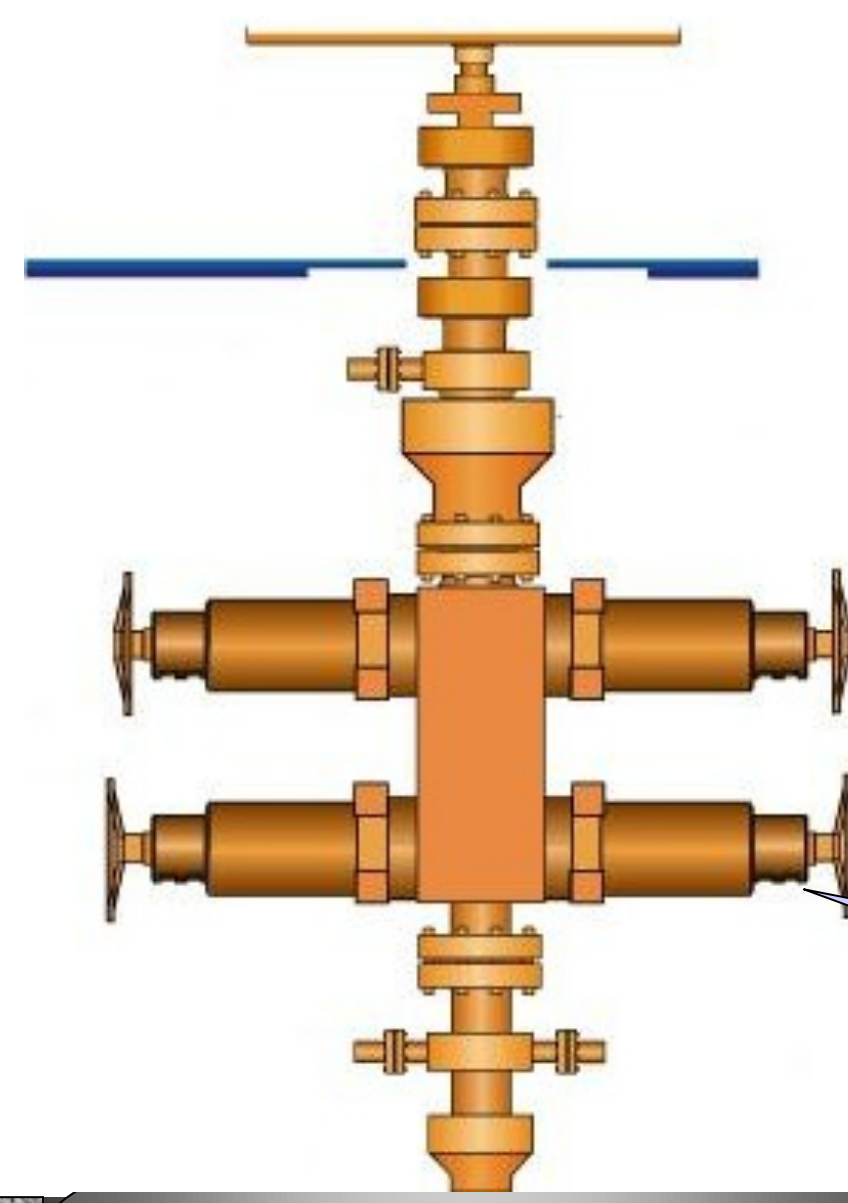


Well Design and Construction in Texas



Well Control at the Surface:

- ◆ Must be designed and tested to Maximum Allowable Surface Pressure;
- ◆ All equipment should be manufactured and tested in accordance with API standards;
- ◆ Must use special metallurgy in sour-gas or high-corrosive environments.

Surface Casing:

- ◆ Must be set close to and below the base of Usable Quality Water to isolate fresh water resources* from deeper formations;
- ◆ Must be cemented to surface;
- ◆ Must have high-quality cement at base of casing;
- ◆ Pressure test before and after drill-out (shoe test)⁺⁺.

*In Texas, fresh water is defined as less than 1,000 mg/L TDS. Usable Quality Water is defined as less than 3,000 mg/L.

Intermediate Casing:

- ◆ Should be set near or into target zone;
- ◆ Cement should be circulated to surface or at least 200 feet into next casing string;
- ◆ If cement is not circulated into next casing string, cement must be at least 600 feet above shallowest productive interval or any other corrosive or over-pressured zones⁺⁺.

Production Casing:

- ◆ Cement should be circulated at least 200 feet into next casing string or no less than 600 feet above shallowest productive interval;
- ◆ Should utilize cement evaluation tools (e.g. temp. survey, bond log) to show cement was circulated to required height;
- ◆ Must pressure test to maximum pressure applied during fracture treatment prior to perforating⁺⁺.

Objectives Outlined in Texas RRC Statewide Rule 13:

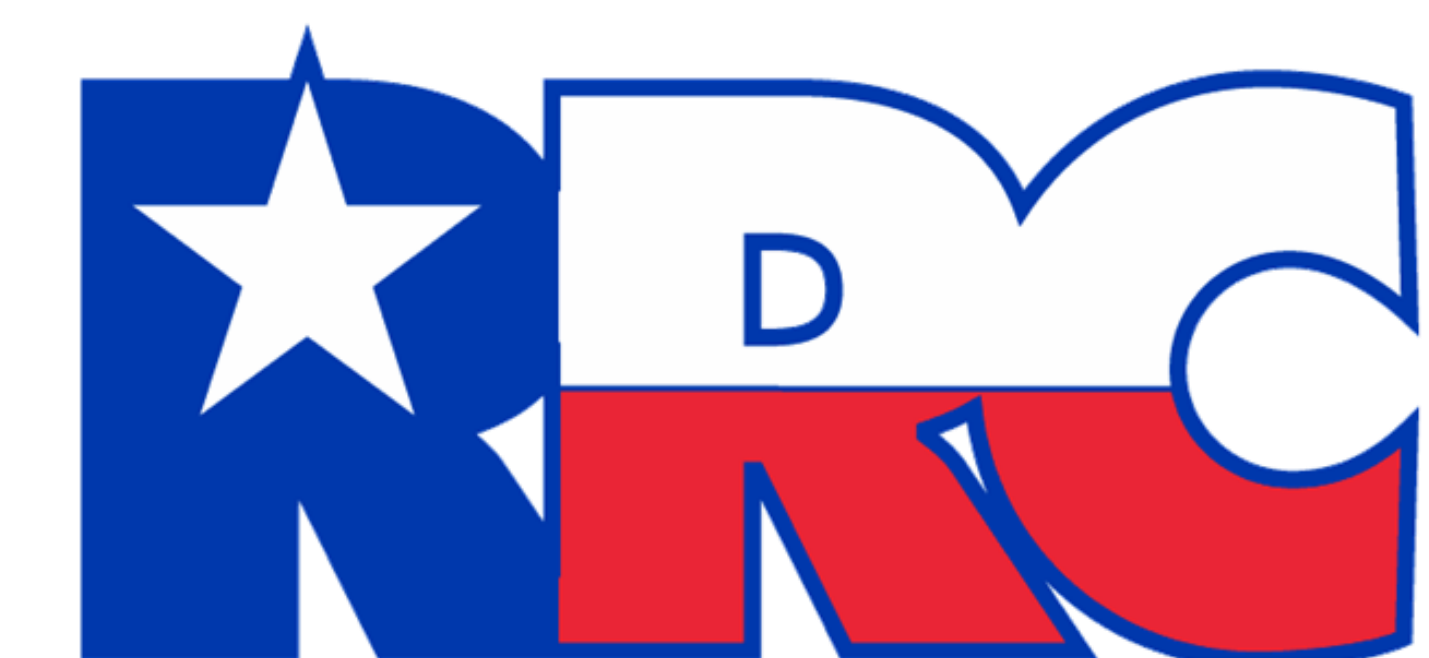
- ◆ Securely anchor casing to assure well control;
- ◆ Isolate and seal off fresh water zones with surface casing and cement to protect groundwater resources;
- ◆ Isolate and seal off potentially productive zones, over-pressured zone, or zones with corrosive formation fluids to prevent vertical migration of fluids behind casing.

Hydraulic Fracturing⁺⁺:

- ◆ Pressure test casing to max frac pressure prior to stimulation;
- ◆ Monitor all casing annuli for pressure fluctuations;
- ◆ Research nearby wells for proper well construction and monitor them for pressure fluctuations.

Concluding Thoughts:

- ◆ Well construction and design play an important role in mitigating concerns about subsurface migration to fresh water resources.
- ◆ Regulating entities must set minimum standards to ensure protection of freshwater resources while also maintaining flexibility to accommodate for technological improvements.



Railroad Commission of Texas

Presented by Travis Baer

⁺⁺Some recommendations represented in this graphic are presently proposed as changes to the current Statewide Rule 13 and are thus subject to change.