# State and Federal Regulation of Hydraulic Fracturing TeleBriefing

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# Oil and Gas Regulation, Enforcement and Litigation,

# a Devil's Advocate Perspective


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# The Theory, Promise and Reality of Roping the Shale Wind

## I. Scope of the Issues Facing Texas.

Given the historic contribution to the State, oil and gas production has been regulated with a light hand. An oil soaked Jett Rink standing under a gushing well of hydrocarbons is an icon of our independence. And for more than a hundred years we have existed in a simmering balance between demands for more regulation and the needs for greater exploration and production. That all changed when George Mitchell perfected the hydraulic fracture in North Texas.

The Barnett Shale became the cradle proving ground for extracting natural gas from shale using a unique method of high pressure water fracture and sand. Combined with technological enhancements in horizontal drilling, the counties in the Barnett Shale went from 6,200 wells in 2005 to more than 15,000 today. (Exhibit 1) Many more wells will be drilled in years to come in every region of the state. Out of a necessity created by the blinding speed of production, industry operators have continually refined practices and techniques to consolidate production sites, handle voluminous waste products, reduce fracture times and move the natural gas to market. All of this having to be performed in urban environments neither familiar with nor accustomed to oil and gas production sites less than 3-400 feet from parks, homes and churches. While activity was at an all time high in the Barnett, the Haynesville shale came on line. Thereafter, the Marcellus and various other shale plays developed. Most recently, the Eagle Ford Shale in South Texas is proving to be a key focus of production activities due to the presence of oil in addition to natural gas. Repeating the early history of the Barnett, undeveloped farm and ranch country is now seeing the location of pad sites and production infrastructure at a rapid pace.

Industry has been able to unlock vast reserves in numerous parts of Texas in a very short period of time. But the speed, velocity and density of this production have proven to be the greatest challenges in finding an effective but proper balance of regulation of shale drilling activities. (See Exhibit 2 for depiction of production density) Regulatory interests range from the Texas Railroad Commission to TCEQ, EPA, TxDot, municipalities and counties. All of these governmental entities are feeling the weight of keeping up with an industry that moves rapidly across vast areas. Regulations and enforcement are slow to evolve in any sector. Awareness and familiarity with the good and bad typically takes years to develop, but government has not had that luxury with shale gas production. It's like sailing with your boat on fire.

The following is an overview of production issues and phases that do or may implicate environmental concerns. Also included is a description of the various aspects of shale gas regulation, where we are getting it done and where we are not.

## II. The Infrastructure of Shale Gas Production.

The common image of an oil and gas production site is a single pumpjack working away alongside a handful of separator tanks. The well is vertical and the oil or gas is pulled or pushed from a reservoir. Shale production technology encompasses far more. The typical Barnett Shale well is drilled approximately 8000 feet vertical and curves to create more than 5000 feet of horizontal reach. The well is cased in various lengths of steel and concrete. It's common to see "pad sites" having more than 10 wells drilled from a 4-5 acre site. Once drilled, the shale must be fractured by a mixture of high pressure fresh water, sand and chemicals to enhance and control various aspects of the fracture. To fracture a well, a large assemblage of equipment and staged water must be placed on site. Massive pumps working in a series push the water down-hole with such force that targeted areas of the shale rock are fractured, releasing the gas. Barnett Shale wells use 4-5 million gallons of fresh water per well and Eagle Ford wells use close to 13 million gallons each. Before the gas begins to flow, large volumes of the injected water mixture as well as produced water from the formation must be captured at the surface to be transported for disposal. The large volumes of fluid contain heavy concentrations of salt, chemicals and hydrocarbons. These volumes of water products are either hauled away in tankers to disposal facilities or in a growing trend are transported by pipeline for disposal. The common method for disposing of the liquid waste is injection wells drilled to the Ellenberger saltwater formation. Trucks hauling waste from the pad sites visit these disposal sites 24 hours a day.

Once the well begins to flow, the pad site may include tanks for capturing additional liquids or condensates flowing to the surface and/or lift compressors or dehydrators. The gas is transported through a dense network of gathering lines to larger transmission lines. These transmission lines require very large compressor facilities to add push or pull to the flow of the line.

## III. Aspects of Production that Warrant Additional Focus.

The light hand of regulation has ineffectively worked for historical production on small disparate fields. But production at the scale and complexity that Texas is undergoing currently renders the light hand of regulation woefully inadequate. We are drilling first and asking few questions.

### A. Water Usage.

Water usage has become an increased focus of shale production, particularly in the Eagle Ford shale currently experiencing extreme drought conditions. Barnett wells take 3-5 Million gallons per well and are sourced from both surface and groundwater facilities. Eagle Ford wells take almost three times as much water, nearly 13 Million gallons per well. Much of that supply is coming from groundwater. While the overall industry usage compared to other uses of fresh water is not uncommonly high, several issues make water a key focus for the future. Due to contamination of the fresh water with salts, chemicals and hydrocarbons, these volumes of water are being removed from the cycle entirely. Its 13 million gallons lost, not just 13 Million gallons used. Second, where groundwater is concerned, the total volume extracted is not as important as the rate and location of withdrawal. Finally, a significant concern is that the usage of water, a chief element in this production technique is entirely unregulated and therefore beyond control or predictability. That is a risk given our recognized limitations on water supplies and chosen method of managing those supplies for the future. The oil and gas industry's usage of water becomes an outlier, posing an unknown and unplanned threat to future water management. See Exhibit 3, (even the Permian Basin and GCDs are expressing concern).

Recycling technology is being used by Devon Energy and others but is not being used at sufficient scale. Necessity of continued supply and public pressure may change that.

B. Disposal of Waste.

One difficult aspect of production that has received very little attention is disposal of the millions of gallons of flowback and process water. The standard practice is transport by truck to a RRC permitted disposal facility where it is disposed of in a deep ground well. Many of these wells have been permitted and located throughout the Barnett. A question exists over whether there is an ultimate volume limit or threshold for each disposal well or area, possibly inducing earthquake activity. Since 2007 Johnson County, Texas has received 316 Million barrels of waste fluid through approximately 32 disposal wells. Other counties have seen similar volumes. With production being far from complete, this issue warrants study and analysis.

| COUNTY | WELLS | VOLUME 2007 – PRESENT (bbls) |
|---|---|---|
| Tarrant | 10 | 64,260,839 |
| Wise | 81 | 79,609,406 |
| Parker | 32 | 97,112,056 |
| Barnett Total | 113 | 604,847,313 |

Volume statistics were retrieved from the Railroad Commission of Texas.

C. Disclosure of Fracture Fluids and Chemicals.

Over the last several years, the call for greater disclosure of the type and content of added chemicals to fracture fluids has increased. Some industry players have heeded this call and have begun disclosing the type and nature of the fluids. This past session, the Texas Legislature passed HB 3328, commonly known as the Fracture Disclosure bill. It was supported but not unanimously by industry. It calls for a hydraulic fracture operator to disclose on the "Fracfocus" website:

- The total volume of water used for each operation;
- Chemical ingredients for each operation.

The operator must also disclose to the Railroad Commission:

- All chemical ingredients not listed on "Fracfocus" that were intentionally included for hydraulic fracture.

Exceptions to disclosure include chemicals not intentionally added, chemicals not disclosed to operator, and trade secrets. How this statute will be carried out remains murky but the Railroad Commission is poised to issue new rules governing the disclosure.

Recently, pursuant to a Congressional inquiry on fracture fluids and disclosure, the House Committee or Energy and Commerce published a thorough report on the subject summarizing the chemicals at issue and various issues related to disclosure. U.S. House of Representatives, Committee on Energy and Commerce, Minority Staff "Chemicals used in Hydraulic Fracturing." A complete list of fracture chemicals is attached as Exhibit 4.

Upon testimony and submissions from fourteen service companies, the report revealed that more than 2,500 different products containing 750 different chemicals were used between 2005 and 2009. These fluids constituted more than 780 million gallons of chemicals over that period. (US House Report at p.1) The most used chemicals were methanol, 2-butoxyethanol and ethylene glycol. Id. The report recognizes that this process and these chemicals are currently exempt from the Safe Drinking Water Act (US House Report at p3 and fn6). Various tables from the report follow:

**Chemicals used in Hydraulic Fracturing**

**Table 1. Chemical Components Appearing Most Often in Hydraulic Fracturing Products Used Between 2005 and 2009**

| Chemical Component | No. of Products Containing Chemical |
|---|---|
| Methanol (Methyl alcohol) | 342 |
| Isopropanol (Isopropyl alcohol, Propan-2-ol) | 274 |
| Crystalline silica – quarts (Si02) | 207 |
| Ethylene glycol monobutyl ether (2-butoxyethanol) | 126 |
| Ethylene glycol (1,2-ethanediol) | 119 |
| Hydrotreated light petroleum distillates | 89 |
| Sodium hydroxide (Caustic soda) | 80 |

**Table 2. States with the Highest Volume of Hydraulic Fracturing Fluids Containing 2-Butoxyethanol (2005-2009)**

| State | Fluid Volume (gallons) |
|---|---|
| Texas | 12,031,734 |
| Oklahoma | 2,186,613 |
| New Mexico | 1,871,501 |
| Colorado | 1,147,614 |
| Louisiana | 890,068 |
| Pennsylvania | 747,416 |
| West Virginia | 464,231 |
| Utah | 382,874 |
| Montana | 362,497 |
| Arkansas | 348,959 |

**Table 3. Chemicals Components of Concern: Carcinogens, SDWA-Regulated Chemicals, and Hazardous Air Pollutants**

| Chemical Component | Chemical Category | No. of Products |
|---|---|---|
| Methanol (Methyl alcohol) | HAP | 342 |
| Ethylene glycol (1,2-ethanediol) | HAP | 119 |
| Diesel[19] | Carcinogen, SDWA, HAP | 51 |
| Naphthalene | Carcinogen, HAP | 44 |
| Xylene | SDWA, HAP | 44 |
| Hydrogen chloride (Hydrochloric acid) | HAP | 42 |
| Toluene | SDWA, HAP | 29 |
| Ethylbenzene | SDWA, HAP | 28 |
| Diethanolamine (2,2-iminodiethanol) | HAP | 14 |
| Formaldehyde | Carcinogen, HAP | 12 |
| Sulfuric acid | Carcinogen | 9 |
| Thiourea | Carcinogen | 9 |
| Benzyl chloride | Carcinogen, HAP | 8 |
| Cumene | HAP | 6 |
| Nitrilotriacetic acid | Carcinogen | 6 |
| Dimethyl formamide | HAP | 5 |
| Phenol | HAP | 5 |
| Benzene | Carcinogen, SDWA, HAP | 3 |
| Di (2-ethylhexyl) phthalate | Carcinogen, SDWA, HAP | 3 |
| Acrylamide | Carcinogen, SDWA, HAP | 2 |
| Hydrogen fluoride (Hydrofluoric acid) | HAP | 2 |
| Phthalic anhydride | HAP | 2 |
| Acetaldehyde | Carcinogen, HAP | 1 |
| Acetophenone | HAP | 1 |
| Copper | SDWA | 1 |
| Ethylene oxide | Carcinogen, HAP | 1 |
| Lead | Carcinogen, SDWA, HAP | 1 |
| Propylene oxide | Carcinogen, HAP | 1 |
| p-Xylene | HAP | 1 |
| **Number of Products Containing a Component of Concern** | | **652** |

**Table 4. States with at Least 100,000 Gallons of Hydraulic Fracturing Fluids Containing a Carcinogen (2005-2009)**

| State | Fluid Volume (gallons) |
|---|---|
| Texas | 3,877,273 |
| Colorado | 1,544,388 |
| Oklahoma | 1,098,746 |
| Louisiana | 777,945 |
| Wyoming | 759,898 |
| North Dakota | 557,519 |
| New Mexico | 511,186 |
| Montana | 394,873 |
| Utah | 382,338 |

**Table 5. States with at Least 100,000 Gallons of Hydraulic Fracturing Fluids Containing a SDWA-Regulated Chemical (2005-2009)**

| State | Fluid Volume (gallons) |
|---|---|
| Texas | 9,474,631 |
| New Mexico | 1,157,721 |
| Colorado | 375,817 |
| Oklahoma | 202,562 |
| Mississippi | 108,809 |
| North Dakota | 100,479 |

Texas is a clear leader in the utilization and disposal of these chemical fluids. A list of chemicals identified at Fracfocus.org is attached as Exhibit 5.

D. Air Emissions.

Possibly the single largest issue that has emerged from shale production is the presence of emissions of volatile organic compounds (VOCs) from production equipment, including condensate tanks, gas treatment plants and compressor stations. Infra red testing of emissions several years ago by TCEQ revealed uncontrolled emissions across the Barnett Shale. TCEQ enacted a significant program of dedicated resources to address the emissions and address citizen complaints on an expedited basis. Currently, the Barnett Shale has numerous Auto GC monitors taking 24/7 samples and reporting those samples real time on line to the public. The City of Fort Worth initiated its own air quality study, which has conducted sampling and evaluation of nearly every oil and gas site within the City boundaries. The results of the study are due in early July, but interim reports revealed that more than 68% of all sites in Fort Worth are releasing emissions. TCEQ also engaged in a rulemaking to modify its permit by rule and standard permit in the Barnett Shale to address shale gas emission issues. Similarly, TCEQ has collected emissions inventory data on a large percentage of the emissions sources in the Barnett Shale. Enforcement actions have been taken and fines assessed on non-complaint facilities. Texas has led all shale producing fields across the U.S. in focusing on emissions from shale production activities and infrastructure.

## IV. <u>State of Enforcement and Regulation</u>.

The primary responsibility for regulation and enforcement of oil and gas production in Texas rests with the Texas Railroad Commission. TCEQ has authority over air emissions and municipalities have police power to regulate certain aspects of production but the bulk of the responsibility rests with the Railroad Commission. By and large the Railroad Commission has struggled to meets its responsibilities. The Sunset Commission review of the RRC demonstrated problems with the agency and its attempt to regulate and enforce the shale production process. From 2003 to 2008, more than 60,000 wells have been drilled, representing an increase in production of 75%. (Pro-Publica Analysis based on Texas Railroad Commission Statistics.) For the same time period, inspectors and inspections have risen only 6%. *Id*. It's either a belief that there are no problems where you do not look or that a handful of overtaxed employees can somehow do more, exponentially more. It's a prayer at best. The sunset Commission report on the Agency revealed that in 2009 there were 80,000 reports of violations, but only 4% were enforcement actions. TCEQ's ratio is 20%. And in 2009 more than

18,000 water related violations and 1% enforcement actions. (Sunset Advisory Commission Report p.p. 33-34.) (Exhibit 6) We are on the wrong course here. As production grows at blinding speed, regulation and enforcement should follow.

Some of the most sophisticated and effective regulations of the shale drilling phases of production were put in place by local jurisdictions. Each municipality has taken its own course but regulations tend to address setbacks, well locations, green completions, closed loop systems, compressor locations, pipelines, waste disposal, truck traffic and noise regulation. The City of Fort Worth engaged a stakeholder task force for approximately one year to study and devise a model ordinance. That ordinance has been utilized by many cities in the Barnett. Excerpts are attached as Exhibit 7. *See also* Texas Midstream Gas Services v. City of Grand Prairie et al., 608 F.3d 200 (5th Cir. 2010) (affirming District Court ruling on location of compressor site construing eminent domain, preemption and local land use). Regrettably, rural areas where a great deal of production is taking place, particularly in the Eagle Ford do not have such authority to regulate. So, much of that production is largely unregulated and citizens and landowners are left with few options to avoid the significant impacts to their land or homes.

## V. Conclusion.

Years of trial, error and grit by a handful of producers resulted in technical innovations unlocking a trapped reserve and giving rise to national and international production that is unprecedented. Shale gas and oil have opened serious conversations about future fuel choices and the increased use of natural gas over coal. While the rush of innovations and production are no less than mesmerizing, the scale of this production is outrunning existing regulatory frameworks. We cannot lead if we cannot plan. Further, significant environmental issues are being presented by the production techniques that must be addressed to ensure both environmental quality and long term public and investor support. The answers to these issues lie in the same source where George Mitchell found it all – technical innovation.