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Shale Gas and Hydraulic Fracturing: Cutting Through the Hysteria on Water Issues

Texas Water Laws and Regulations

HalfMoon Seminars

May 25, 2011

San Antonio, Texas



EPA's Range Resources Emergency Order

- “The consumer and well owner removed Domestic Well 1 from service...due to rising gas content within the drinking water and concerns with water quality, indoor air quality, and potential explosivity.”
- “The contaminants identified...may present an imminent and substantial endangerment to the health of persons because methane in the levels found by EPA are potentially explosive or flammable, and benzene if ingested or inhaled could cause cancer, anemia, neurological impairment and other adverse health impacts.”
- “EPA has determined that appropriate state and local authorities have not taken sufficient action to address the endangerment...and do not intend to take such action at this time....EPA has determined that this action is necessary to protect the health of persons.”

Even in Texas, Concerns Grow About Gas Drilling



 [Enlarge](#)

photo by: Stuart Palley

Demonstrators protest against natural gas drilling in downtown Fort Worth, Wednesday April 20th, 2011. The day marked the one year anniversary of BP's Deepwater Horizon rig explosion in the Gulf of Mexico.

by [Kate Galbraith](#) | April 25, 2011 | [35 Comments](#)

Texans pride themselves on being the heart of the nation's oil and gas business. But even here, public concern about the environmental consequences of natural gas drilling is growing. [FULL STORY](#)

Media's Take on Fracing

THE TEXAS TRIBUNE

Does Gas Drilling Put Radiation in Texas Water?



 [Enlarge](#)

photo by: Creative Commons/Daniel Foster

by [Kate Galbraith](#)
| [March 11, 2011](#) | [2 Comments](#)

With drilling on the rise, the Texas Railroad Commission and the Texas Commission on Environmental Quality answer questions about whether Texans need to worry about radioactivity in their water. [FULL STORY](#)

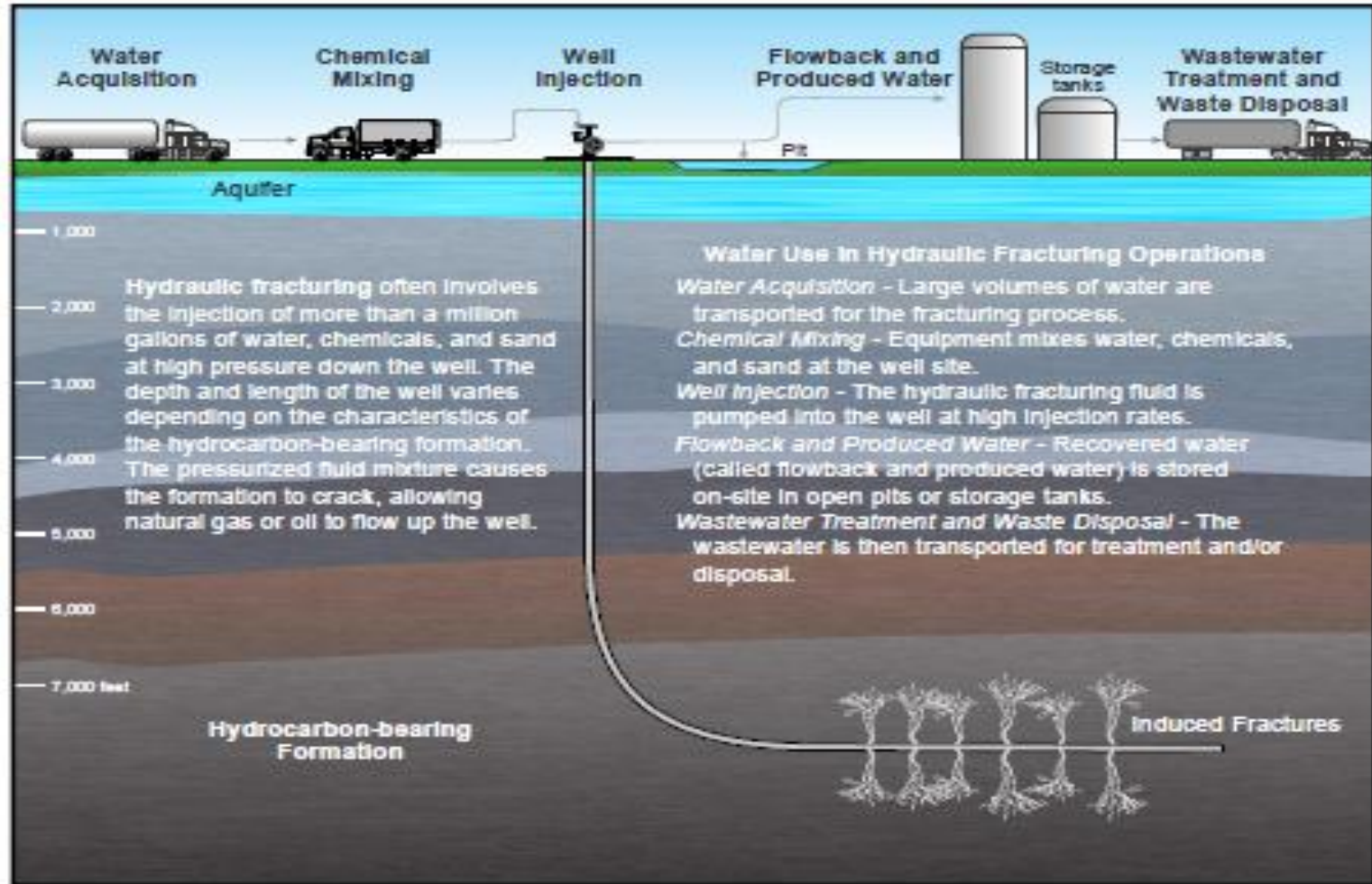
Presentation Outline

- Unconventional Shale Gas in Texas
- Regulatory Overview
- Water Needs, Supply Options, and Challenges
- Potential Risks to Groundwater and Surface Water
- Range Resources Case

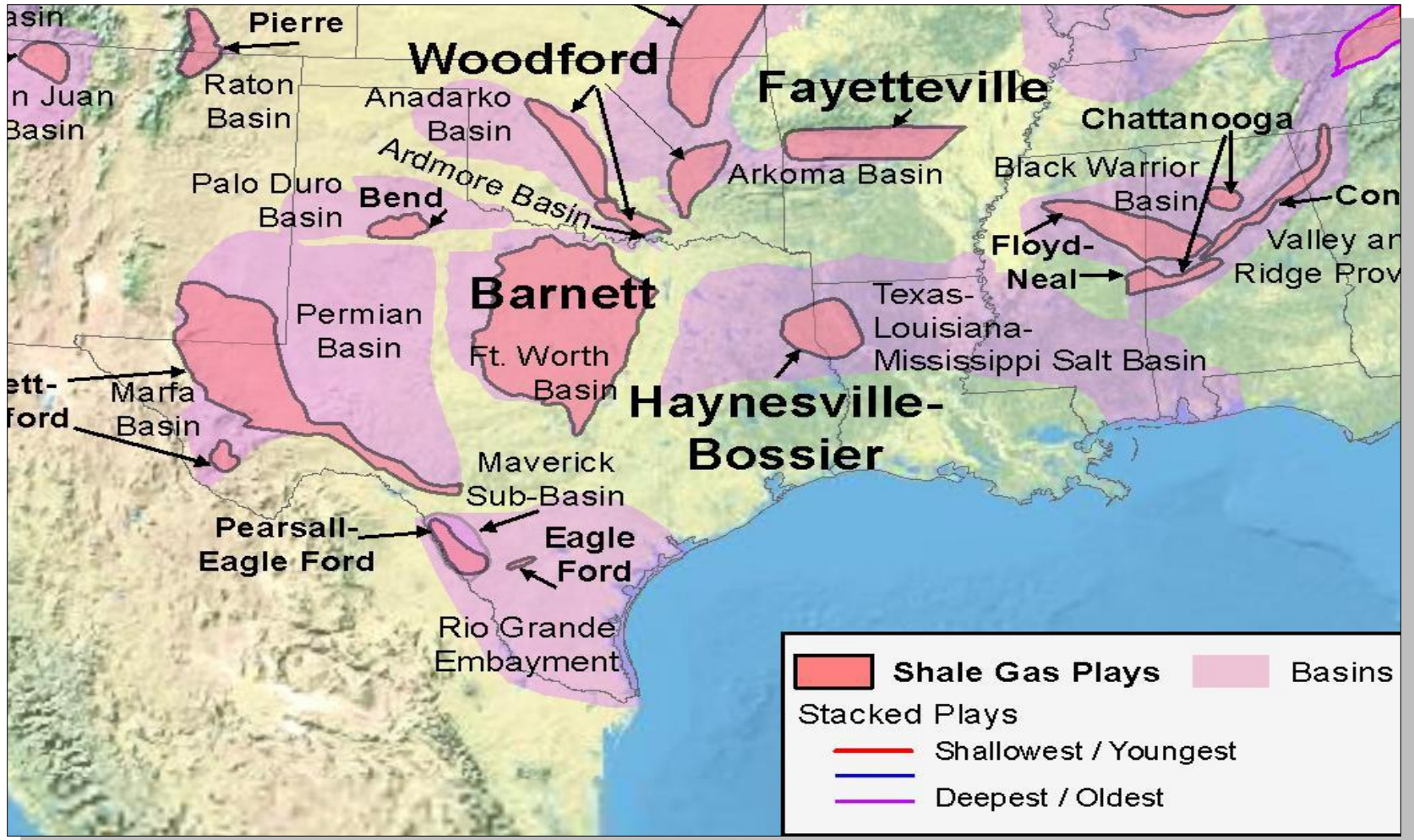
What is “Fracing”?

- “Fracing” or “Fracking” is short for Hydraulic Fracturing.
- Fracing was first used in the United States in 1947; “shooting” wells date back to 1860s.
- Fracing is basically pumping fluids at high pressures into producing formations to create fissures to allow more natural gas to escape.
- Typically fracing takes place in horizontal wells, which extend hundreds or a few thousand feet horizontally at thousands of feet of depth.
- Fracturing fluids are composed typically of:
 - 90% water
 - 9.5% sand
 - 0.5% other chemicals

Fracing Lifecycle



Texas Shale Plays



Source: EIA, http://www.eia.doe.gov/energy_in_brief/about_shale_gas.cfm.

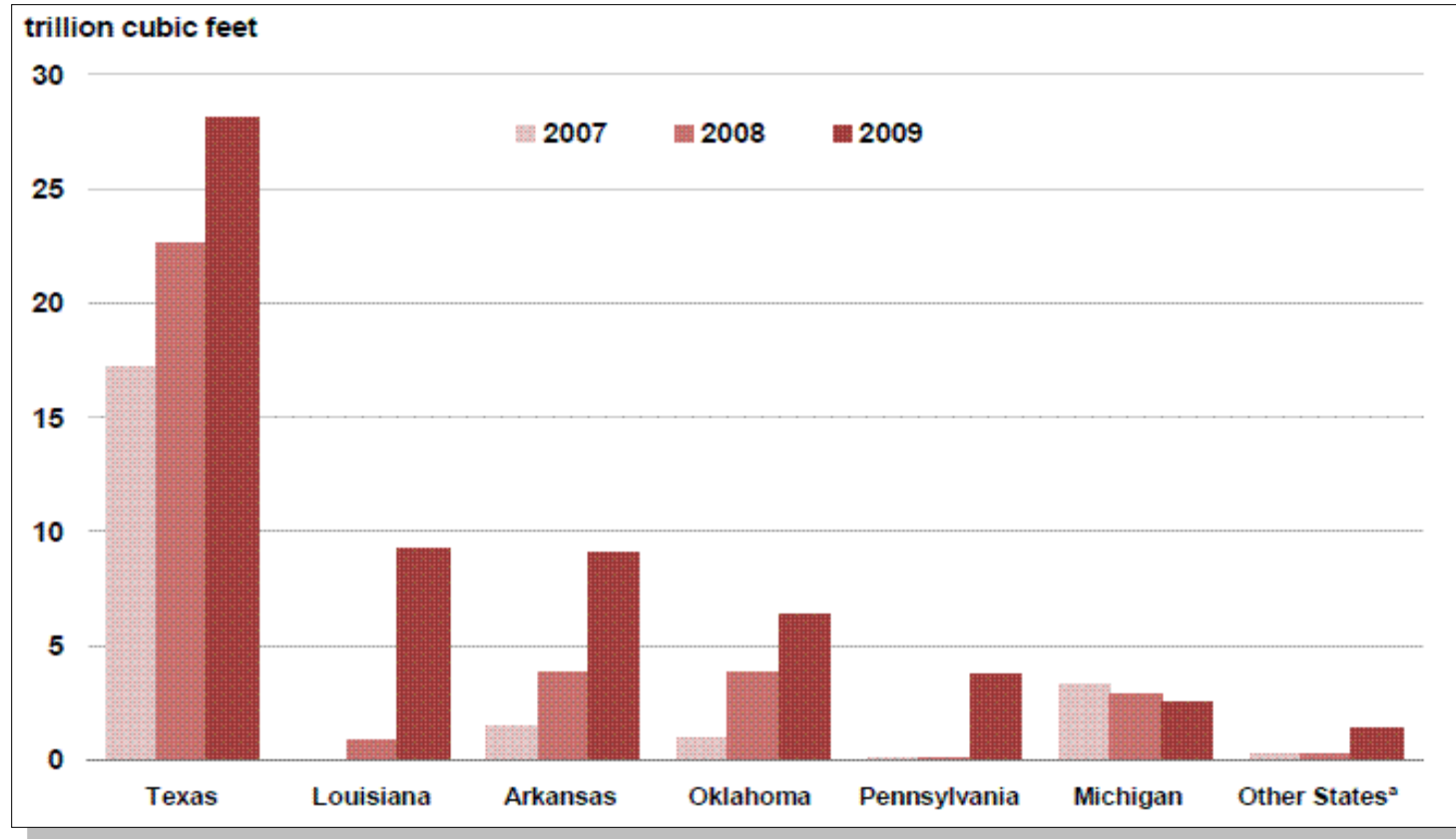
Three Primary Texas Shale Plays

- Barnett
 - Ft. Worth area
- Haynesville
 - Far East Texas – Extends into Louisiana
- Eagle Ford (Gas and Oil)
 - South of San Antonio

Shale Natural Gas Reserves and Production

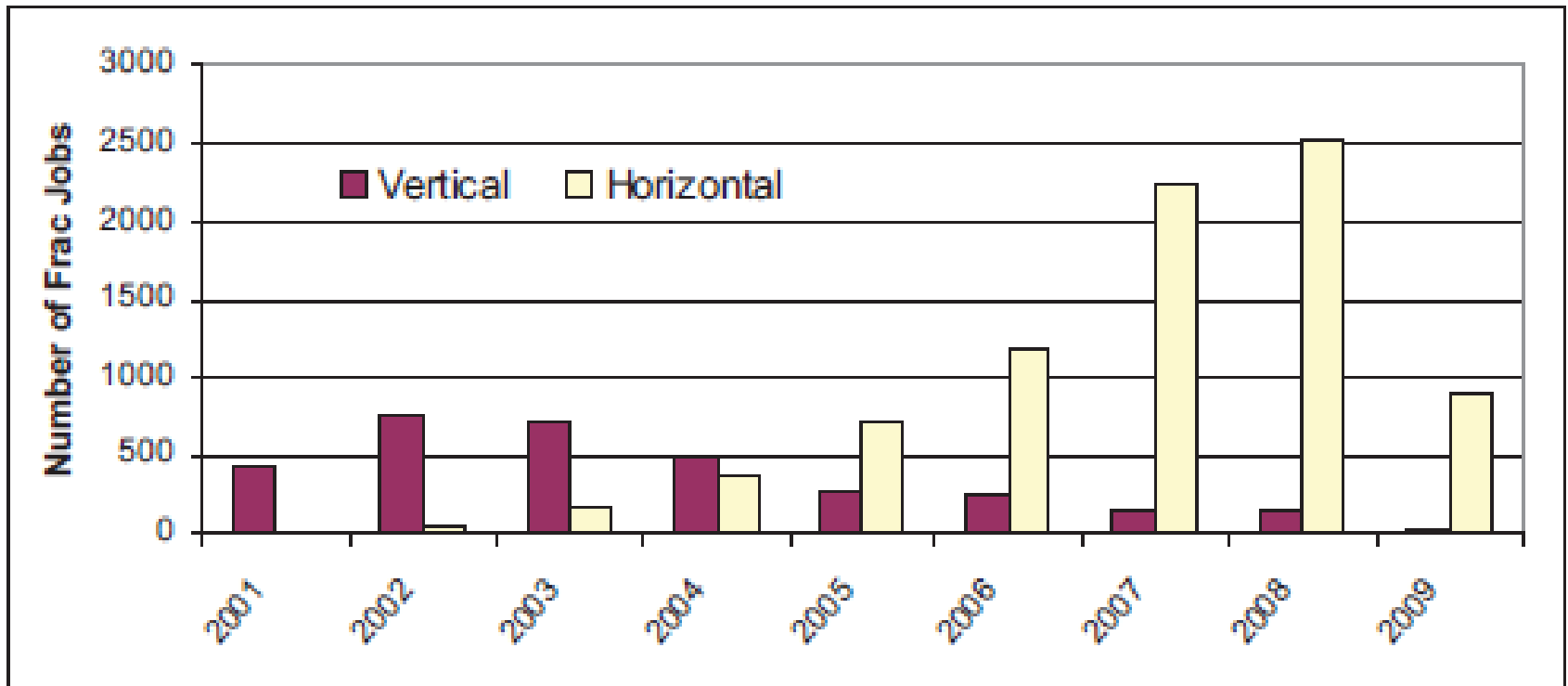
- U.S. Proven Reserves & Production:
 - Reserves
 - 2007: 23,304 (Billion Cubic Feet)
 - 2008: 34,428
 - 2009: 60,644
 - Production
 - 2007: 1,293 (Billion Cubic Feet)
 - 2008: 2,116
 - 2009: 3,110
- Texas Proven Reserves & Production:
 - Reserves
 - 2007: 17,256
 - 2008: 22,667
 - 2009: 28,167
 - Production
 - 2007: 988
 - 2008: 1,503
 - 2009: 1,789

Shale Natural Gas Reserves



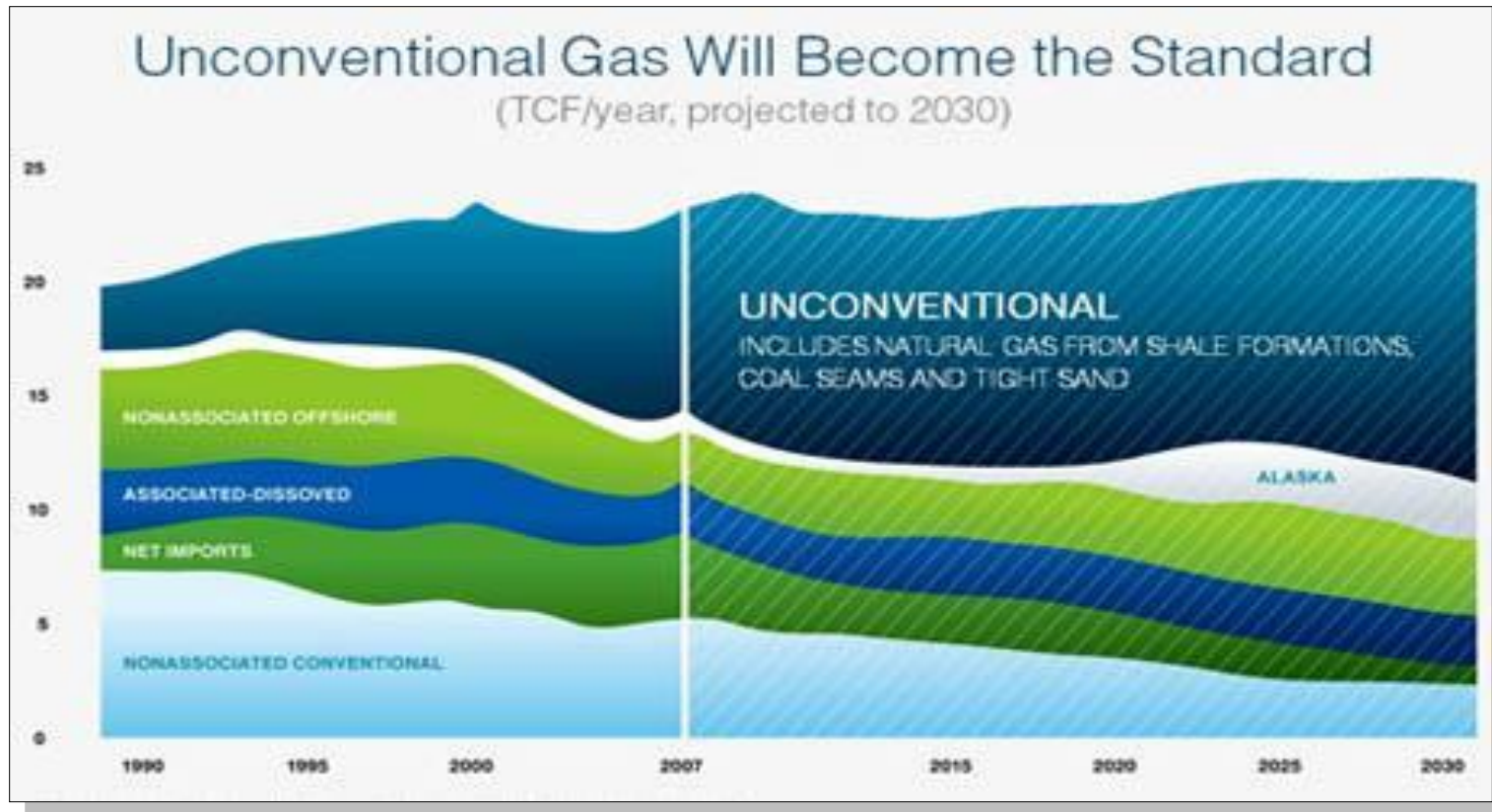
Source: EIA, http://www.eia.doe.gov/oil_gas/natural_gas/data_publications/crude_oil_natural_gas_reserves/cr.html.

Horizontal Fracing Becomes the Norm: Barnett Shale Example

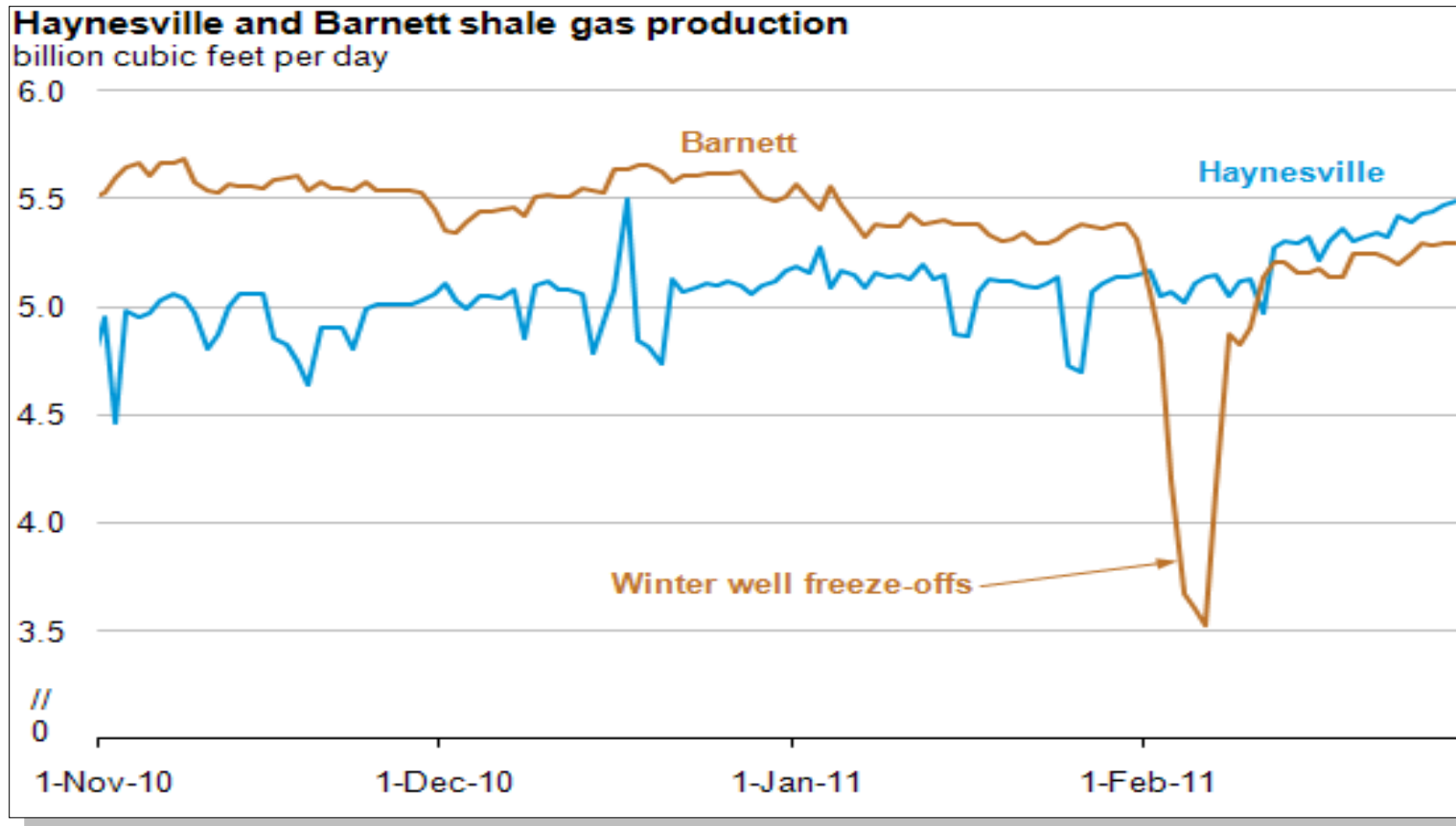


Source: Current and Projected Water Use in the Texas Mining and Oil and Gas Industry, Draft Report, Texas Water Development Board, February 2011. (TWDB Frac Study).

Shale Natural Gas Production



Haynesville Producing Greater Than Barnett



Federal Regulation

- Fracing, except for fracing with diesel fuel, was excluded from Safe Drinking Water Act definition of “underground injection” by the Energy Policy Act of 2005. (42 U.S.C. 300h(d)(1)(B)(ii)).
 - Bills introduced March 15, 2011 to remove exemption (HR 1084).
 - Similar bills introduced in Senate (S 587) and in past (2009 – HR 2766).
- April 12, 2011: EPA Deputy Administrator Bob Perciasepe testified before Congress that using diesel in fracing requires an SDWA permit or is a violation.
 - Some members of industry have previously stated that diesel is used, but also report being unable to obtain diesel fracing permits from EPA in past despite efforts.
- April 26, 2011: EPA Administrator Lisa Jackson announced EPA will issue guidance soon on the use of diesel fuel in fracing.

Texas Regulation

- No specific fracking regulation but generally covered by oil and gas laws.
- Railroad Commission of Texas (RCT) has primary oversight authority, not Texas Commission on Environmental Quality (TCEQ)
- May 2009 RCT Chairman letter: “not...a single documented contamination case associated with hydraulic fracturing.”
- Bills have been proposed to increase fracking regulation.
 - Ex: SB 1049 to increase disclosure requirements for fracking operations.

Existing RCT Regulations

- Regulations to protect groundwater include:
 - 16 Texas Administrative Code (TAC) § 3.5 permit required for drilling and deepening of wells but does not specifically cover fracing operations.
 - 16 TAC § 3.8 covers water protection and regulates storage and disposal of oil and gas wastes.
 - 16 TAC § 3.13 establishes casing, cementing, drilling, and completion of well requirements.
 - 16 TAC § 3.46 requires permit for fluid injection for enhanced oil recovery but does NOT regulate fracing.
 - If injecting diesel, will require permit.

Subsurface Trespass in Texas

- In *Coastal Oil v. Garza Energy Trust*, the Texas Supreme Court held that the rule of capture prevented a neighbor from recovering damages when subsurface hydraulic fracturing extended into the neighbor's land.
 - Court held that since the only claim of damage from trespass was damages from drainage resulting from fracturing, the claim was precluded by rule of capture.
- Texas Supreme Court intentionally avoided question of whether fracturing extending beneath another's land was itself a subsurface trespass.
 - Long history of case law where Texas Supreme Court has decided not to address question.
 - In 1992, Texas Supreme Court in *Geo Viking, Inc. v. Tex-Lee Operating Company* said fracturing constituted a trespass when it extended onto neighboring property but withdrew the opinion 6 months later.

EPA Hydraulic Fracing Study

- February 8, 2011 EPA releases Draft Hydraulic Fracturing Study Plan
- Study designed to examine “life cycle” of fracing, particularly potential affect to drinking water resources and human exposure to chemicals.
- Study will analyze and research questions involving:
 - Water Acquisition; Chemical Mixing; Well Injection; Flowback and Produced Water; and Wastewater Treatment and Waste Disposal
- Study will include:
 - Retrospective case studies, possibly in Barnett Shale counties of Wise and Denton Counties
 - Prospective cases studies, possibly in Flower Mound/Bartonville.
- Study expected to be completed in 2012, with 2014 follow-up.
- In 2004, EPA conducted study finding that hydraulic fracturing in coal-bed methane wells pose little to no threat to underground drinking water.

Other Recent Studies and Reports

- April 16, 2011:
 - Congressional report prepared by Waxman, Markey, and DeGette outlining chemicals used in fracking, including benzene, lead, and methanol.
 - Alleged use of 29 chemicals that are known or possible carcinogens.
- April 2011:
 - Prepublication of report by Cornell Professors that CO₂ emissions from shale fracking are greater than coal.

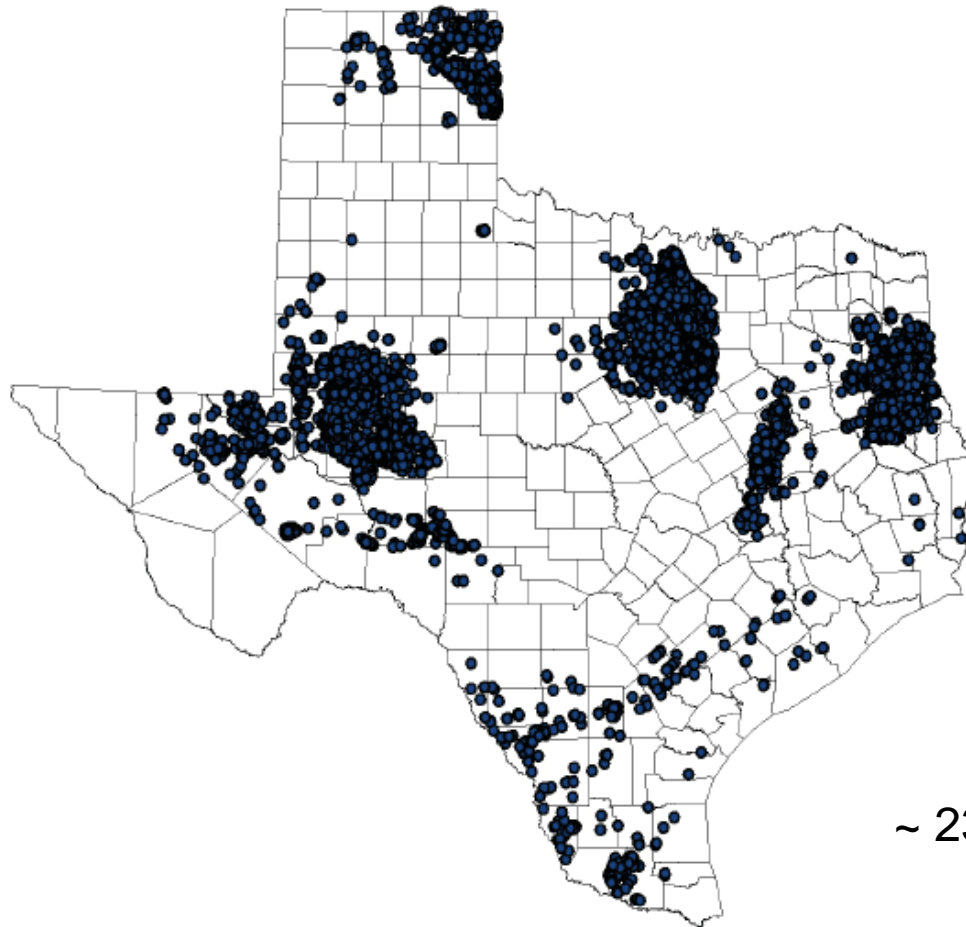
Average Water Demands of Well Fracing

- Barnett
 - Water Use (gallons/well): 2,300,000
- Haynesville
 - Water Use: 2,700,000
- Marcellus (PA)
 - Water Use: 3,800,000

Prevalence of Fracing Wells

- US: 35,000 wells fractured per year.
- US: Estimated annual water use of 70 to 140 billion gallons.
 - Equivalent water use of 40-80 cities with population of 50,000 or 1 to 2 cities of 2.5 million.
- Barnett Shale: Estimated annual water use of 2.6 to 5.3 billion gallons, estimated to peak at 9.5 billion gallons in 2010 or 1.7 % of all freshwater demand in Barnett Shale area.

All Texas Frac Jobs 2005-2009



~ 23,500 Wells

Existing Texas Water Use for Fracing (2008 Data)

| Play | Water Use (thousand AF) |
|---|----------------------------|
| Barnett Shale | 25.45 |
| Haynesville Shale | 0.11 |
| Eagle Ford Shale | 0.07 |
| Woodford/Barnett PB/Pearsall Shale | 0.09 |
| Anadarko Tight Formation | 2.22 |
| East Texas Tight Formation | 4.26 |
| Permian Basin Tight Formation | 3.09 |
| Gulf Coast Tight Formation | 0.6 |
| Caballos/Tesnus Tight Formation | 0.17 |
| Sum Shale (filtered at >0.001 Mgal) | 25.71 |
| Sum Tight Fm. (filtered at >0.001 Mgal) | 10.33 |
| Sum All (filtered at >0.001 Mgal) | 36.04 |

TWDB Demand & Supply Estimates

- Total Texas Water Demand: 22 million acre feet by 2060
- Total Texas Water Supply: 15 million acre feet by 2060

Source of Fracing Water

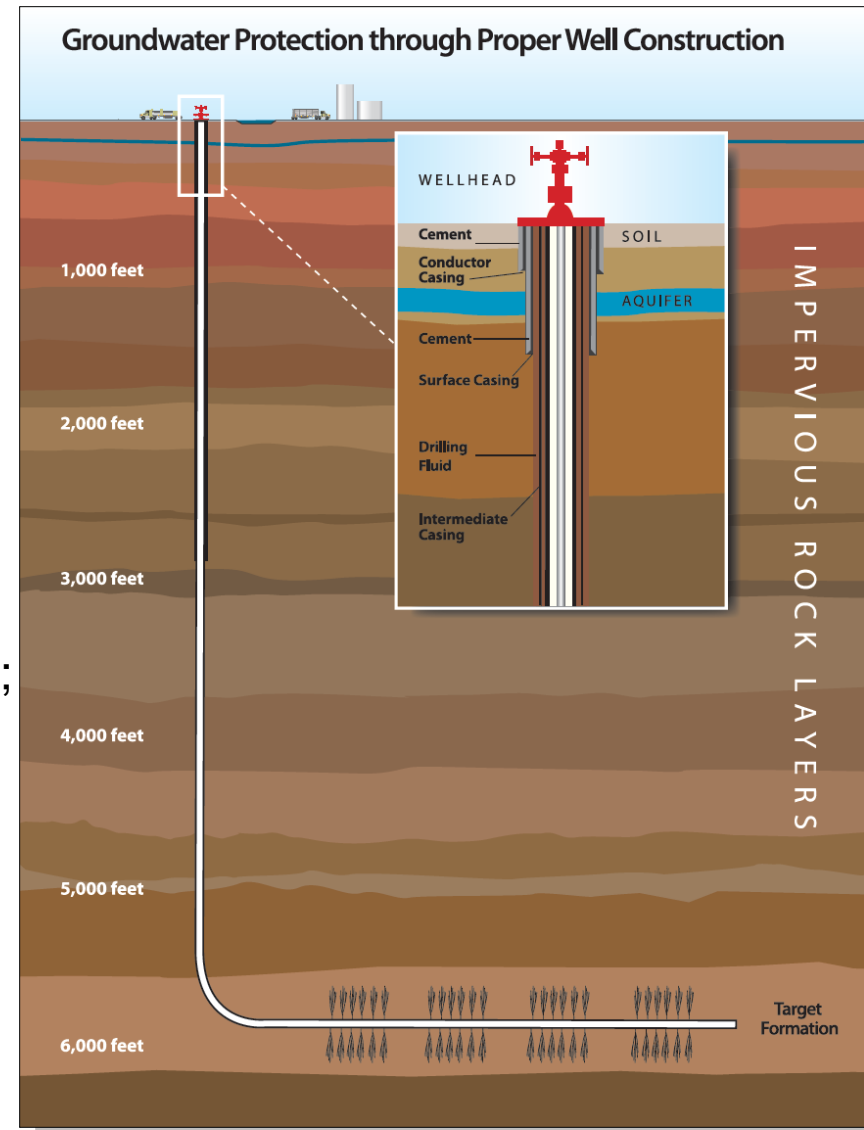
- Water typically stored on-site in 20,000-gallon portable steel (“frac”) tanks, impoundments, or centralized locations serving multiple sites.
 - In Barnett water may be stored in impoundments ranging from 8 million to 163 million gallons
 - 163 million gallons may serve 2,000 gas wells
- Water used may come from ground or surface water
- Effort are made to recycled flowback water produced in fracturing process
 - Estimates range from 10 to 40 percent recovery of flowback water in first 2 weeks.

Future Texas Water Demands

- Fracing will increase from the current ~ 37,000 AF to a peak of ~ 120,000 AF by 2020-2030
 - Expected Texas peak water demand by mid-2020s.
- Water use is contingent on price of gas
- Gas prices > \$10/Mcf:
 - All gas plays, even with marginal permeability, are expected to be fraced
- Gas prices < \$5/Mcf
 - Less gas wells will likely be drilled, less water use expected

Risk to Groundwater

- Little to no evidence of direct impact to groundwater.
- Potential contamination of groundwater if mechanical integrity of well is compromised.
- Lowering aquifer water levels by water consumption from fracing may:
 - Affect water quality by exposing mineral to oxygen-rich environment;
 - Increasing salination and potential chemical contamination;
 - Increase bacterial growth;
 - Cause upwelling of lower quality water from deeper within aquifers.



Depths of Formations and Freshwater

- Barnett
 - Formation Depth: 6,500-8,500 ft.
 - Freshwater Depth: 1,200
- Haynesville
 - Formation Depth: 10,500-13,500
 - Freshwater Depth: 400
- Marcellus (PA)
 - Formation Depth: 4,000-8,500
 - Freshwater Depth: 850

Risks to Surface Water: Flowback

- After fracing, pressure decreases and frac fluid flows back to the surface.
- Amount of frac fluid recovered as flowback varies from 25% to 75%.
- Flowback rate in first few days can exceed 100,000 gallons per day
 - Will drop to ~ 50 gallons per day over time
- As of 2009, none of 27 states with fracing require reporting of flowback
- Flowback can have frac fluids and high TDS values, concentrations of major ions (e.g. barium, bromide, calcium, iron), radionuclides, VOC, and other natural occurring elements.
- Depleted surface water sources may affect flow, depth, temperature and reduce dilution of surface water sources increase contaminations concentrations.

Handling/Disposing of Flowback

- Flowback and produced water are held in storage tanks and water impoundment pits prior to and during treatment, recycling, and disposal.
- Impoundments may be temporary or long-term.
- Underground injection is primary method for disposal for flowback and produced water.
 - Concerns regarding injection capacity and cost of trucking wastewater to injection site.
- Potential for use of publicly owned treatment works (POTW) or commercial treatment facilities if in populated areas.
 - POTWs not designed to treat fracing wastewaters
- Releases, leaks, and/or spills involving storage and transportation of flowback and produced water could contaminate shallow drinking water aquifers and surface water bodies.

EPA's Range Resources Emergency Order

- December 7, 2010: EPA issues emergency order alleging contamination of two wells.
- Order requires Range Resources, amongst other requirements, to:
 - Provide drinking water within 48 hours to affected residents;
 - Install explosivity meters within 48 hours;
 - Identify gas flow, eliminate gas flow if possible, and remediate areas of aquifer that have been impacted.
- Alleges methane contamination, not fracking fluid specifically
- Alleges that state and local authorities had not taken sufficient action to address endangerment
- Emergency Order under Section 1431 of SDWA.
 - No notice, no opportunity for Range Resources to comment, and no presentation evidence.
 - Failing to comply with Emergency Order could lead to \$16,500 per violation per day penalty.

DOJ Suit & RCT Finding

- January 18, 2011: U.S. DOJ files complaint against Range Resources for not complying with EPA's emergency order.
- January 20, 2011: Range Resources appeals order.
- March 22, 2011: Following investigation, RCT Commissioners unanimously vote to clear Range Resources of EPA allegations. EPA did not testify at hearing.

Regulatory Forecast

- Disclosure of chemical additives
- Recordkeeping and reporting
- Narrowing of UIC exemptions
- Ban on use of certain additives
- Restrictions on Disposal of Flowback Fluids

QUESTIONS?

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