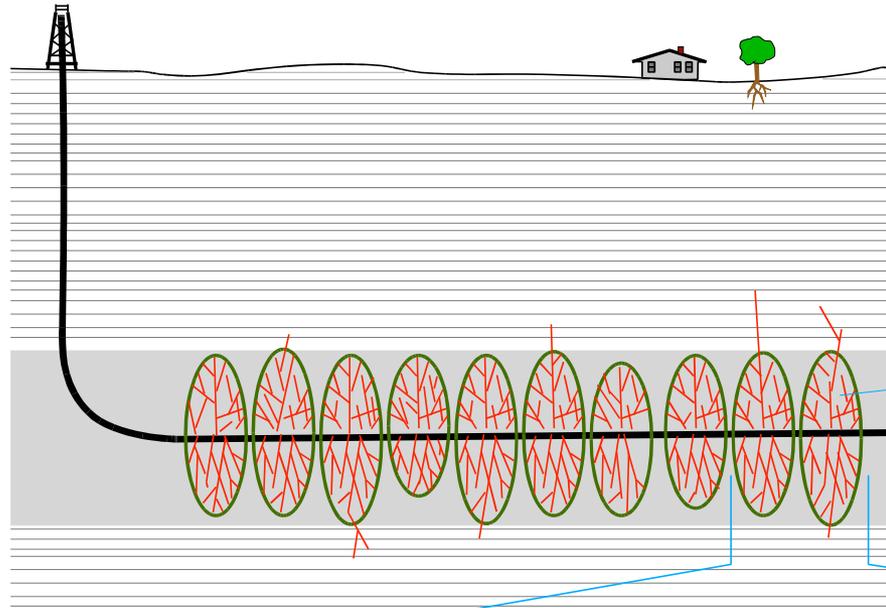


# Unconventional petroleum exploitation III: fracking design



Idealized fractures from hydraulic fracturing from one perforation in one perforation cluster of one fracking stage among 10 to 20 stages in one well

Width = 0.1 inches (2.5 mm)

Individual fractures are typically nearly vertical, because the natural maximum compressive stress is vertical, disfavoring horizontal fractures.

Width = 0.2 inches (5 mm)

300-2500 feet (100-800 m)

Sources include  
 Warpinski (2013) Understanding hydraulic fracture growth, effectiveness, and safety through microseismic monitoring (Intech);  
 Roth and Roth (2013) An analytic approach to optimizing well spacing and completions in the Bakken/Three Forks plays (URTeC); King (2012) Hydraulic fracturing 101: what every representative, environmentalist, regulator, reporter, investor, university researcher, neighbor, and engineer should know about estimating frac risk and improving frac performance in unconventional gas and oil wells (SPE). Most useful were Ajayi et al. (2013) Stimulation design for unconventional resources (Schlumberger Oilfield Review 25, 34-46) and Beard (2011 - Chesapeake Energy Corp.) Fracture design in horizontal shale wells – data gathering to implementation (EPA Hydraulic Fracturing Workshop).

Perforated casing

Cement

Four perforation clusters in one frack stage (one fracking episode of 20 minutes to four hours)

Four perforation clusters in one frack stage (one fracking episode of 20 minutes to four hours)