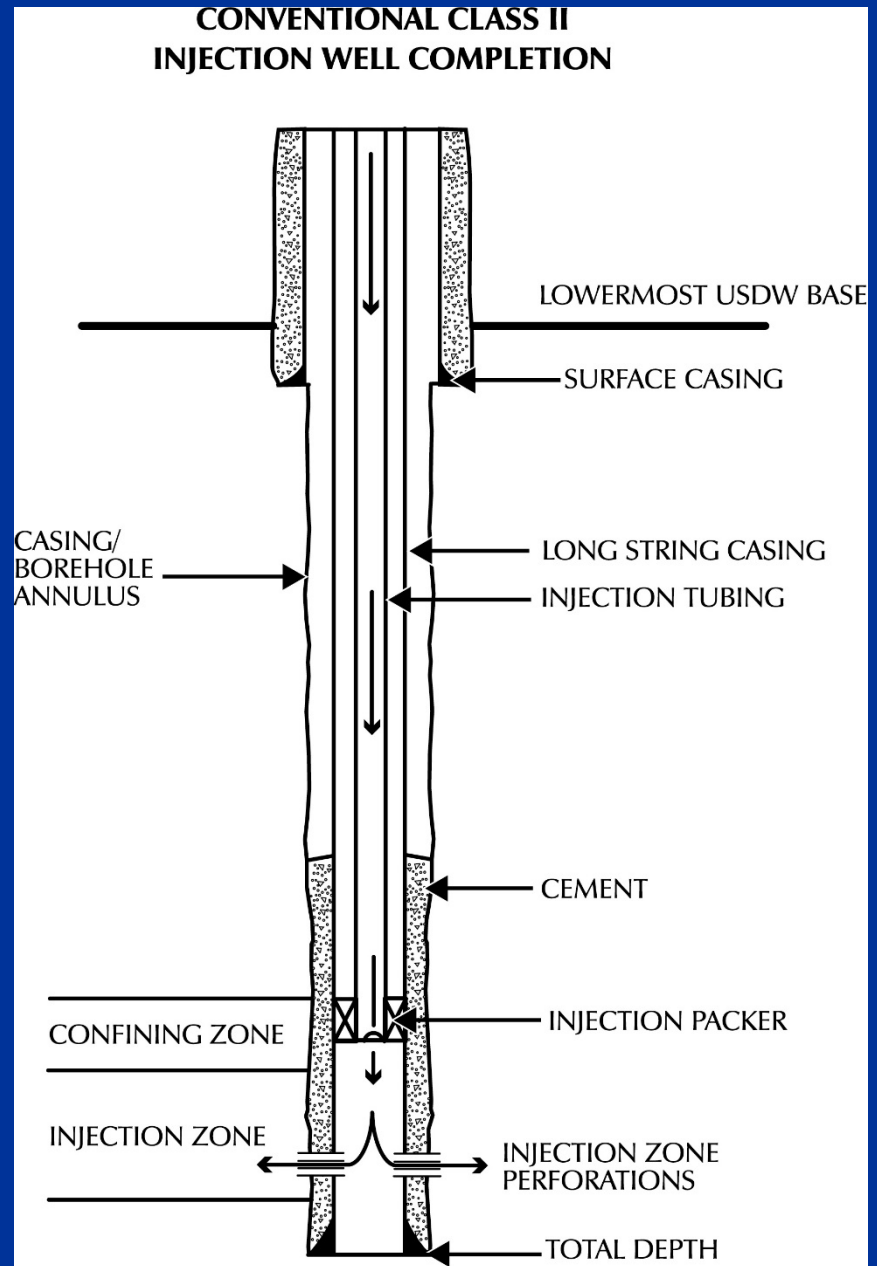
Class II Injection Well

Completion Method

Perforated Cased Hole

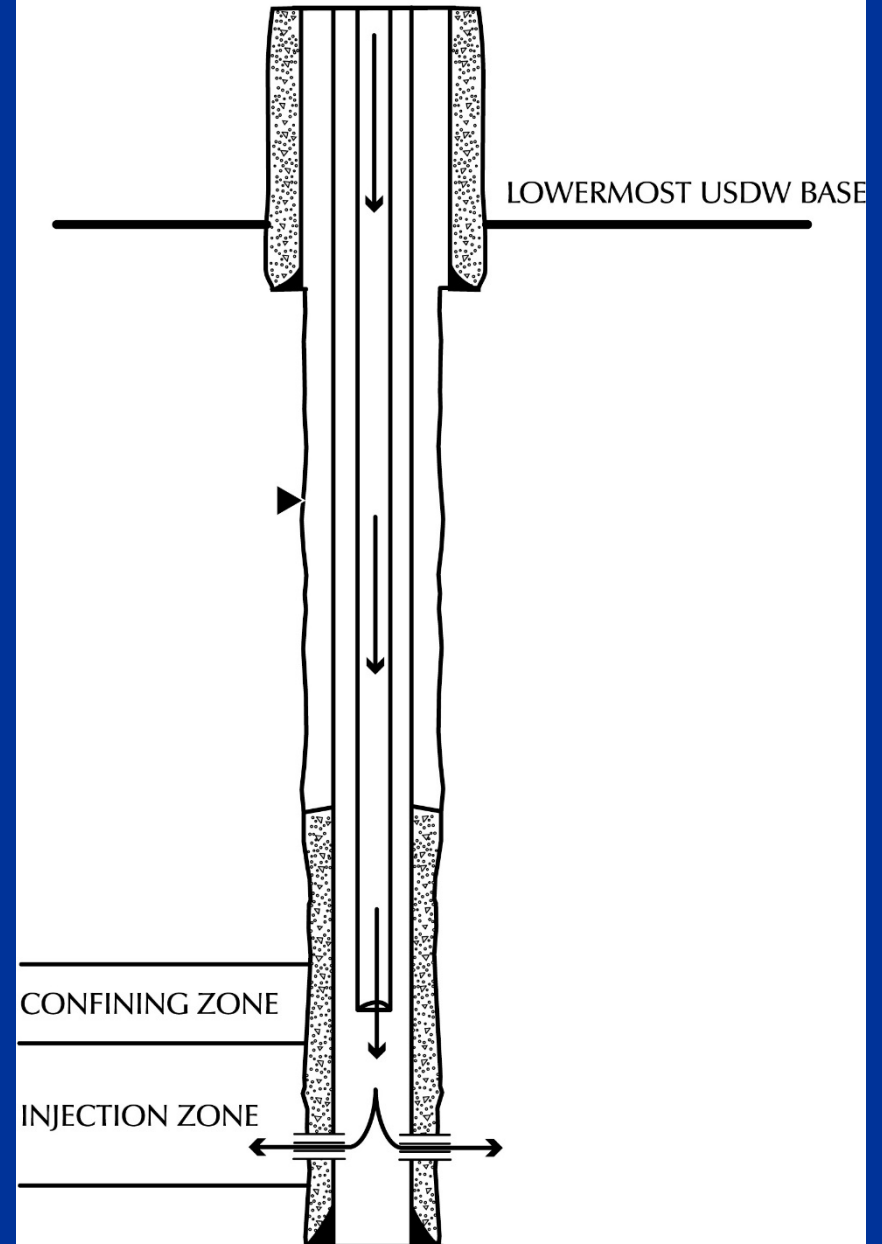


Conventional Class II Injection Well Completion

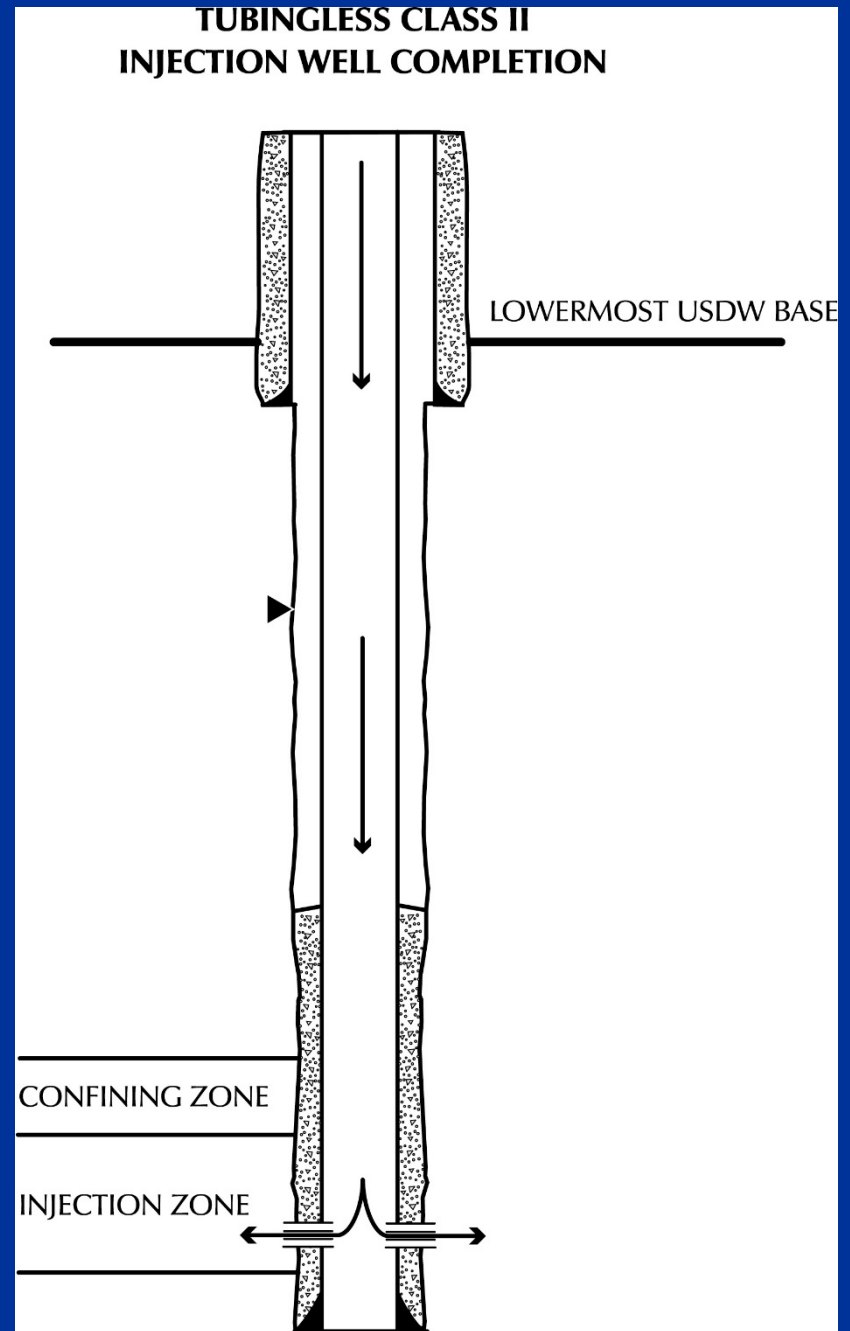


Packerless Class II Injection Well Completion

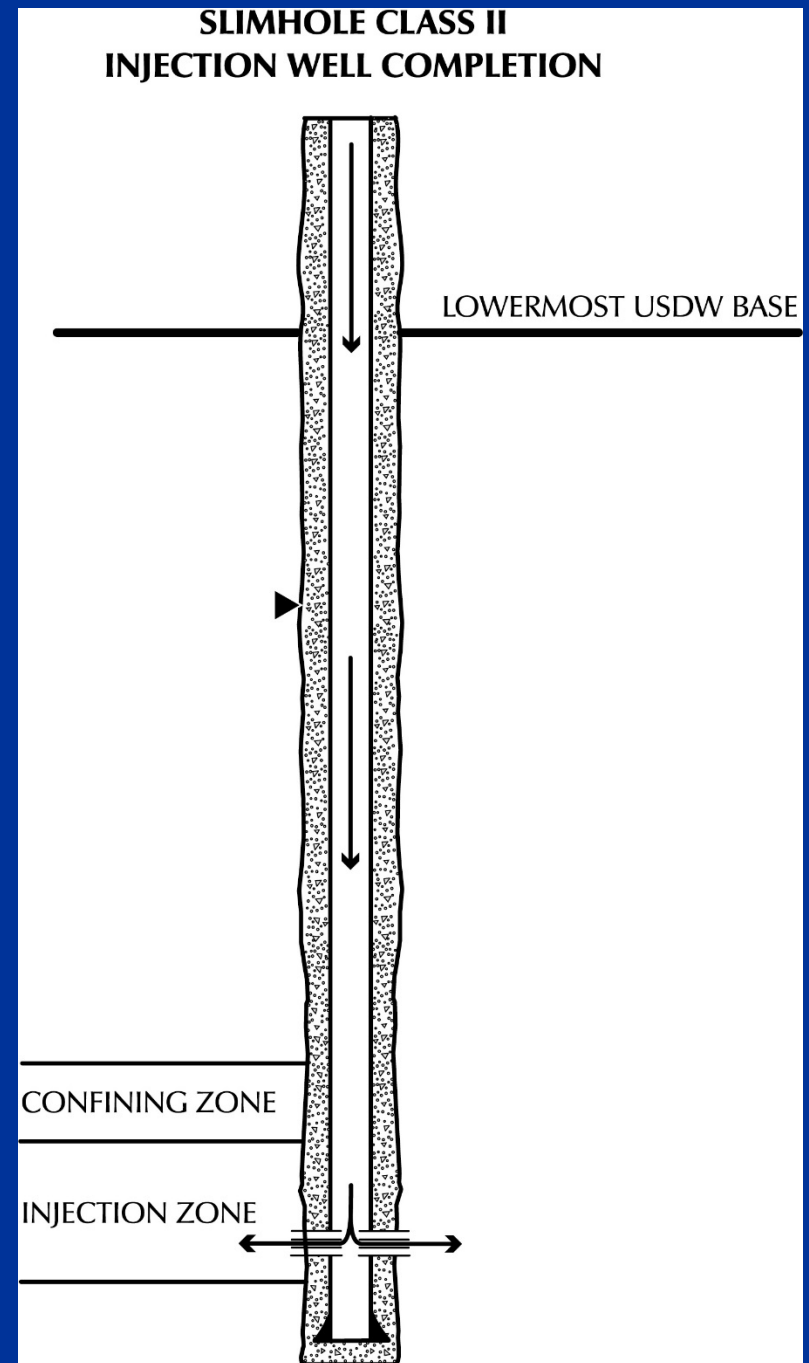
PACKERLESS CLASS II INJECTION WELL COMPLETION



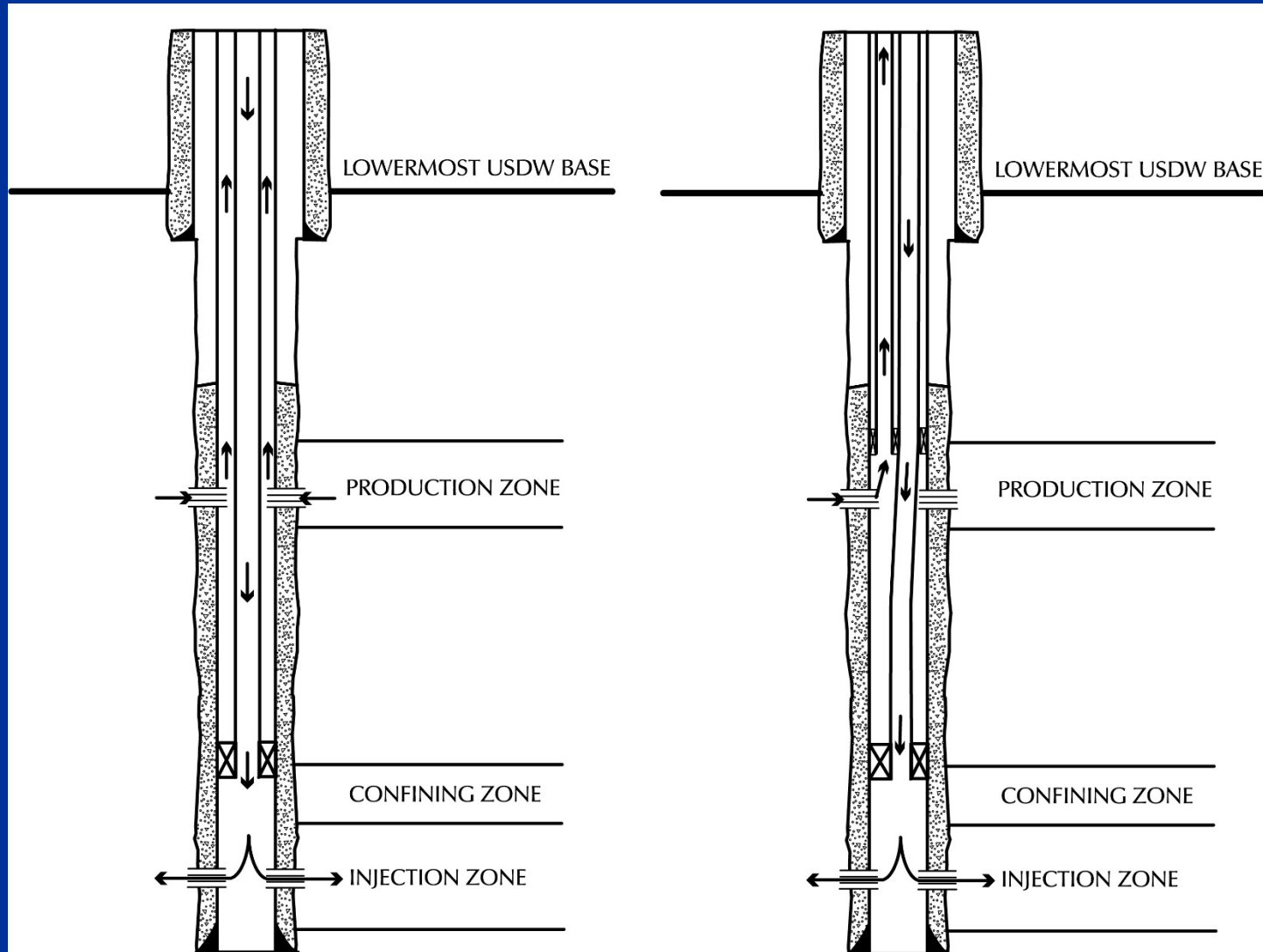
Tubingless Class II Injection Well Completion



Slimhole Class II Injection Well Completion



Dual Completion Class II Injection Well Completions



Types of Inspections

- Routine or operational
- Drilling/Workover
- Well logging/Testing
- Frac job
- Plugging and abandonment
- Compliance and enforcement
- Sampling
- Citizen complaint

PREP for INSPECTIONS

- Well Construction (downhole & surface)
- Operating Limits (pressures/rates/vol)
- Site Access (locked/gated/etc.)
- Equipment Needs (gauges/tools, PPE)
- Operator contact information

Typical Operating and Monitoring Requirements

- Injection pressure
- Flow rate and cumulative volume
- Fluid analysis
- Annular pressure
- Shut-in Equipment
- Flowback (check valve)

Surface Equipment

Flowlines

Wellheads / Cellars

Tanks

Pressure Gauges

Flowmeters

Volume Meters

SCADA Devices

Shut-In Devices

Wellheads and Gauges

- CO₂



Wellheads and Gauges

- SWD



Wellheads

- SWD

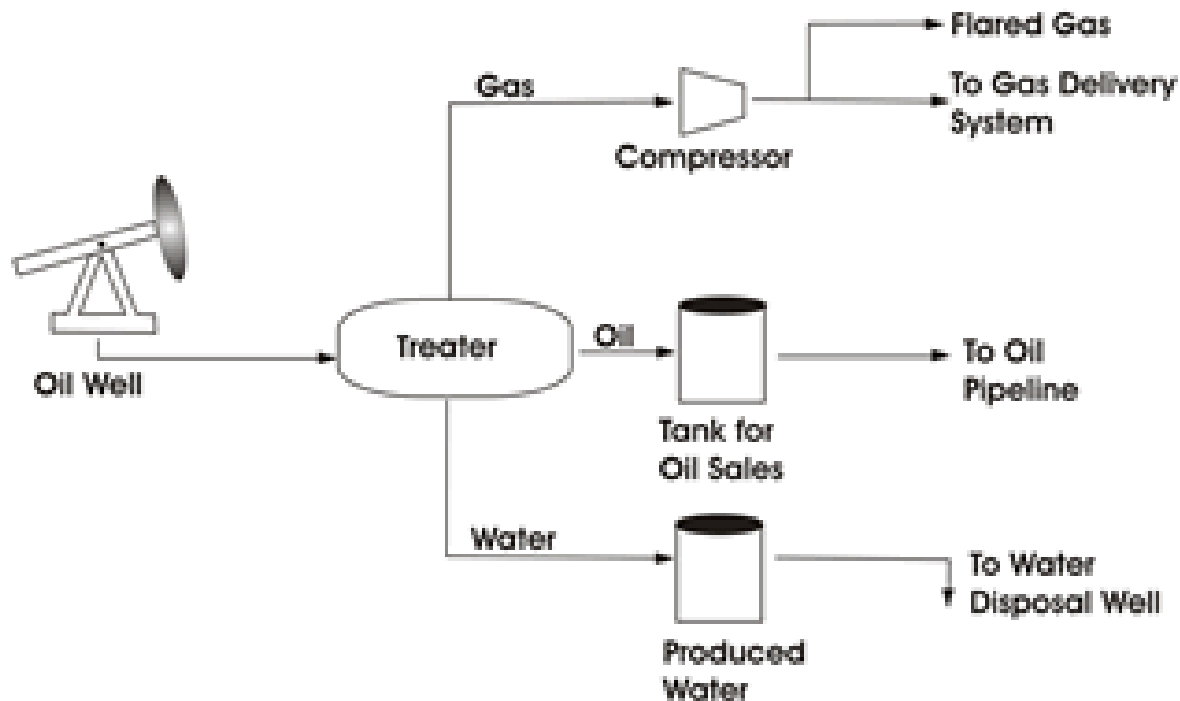


Wellheads

- SWD



Wellsite



Example of a Single Well Oil Battery

Wellsite



Wellsite



SCADA Systems



Flow Meters



Volume Counters



Combination Meters



Shut-in Devices



Chart Recorders



Chart Recorders



Frac Pressures/Gradient

- Frac Gradient is presented in psi/ft
- Reflects the frac pressure at depth
- Best Measured with a Step Rate Test

Frac Pressures/Gradient

- Frac Pressure is the pressure at the formation face that causes the formation to fracture
- Two pressures contribute to the bottom hole pressure:
 - Hydrostatic head of the fluid column
 - Surface pressure (injection pressure)

Frac Pressures/Gradient

- Hydrostatic Head contribution:

Must know fluid contribution to psi

- Depth
- Specific Gravity

Frac Pressures/Gradient

- Hydrostatic Head contribution:

$$P_h = (SG) (0.433 \text{ psi/ft}) (D \text{ ft})$$

Frac Pressures/Gradient

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- For a 5000 ft well, with a SG = 1.003

Frac Pressures/Gradient

- Hydrostatic Head contribution:

$$P_h = (SG) (0.433 \text{ psi/ft}) (D \text{ ft})$$

- For a 5000 ft well, with a SG = 1.003

$$P_h = (1.003) (0.433) (5000)$$

$$P_h = 2171 \text{ psi}$$

Frac Pressures/Gradient

- If you know the frac gradient of your injection formation, the hydrostatic head contributes to that pressure, the remainder is added at the surface.
- If your frac gradient is 0.765 psi/ft, how much surface pressure can be added to the previous well example before frac?

Frac Pressures/Gradient

- For a 0.765 psi/ft frac gradient, the frac pressure at the formation face is:

$$P_f = (0.765 \text{ psi/ft})(5000 \text{ ft})$$

- $P_f = 3825 \text{ psi}$
- $P_h = 2171 \text{ psi}$ (from example)
- $P_{\max} = 3825 - 2171 = 1654 \text{ psi}$

CONFIDENCE
IN OWN
VIEWPOINTS

MAXIMUM KNOWLEDGE
OBTAINABLE IN A
HUMAN LIFESPAN

KNOWLEDGE