

Members of this subcommittee, thank you for the opportunity to testify on this issue of great importance to our State and region. My name is Craig Meis and I am currently the chairman of the Board of County Commissioners in Mesa County, Colorado. Those of you that may not be familiar with Mesa County, we are situated on the Utah-Colorado border. Our county seat is Grand Junction and we are the most populous county between Denver and Salt Lake City. We also happen to be in the heart of the Piceance Basin, were back in the late '90s when hydraulic fracturing or fracing was beginning to be employed regularly to develop the tight gas sands of the Williams Fork Formation in the Piceance Basin, we then where fully immersed in the fracing hysteria. To make a long story short, our community educated ourselves on this technology in cooperation with industry and State regulators on how and why it was being employed and became much more comfortable with its use with the safeguards in place and recognized that without this technology this resource simply could not be developed. Obviously those that profit from this hysteria being propogated then begin to discredit anyone that does not share their belief.

Little did I know at the time that as new oil and natural gas basins of our Nation began to develop as a result of fracing technology that we would once again be brought back to this issue. Around 2002, when development of Coal Bed Methane (CBM) in the Powder River Basin of Wyoming and other similar resource plays of the mid-west began attracting attention the same hysteria was raised and subsequently addressed again through education. An EPA study (attached Exhibit A) was conducted and completed in 2004 to determine if underground sources of drinking water (USDWs) were impacted from the injection of hydraulic fracturing fluids into coalbed methane wells. The EPA concluded at the time "...injection of hydraulic fracturing fluids into CBM wells poses little or no threat to USDWs and does not justify additional study at this time." The Interstate Oil and Gas Compact Commission (IOGCC), which represents the Governors of 37 States that produce virtually all the domestic oil and natural gas in the United States sent out a survey to its member States in 2002 to determine how widespread fracing technology was being deployed, if any impact related to fracing had been identified and whether state regulatory framework was in place to address this technique. The IOGCC survey determined that fracing "...has been in widespread, common use for nearly 60 years...". "Approximately 35,000 wells are hydraulically fractured annually in this country with close to one million wells having been hydraulically fractured in the United States since the technique's inception with no documented harm to groundwater." "Hydraulic fracturing has been regulated by the states since its inception...is a process that is well understood and well regulated by the petroleum producing states." (attached Exhibit B)

Fast forward to where we sit today back to the same dance now as a result of this technology being deployed in the newly developed shale oil and gas basins of the Bakken, Barnett, Marcellus, our own DJ and Piceance Basins and others. We should have guessed that the hysteria would hit a new high water mark due to the development and the deployment of fracing in the Marcellus Basin with its location in the Northeast portion of our Nation and near our most populous and politically influential States. In an attempt to locally address this issue once again several predominant industry operators in Colorado began to voluntarily disclose the chemicals used in their fracing operations via the Frac Focus website (www.fracfocus.org) managed by the Ground Water Protection Council and the IOGCC. The State of Colorado took it to another level in December of last year with passage by the Colorado Oil and Gas

Conservation Commission (COGCC) of Order No. 1R-114 or the Hydraulic Fracturing Disclosure Regulations (attached Exhibit C). Colorado now has the dubious honor of being the most regulated State in the US when it comes to hydraulic fracturing and when you consider the 2008 COGCC rulemaking and the various other State and local government regulations, we may very well be the most regulated State for the oil and gas industry. This is not necessarily a good thing when you're County like ours has been hovering around 10% unemployment for the past three years, foreclosures are at record highs and over a 1/3 of your county population is on some form of government assistance. Property tax assessments on the oil and gas industry in NW Colorado can top 80% of a Counties total taxable assessed value which shows you how volatile local government finance can be and how significant a role the industry plays in the financial wellbeing of resource rich communities of Colorado.

As I'm now in my last year of elected office having served two four year terms, I've learned that engineers like me don't necessarily make good politicians. We tend to be very analytical and technical in our assessments and decisions regardless of party affiliation. I've always tried to do what is right rather than what is politically expedient or popular since I don't consider politics to be a career path but rather community service. With this said, I've concluded that energy development in general and fracking specifically is an industry and issue that will be exploited for many years to come by the so called "environmental" organizations as their greatest fund raising efforts to date. Prior to energy development in our community these organizations tried with little success to attack the agricultural industry, with everything from land splits to pesticide use to burning, which got little traction or attention till energy development came to town. Christine Hansen – Executive Director of the IOGCC in a letter response to a Denver Post article in 2003 (attached Exhibit D) said it best, "...outrageous statements are effective in scaring people into writing big checks for phantom or overstated causes" and "Propagating the lie that hydraulic fracturing is a serious threat to drinking water are those individuals interested in the ever-expanding role for the federal government in massive environmental overregulation." I'm not sure when we are going to wake up to the fact that these organizations have become big business and are making lots of money by scaring people that are depending on leaders such as yourselves to separate the fact from the fiction. When a very technical industry like oil and gas is hiring more governmental affairs, public relations and environmental compliance staff then they are engineers and scientists, we should probably be asking ourselves what are the real cost/benefits to the rules and regulations already on the books rather than figuring out new ways to create additional ones.

With this in mind I want to share with you as I conclude an initiative started by Colorado Counties call REAL (attached Exhibit E) which stands for Responsive, Efficient, Accountable services delivered through Local-State partnership. Contained in this are key questions I hope you will ask yourselves as you consider this item or any future legislation, rule or regulation. I believe once you do you'll quickly see that hydraulic fracturing is an item which States are dealing with very effectively and given the many different technical aspects in all basins, the one size fits all approach of the Federal Government is a recipe for epic failure.

Thank you for your time and willingness to hear a local government perspective on this issue.

Executive Summary

The U.S. Environmental Protection Agency (EPA, or the Agency) conducted a study that assesses the potential for contamination of underground sources of drinking water (USDWs) from the injection of hydraulic fracturing fluids into coalbed methane (CBM) wells. To increase the effectiveness and efficiency of the study, EPA has taken a phased approach. Apart from using real world observations and gathering empirical data, EPA also evaluated the theoretical potential for hydraulic fracturing to affect USDWs. Based on the information collected and reviewed, EPA has concluded that the injection of hydraulic fracturing fluids into CBM wells poses little or no threat to USDWs and does not justify additional study at this time. EPA's decision is consistent with the process outlined in the April, 2001 Final Study Design, which is described in Chapter 2 of this report.

A USDW is defined as an aquifer or a portion of an aquifer that:

- A.
 1. *Supplies any public water system; or*
 2. *Contains sufficient quantity of groundwater to supply a public water system; and*
 - i. *currently supplies drinking water for human consumption; or*
 - ii. *contains fewer than 10,000 milligrams per liter (mg/L) total dissolved solids (TDS); and*
- B. *Is not an exempted aquifer.*

NOTE: Although aquifers with greater than 500 mg/L TDS are rarely used for drinking water supplies without treatment, the Agency believes that protecting waters with less than 10,000 mg/L TDS will ensure an adequate supply for present and future generations.

The first phase of the study, documented in this report, is a fact-finding effort based primarily on existing literature to identify and assess the potential threat to USDWs posed by the injection of hydraulic fracturing fluids into CBM wells. EPA evaluated that potential based on two possible mechanisms. The first mechanism was the direct injection of fracturing fluids into a USDW in which the coal is located, or injection of fracturing fluids into a coal seam that is already in hydraulic communication with a USDW (e.g., through a natural fracture system). The second mechanism was the creation of a hydraulic connection between the coalbed formation and an adjacent USDW.

EPA also reviewed incidents of drinking water well contamination believed to be associated with hydraulic fracturing and found no confirmed cases that are linked to fracturing fluid injection into CBM wells or subsequent underground movement of fracturing fluids. Although thousands of CBM wells are fractured annually, EPA did not find confirmed evidence that drinking water wells have been contaminated by hydraulic fracturing fluid injection into CBM wells.

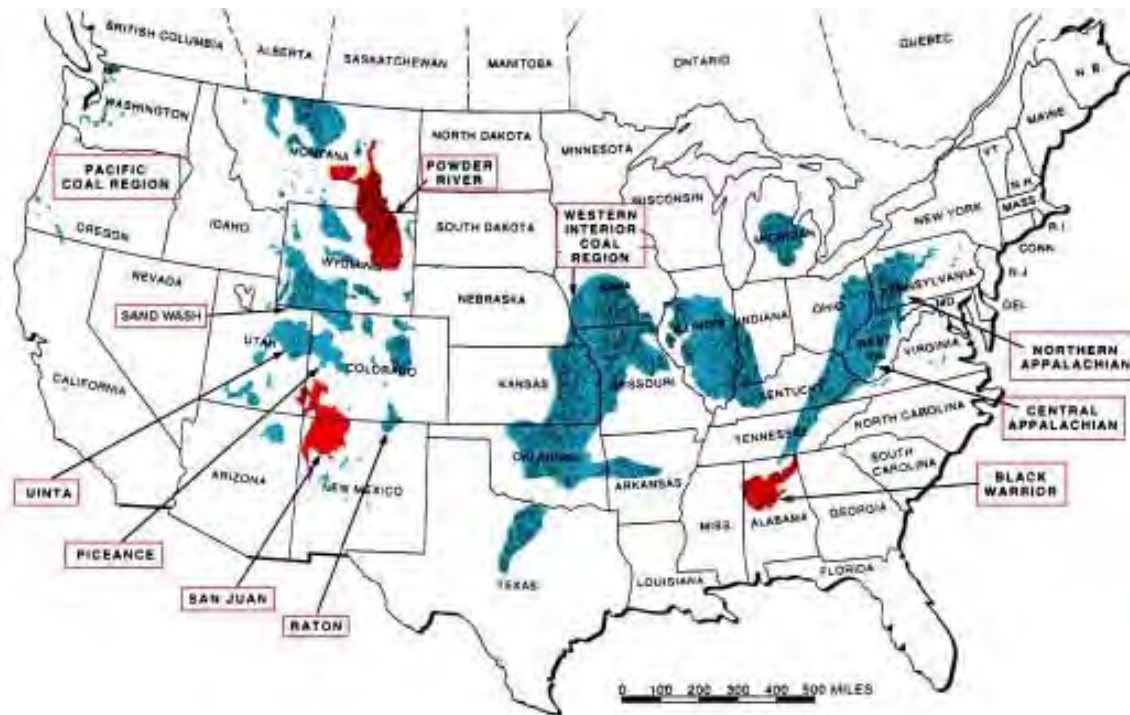
EPA has determined that in some cases, constituents of potential concern (section ES-6) are injected directly into USDWs during the course of normal fracturing operations. The use of diesel fuel in fracturing fluids introduces benzene, toluene, ethylbenzene, and xylenes (BTEX) into USDWs. BTEX compounds are regulated under the Safe Drinking Water Act (SDWA).

Given the concerns associated with the use of diesel fuel and the introduction of BTEX constituents into USDWs, EPA recently entered into a Memorandum of Agreement (MOA) with three major service companies to voluntarily eliminate diesel fuel from hydraulic fracturing fluids that are injected directly into USDWs for CBM production (USEPA, 2003). Industry representatives estimate that these three companies perform approximately 95 percent of the hydraulic fracturing projects in the United States. These companies signed the MOA on December 15, 2003 and have indicated to EPA that they no longer use diesel fuel as a hydraulic fracturing fluid additive when injecting into USDWs.

ES-1 How Does CBM Play a Role in the Nation's Energy Demands?

CBM production began as a safety measure in underground coalmines to reduce the explosion hazard posed by methane gas (Elder and Deul, 1974). In 1980, the U.S. Congress enacted a tax credit for non-conventional fuels production, including CBM production, as part of the Crude Oil Windfall Profit Act. In 1984, there were very few CBM wells in the U.S.; by 1990, there were almost 8,000 CBM wells (Pashin and Hinkle, 1997). In 1996, CBM production in 12 states totaled about 1,252 billion cubic feet, accounting for approximately 7 percent of U.S. gas production (U.S. Department of Energy, 1999). At the end of 2000, CBM production from 13 states totaled 1.353 trillion cubic feet, an increase of 156 percent from 1992. During 2000, a total of 13,973 CBM wells were in production (GTI, 2001; EPA Regional Offices, 2001). According to the U.S. Department of Energy, natural gas demand is expected to increase at least 45 percent in the next 20 years (U.S. Department of Energy, 1999). The rate of CBM production is expected to increase in response to the growing demand.

In evaluating CBM production and hydraulic fracturing activities, EPA reviewed the geology of 11 major coal basins throughout the United States (Figure ES-1). The basins shown in red have the highest CBM production volumes. They are the Powder River Basin in Wyoming and Montana, the San Juan Basin in Colorado and New Mexico, and the Black Warrior Basin in Alabama. Hydraulic fracturing is or has been used to stimulate CBM wells in all basins, but it has not frequently been used in the Powder River, Sand Wash, or Pacific Coal Basins. Table ES-1 provides production statistics for 2000 and information on hydraulic fracturing activity for each of the 11 basins in 2000.

Figure ES-1. Major United States Coal Basins**Table ES-1. Coal Basins Production Statistics and Activity Information in the U.S.**

Basin	Number of CBM Producing Wells (Year 2000)*	Production of CBM in Billions of Cubic Feet (Year 2000)*	Does Hydraulic Fracturing Occur?
Powder River	4,200	147	Yes (but infrequently)
Black Warrior	3,086	112	Yes
San Juan	3,051	925	Yes
Central Appalachian	1,924	52.9	Yes
Raton Basin	614	30.8	Yes
Uinta	494	75.7	Yes
Western Interior	420	6.5	Yes
Northern Appalachian	134	1.41	Yes
Piceance	50	1.2	Yes
Pacific Coal	0	0	Yes (but infrequently)
Sand Wash	0	0	Yes (but infrequently)

* Data provided by the Gas Technology Institute and EPA Regional Offices. Production figures include CBM extracted using hydraulic fracturing and other processes.

ES-2 What Is Hydraulic Fracturing?

CBM gas is not structurally trapped in the natural fractures in coalbeds. Rather, most of the methane is adsorbed to the coal (Koenig, 1989; Winston, 1990; Close, 1993). To extract the CBM, a production well is drilled through the rock layers to intersect the coal seam that contains the CBM. Next, fractures are created or existing fractures are enlarged in the coal seam through which the CBM can be drawn to the well and pumped to the surface.

Figure ES-2 illustrates what occurs in the subsurface during a typical hydraulic fracturing event. This diagram shows the initial fracture creation, fracture propagation, proppant placement, and the subsequent fracturing fluid recovery/groundwater extraction stage of the CBM production process. The actual extraction of CBM generally begins after a period of fluid recovery/groundwater extraction. The hydraulically created fracture acts as a conduit in the rock or coal formation, allowing the CBM to flow more freely from the coal seams, through the fracture system, and to the production well where the gas is pumped to the surface.

To create or enlarge fractures, a thick fluid, typically water-based, is pumped into the coal seam at a gradually increasing rate and pressure. Eventually the coal seam is unable to accommodate the fracturing fluid as quickly as it is injected. When this occurs, the pressure is high enough that the coal fractures along existing weaknesses within the coal (steps 1 and 2 of Figure ES-1). Along with the fracturing fluids, sand (or some other propping agent or “proppant”) is pumped into the fracture so that the fracture remains “propped” open even after the high fracturing pressures have been released. The resulting proppant-containing fracture serves as a conduit through which fracturing fluids and groundwater can more easily be pumped from the coal seam (step 3 of Fig. ES-1).

To initiate CBM production, groundwater and some of the injected fracturing fluids are pumped out (or “produced” in the industry terminology) from the fracture system in the coal seam (step 4 of Figure ES-1). As pumping continues, the pressure eventually decreases enough so that methane desorbs from the coal, flows toward, and is extracted through the production well (step 5 of Figure ES-1). In contrast to conventional gas production, the amount of water extracted declines proportionally with increasing CBM production. In some basins, huge volumes of groundwater are extracted from the production well to facilitate the production of CBM.

Figure ES-2. A Graphical Representation of the Hydraulic Fracturing Process in Coalbed Methane Wells

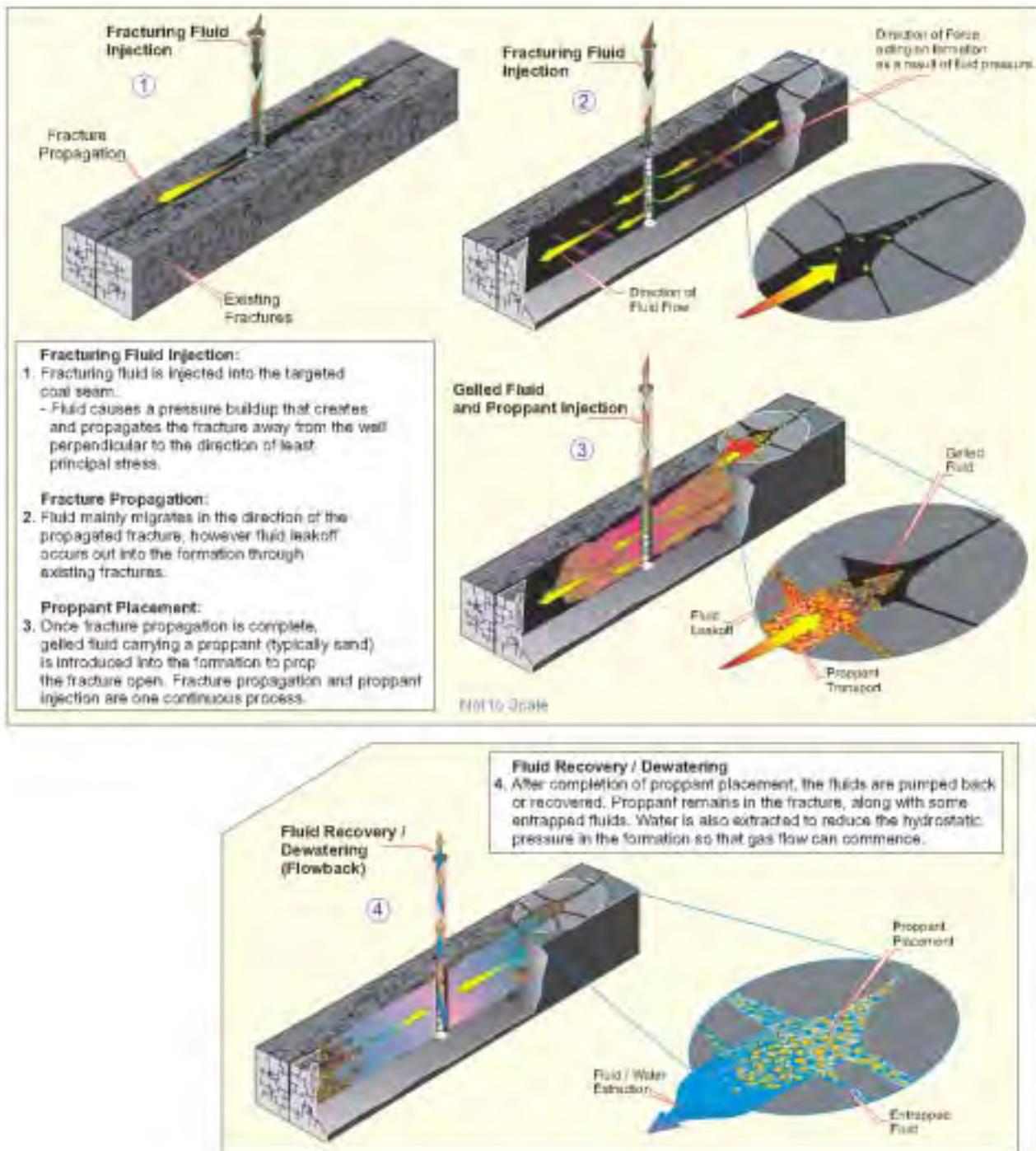
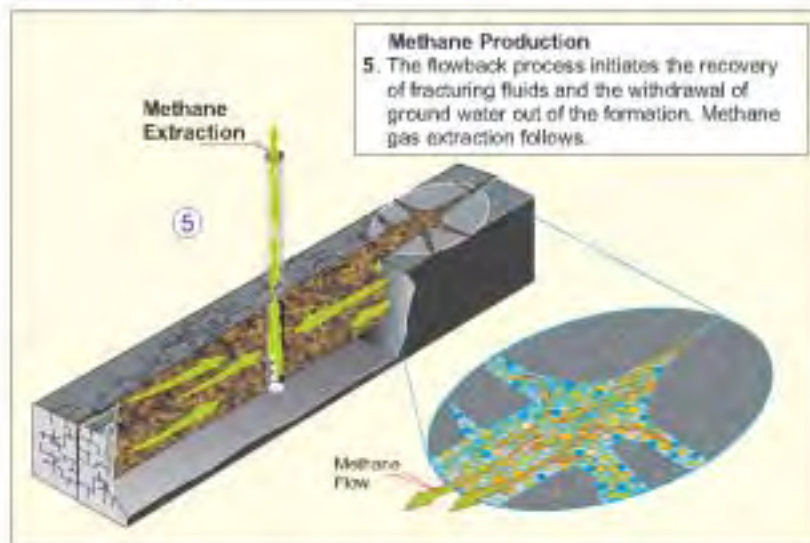
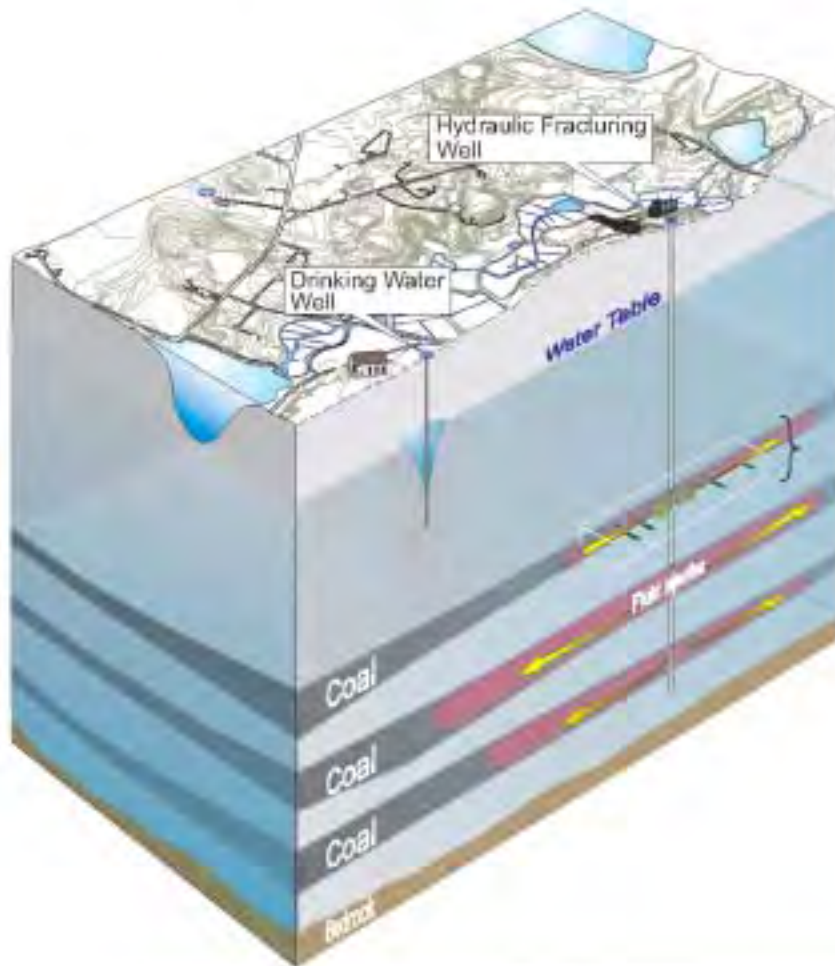


Figure ES-2. A Graphical Representation of the Hydraulic Fracturing Process in Coalbed Methane Wells (Continued)



ES-3 Why Did EPA Evaluate Hydraulic Fracturing?

SDWA requires EPA and EPA-authorized states to have effective programs to prevent underground injection of fluids from endangering USDWs (42 U.S.C. 300h et seq.). Underground injection is the subsurface emplacement of fluids through a well bore (42 U.S.C. 300h(d)(1)). Underground injection endangers drinking water sources if it may result in the presence of any contaminant in underground water which supplies or can reasonably be expected to supply any public water system, and if the presence of such a contaminant may result in such system's noncompliance with any national primary drinking water regulation (i.e., maximum contaminant levels (MCLs)) or may otherwise adversely affect the health of persons (42 U.S.C. 300h(d)(2)). SDWA's regulatory authority covers underground injection practices, but the Act does not grant authority for EPA to regulate oil and gas production.

In 1997, the Eleventh Circuit Court ruled, in *LEAF v. EPA* [*LEAF v. EPA*, 118F.3d 1467 (11th Circuit Court of Appeals, 1997)], that because hydraulic fracturing of coalbeds to produce methane is a form of underground injection, Alabama's EPA-approved Underground Injection Control (UIC) Program must effectively regulate this practice. In the wake of the Eleventh Circuit's decision, EPA decided to assess the potential for hydraulic fracturing of CBM wells to contaminate USDWs. EPA's decision to conduct this study was also based on concerns voiced by individuals who may be affected by CBM development, Congressional interest, and the need for additional information before EPA could make any further regulatory or policy decisions regarding hydraulic fracturing.

The Phase I study is tightly focused to address hydraulic fracturing of CBM wells and does not include other hydraulic fracturing practices (e.g., those for petroleum-based oil and gas production) because: (1) CBM wells tend to be shallower and closer to USDWs than conventional oil and gas production wells; (2) EPA has not heard concerns from citizens regarding any other type of hydraulic fracturing; and (3) the Eleventh Circuit litigation concerned hydraulic fracturing in connection with CBM production. The study also does not address potential impacts of non-injection related CBM production activities, such as impacts from groundwater removal or production water discharge. EPA did identify, as part of the fact-finding process, citizen concerns regarding groundwater removal and production water.

ES-4 What Was EPA's Project Approach?

Based on public input, EPA decided to carry out this study in discrete phases to better define its scope and to determine if additional study is needed after assessing the results of the preliminary phase(s). EPA designed the study to have three possible phases, narrowing the focus from general to more specific as findings warrant. This report describes the findings from Phase I of the study. The goal of EPA's hydraulic fracturing Phase I study was to assess the potential for contamination of USDWs due to the injection of hydraulic fracturing fluids into CBM wells and to determine based on these findings, whether further study is warranted.

Phase I is a fact-finding effort based primarily on existing literature. EPA reviewed water quality incidents potentially associated with CBM hydraulic fracturing, and evaluated the theoretical potential for CBM hydraulic fracturing to affect USDWs. EPA researched over 200 peer-reviewed publications, interviewed approximately 50 employees from industry and state or local government agencies, and communicated with approximately 40 citizens and groups who are concerned that CBM production affected their drinking water wells.

For the purposes of this study, EPA assessed USDW impacts by the presence or absence of documented drinking water well contamination cases caused by CBM hydraulic fracturing, clear and immediate contamination threats to drinking water wells from CBM hydraulic fracturing, and the potential for CBM hydraulic fracturing to result in USDW contamination based on two possible mechanisms as follows:

1. The direct injection of fracturing fluids into a USDW in which the coal is located (Figure ES-3), or injection of fracturing fluids into a coal seam that is already in hydraulic communication with a USDW (e.g., through a natural fracture system).
2. The creation of a hydraulic connection between the coalbed formation and an adjacent USDW (Figure ES-4).

Figure ES-3. Hypothetical Mechanisms - Direct Fluid Injection into a USDW (Where Coal Lies Within a USDW or USDWs)

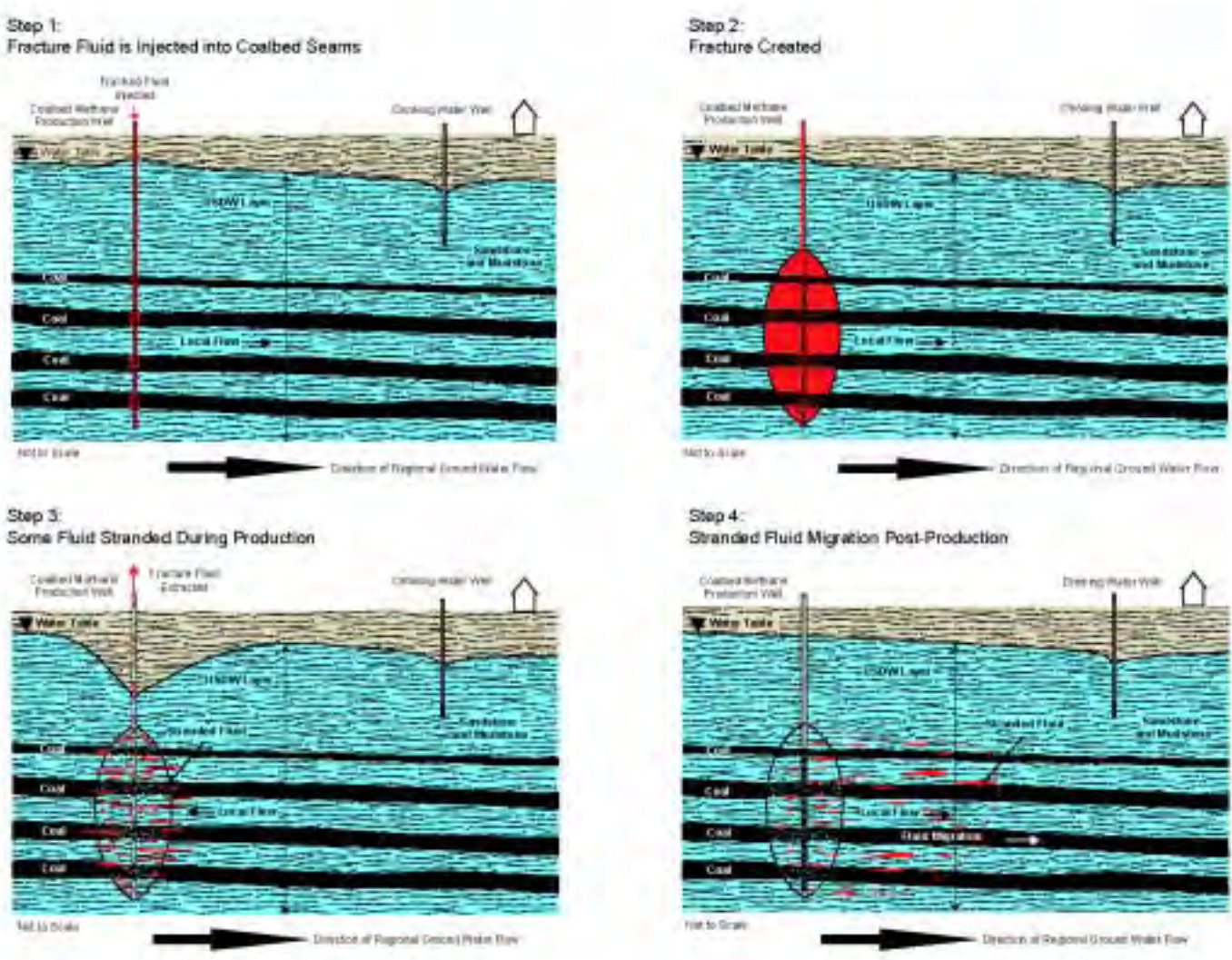
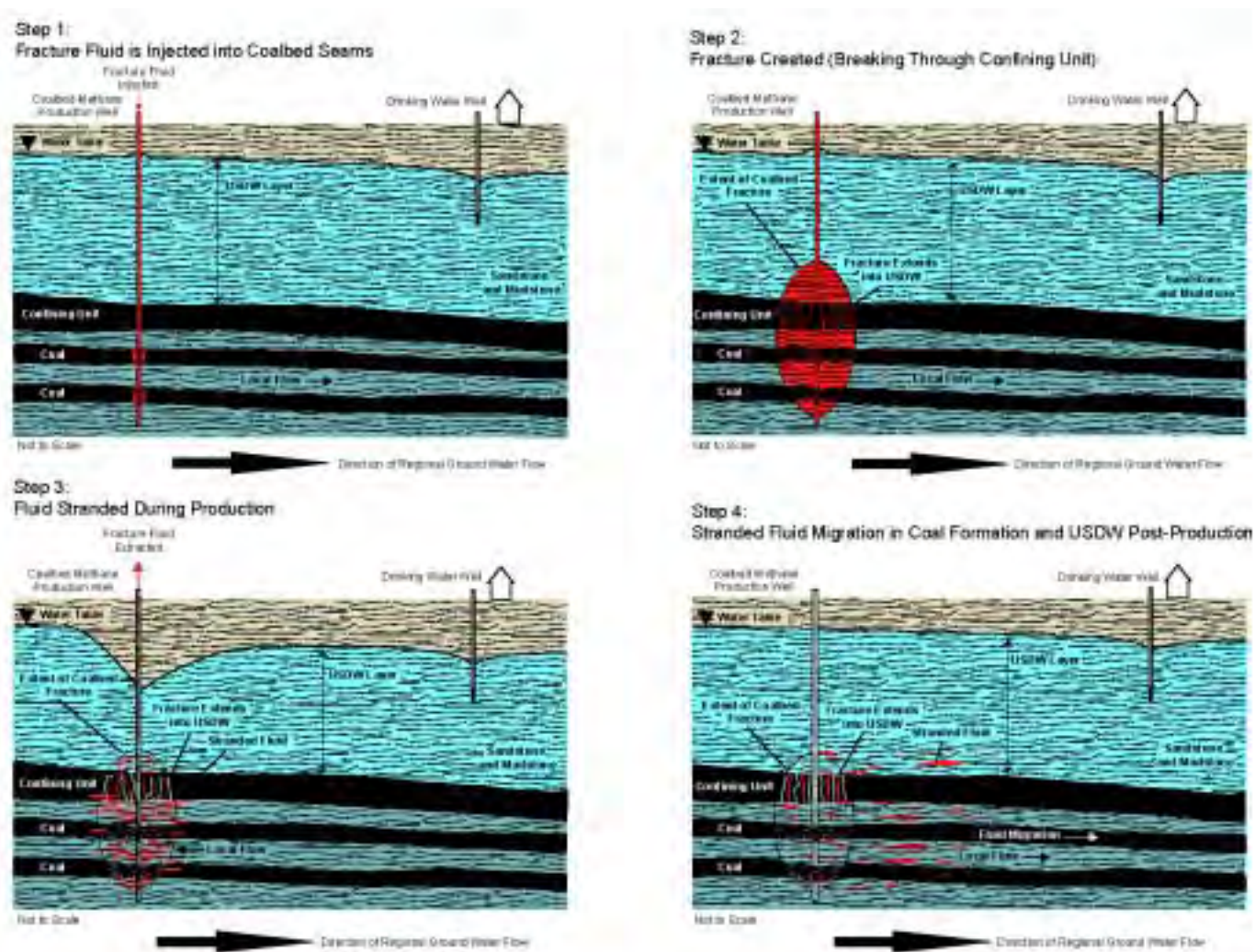


Figure ES-4. Hypothetical Mechanisms - Fracture Creates Connection to USDW

ES-5 How Do Fractures Grow?

In many CBM-producing regions, the target coalbeds occur within USDWs, and the fracturing process injects “stimulation” fluids directly into the USDWs. In other production regions, target coalbeds are adjacent to the USDWs (i.e., either higher or lower in the geologic section). Because shorter fractures are less likely to extend into a USDW or connect with natural fracture systems that may transport fluids to a USDW, the extent to which fractures propagate vertically influences whether hydraulic fracturing fluids could potentially affect USDWs.

The extent of the fractures is difficult to predict because it is controlled by the characteristics of the geologic formation (including the presence of natural fractures), the fracturing fluid used, the pumping pressure, and the depth at which the fracturing is being performed. Fracture behavior through coals, shales, and other geologic strata commonly present in coal zones depends on site-specific factors such as the relative thickness and in-situ stress differences between the target coal seam(s) and the surrounding geologic strata, as well as the presence of pre-existing natural fractures. Often, a high stress contrast between adjacent geologic strata results in a barrier to fracture propagation. An example of this would be where there is a geologic contact between a coalbed and an overlying, thick, higher-stress shale.

Another factor controlling fracture height can be the highly cleated nature of some coalbeds. In some cases, highly cleated coal seams will prevent fractures from growing vertically. When the fracturing fluid enters the coal seam, it is contained within the coal seam's dense system of cleats and the growth of the hydraulic fracture will be limited to the coal seam (see Appendix A).

Deep vertical fractures can propagate vertically to shallower depths and develop a horizontal component (Nielsen and Hansen, 1987, as cited in Appendix A: DOE, Hydraulic Fracturing). In the formation of these "T-fractures," the fracture tip may fill with coal fines or intercept a zone of stress contrast, causing the fracture to turn and develop horizontally, sometimes at the contact of the coalbed and an overlying formation. (Jones et al., 1987; Morales et al., 1990). For cases where hydraulically induced fractures penetrate into, or sometimes through, formations overlying coalbeds, they are most often attributed to the existence of pre-existing natural fractures or thinly interbedded layering.

ES-6 What Is in Hydraulic Fracturing Fluids?

Fracturing fluids consist primarily of water or inert foam of nitrogen or carbon dioxide. Other constituents can be added to fluids to improve their performance in optimizing fracture growth. Components of fracturing fluids are stored and mixed on-site. Figures ES-5 and ES-6 show fluids stored in tanks at CBM well locations.

During a hydraulic fracturing job, water and any other additives are pumped from the storage tanks to a manifold system placed on the production wells where they are mixed and then injected under high pressure into the coal formation (Figure ES-6). The hydraulic fracturing in CBM wells may require from 50,000 to 350,000 gallons of fracturing fluids, and from 75,000 to 320,000 pounds of sand as proppant (Holditch et al., 1988 and 1989; Jeu et al., 1988; Hinkel et al., 1991; Holditch, 1993; Palmer et al., 1991, 1993a, and 1993b). More typical injection volumes, based on average injection volume data provided by Halliburton for six basins, indicate a maximum average injection volume of 150,000 gallons of fracturing fluids per well, with a median average injection volume of 57,500 gallons per well (Halliburton, Inc., 2003).

Figure ES-5. Water used for the fracturing fluid is stored on-site in large, upright storage tanks and in truck-mounted tanks.



EPA reviewed material safety data sheets to determine the types of additives that may be present in fracturing fluids. Water or nitrogen foam frequently constitutes the solute in fracturing fluids used for CBM

stimulation. Other components of fracturing fluids contain benign ingredients, but in some cases, there are additives with constituents of potential concern. Because much more gel can be dissolved in diesel fuel as compared to water, the use of diesel fuel increases the efficiency in transporting proppant in the fracturing fluids. Diesel fuel is the additive of greatest concern because it introduces BTEX compounds, which are regulated by SDWA.

A thorough discussion of fracturing fluid components and fluid movement is presented in Chapter 4.

Figure ES-6. The fracturing fluids, additives, and proppant are pumped from the storage tanks to a manifold system placed on the wellhead where they are mixed just prior to injection.



ES-7 Are Coalbeds Located within USDWs?

EPA reviewed information on 11 major coal basins to determine if coalbeds are co-located with USDWs and to understand the CBM activity in the area. If coalbeds are located within USDWs, then any fracturing fluids injected into coalbeds have the potential to contaminate the USDW. As described previously, a USDW is not necessarily currently used for drinking water and may contain groundwater unsuitable for drinking without treatment. EPA found that 10 of the 11 basins may lie, at least in part, within USDWs. Table ES-2 identifies coalbed basin locations in relation to USDWs and summarizes evidence used as the basis for the conclusions.

ES-8 Did EPA Find Any Cases of Contaminated Drinking Water Wells Caused by Hydraulic Fracturing in CBM Wells?

EPA did not find confirmed evidence that drinking water wells have been contaminated by hydraulic fracturing fluid injection into CBM wells. EPA reviewed studies and follow-up investigations conducted by state agencies in response to citizen reports that CBM production resulted in water quality and quantity incidents. In addition, EPA received reports from concerned citizens in each area with significant CBM development. These complaints pertained to the following basins:

- San Juan Basin (Colorado and New Mexico);
- Powder River Basin (Wyoming and Montana);
- Black Warrior Basin (Alabama); and
- Central Appalachian Basin (Virginia and West Virginia).

Examples of concerns and claims raised by citizens include:

- Drinking water with strong, unpleasant taste and odor.
- Impacts on fish, and surrounding vegetation and wildlife.
- Loss of water in wells and aquifers, and discharged water creating artificial ponds and swamps not indigenous to region.

Water quantity complaints were the most predominant cause for complaint by private well owners. After reviewing data and incident reports provided by states, EPA sees no conclusive evidence that water quality degradation in USDWs is a direct result of injection of hydraulic fracturing fluids into CBM wells and subsequent underground movement of these fluids. Several other factors may contribute to groundwater problems, such as various aspects of resource development, naturally occurring conditions, population growth, and historical well-completion or abandonment practices. Many of the incidents that were reported (such as water loss and impacts on nearby flora and fauna from discharge of produced water) are beyond the authorities of EPA under SDWA and the scope of Phase I of this study.

Table ES-2. Evidence in Support of Coal-USDW Co-Location in U.S. Coal Basins

Basin	Are coalbeds found within USDWs?	Explanation and/or evidence
San Juan	Yes	A large area of the Fruitland system produces water containing less than 10,000 mg/L total dissolved solid (TDS), the water quality criterion for a USDW. Analyses taken from a selected coal well area (16 of 27 wells) show that produce water containing less than 10,000 mg/L TDS (Kaiser et al., 1994).
Black Warrior	Yes	Some portions of the Pottsville Formation contain waters that meet the quality criteria of less than 10,000 mg/L TDS for a USDW. According to the Alabama Oil and Gas Board, some waters in the Pottsville Formation do not meet the definition of a USDW and have TDS levels considerably higher than 10,000 mg/L (Alabama Oil and Gas Board, 2002). In the early 1990s, several authors reported fresh water production from coalbed wells at rates up to 30 gallons per minute (in Pashin et al., 1991; Ellard et al., 1992).
Piceance	Unlikely	The CBM producing Cameo Coal Zone and the lower aquifer system in the Green River Formation are more than 6,000 feet apart. The coal zone, lies at great depth, roughly 6,000 feet below the ground surface in a large portion of the basin (Tyler et al., 1998). A composite water quality sample taken from 4,637 to 5,430 feet deep within the Cameo Coal Zone in the Williams Fork Formation exhibited a TDS level of 15,500 mg/L (Graham, 2001). The produced water from CBM extraction in the Piceance Basin is of such low quality that it must be disposed of in evaporation ponds, re-injected into the formation from which it came, or re-injected at even greater depths (Tessin, 2001).
Uinta	Likely	The water quality in the Ferron and Blackhawk varies greatly with location, each having TDS levels below and above 10,000 mg/l (Utah Department of Natural Resources, 2002)
Powder River	Yes	A report prepared by the United States Geological Survey (USGS) showed that samples of water co-produced from 47 CBM wells in the Powder River Basin all had TDS levels of less than 10,000 mg/L (Rice et al., 2000). The water produced by CBM wells in the Powder River Coal Field commonly meets drinking water standards. In fact, production waters such as these have been proposed as a separate or supplemental source for municipal drinking water in some areas (DeBruin et al., 2000).
Central Appalachian	Likely	Depths of coal groups are coincident with fresh water in at least two of the states within the overall basin (Kelaifant et al., 1988; Wilson, 2001; Foster, 1980; Hopkins, 1966; USGS, 1973). Anecdotal information suggests that private wells in Virginia are screened within coal seams (Wilson 2001; VDMME, 2001).

Basin	Are coalbeds found within USDWs?	Explanation and/or evidence
Northern Appalachian	Yes	The depth of each coal group within the basin is coincident with the depths of USDWs (Kelafant et al., 1988; Platt, 2001; Foster, 1980; Hopkins, 1996; USGS, 1973; Sedam and Stein, 1970; USGS, 1971; Dugon, 1995). Water quality data from eight historic Northern Appalachian Coal Basin projects show TDS levels below 10,000 mg/L (Zebrowitz et al., 1991).
Western Interior: Arkoma	Yes (in Arkansas) Unlikely (in Oklahoma)	The depths of coalbeds within Arkansas are coincident with depths to fresh water (Andrews et al., 1998; Cordova, 1963; Friedman, 1982; Quarterly Review, 1993). Based on maps provided by the Oklahoma Corporation Commission (OCC) showing depths of the 10,000 mg/L TDS groundwater quality boundary in Oklahoma, the location of CEM wells and USDWs would most likely not coincide in that state. This is based on depths to coals typically greater than 1,000 feet (Andrews et al., 1998) and depths to the base of the USDW typically less than 900 feet (OCC Depth to Base of Treatable Water Map Series, 2001). The depths of coalbeds in Kansas are coincident with depths to fresh water (Quarterly Review, 1993; Macfarlane, 2001; DASC, 2001a).
Cherokee	Yes	The thinness of the aquifer suggests that there is significant separation from the deeper coalbeds within the basin (Bostic et al., 1993; DASC, 2001b; Condra and Reed, 1959; Flowerday et al., 1998).
Forest City	Unlikely	Water quality results from CEM wells in the Raton Basin demonstrate TDS content of less than 10,000 mg/L. Nearly all wells surveyed show a TDS of less than 2,500 mg/L, and more than half had TDS of less than 1,000 mg/L (National Water Summary, 1984).
Raton	Yes	Two gas companies produced water from coals that showed TDS levels below 10,000 mg/L. At Craig Dome in Moffat County, Cockrell Oil Corporation drilled 16 CEM wells. The wells yielded large volumes of fresh water with TDS <1,000 mg/L (Colorado Oil and Gas Commission, 2001). Fuelco was operating 11 wells along Cherokee arch. Water pumped from the wells contained 1,800 mg/L of TDS and was discharged to the ground under a National Pollution Discharge Elimination System (NPDES) permit (Quarterly Review, 1993).
Sand Wash	Yes	Data from a 1984 study demonstrates the co-location of a coal seam and a USDW in Pierce County. Water quality information from four gas test wells indicates TDS levels between 1,330 and 1,660 mg/L, well below the 10,000 mg/L criterion (Dion, 1984). Wells in the basals commonly yield 150 to 3,000 gallons per minute. TDSs levels in the water produced generally range from 250 to 500 mg/L (Dion, 1984).
Pacific and Central Coal Regions	Yes	

ES-9 What Are EPA's Conclusions?

Based on the information collected and reviewed, EPA has determined that the injection of hydraulic fracturing fluids into CBM wells poses little or no threat to USDWs. Continued investigation under a Phase II study is not warranted at this time.

As proposed in the Final Study Design (April 2001), Phase I of the study was a limited-scope assessment in which EPA would:

- Gather existing information to review hydraulic fracturing processes, practices, and settings;
- Request public comment to identify incidents that have not been reported to EPA;
- Review reported incidents of groundwater contamination and any follow-up actions or investigations by other parties (state or local agencies, industry, academia, etc.); and,
- Make a determination regarding whether further investigation is needed, based on the analysis of information gathered through the Phase I effort.

EPA's approach for evaluating the potential threat to USDWs was an extensive information collection and review of empirical and theoretical data. EPA reviewed incidents of drinking water well contamination believed to be associated with hydraulic fracturing and found no confirmed cases that are linked to fracturing fluid injection into CBM wells or subsequent underground movement of fracturing fluids. Although thousands of CBM wells are fractured annually, EPA did not find confirmed evidence that drinking water wells have been contaminated by hydraulic fracturing fluid injection into CBM wells.

EPA also evaluated the theoretical potential for hydraulic fracturing to affect USDWs through one of two mechanisms:

1. Direct injection of fracturing fluids into a USDW in which the coal is located, or injection of fracturing fluids into a coal seam that is already in hydraulic communication with a USDW (e.g., through a natural fracture system).
2. Creation of a hydraulic connection between the coalbed formation and an adjacent USDW.

Regarding the question of injection of fracturing fluids directly into USDWs, EPA considered the nature of fracturing fluids and whether or not coal seams are co-located with USDWs. Potentially hazardous chemicals may be introduced into USDWs when fracturing fluids are used in operations targeting coal seams that lie within USDWs. In

particular, diesel fuel contains BTEX compounds, which are regulated under SDWA. However, the threat posed to USDWs by the introduction of some fracturing fluid constituents is reduced significantly by the removal of large quantities of groundwater (and injected fracturing fluids) soon after a well has been hydraulically fractured. In fact, CBM production is dependent on the removal of large quantities of groundwater. EPA believes that this groundwater production, combined with the mitigating effects of dilution and dispersion, adsorption, and potentially biodegradation, minimize the possibility that chemicals included in the fracturing fluids would adversely affect USDWs.

Because of the potential for diesel fuel to be introduced into USDWs, EPA requested, and the three major service companies agreed to, the elimination of diesel fuel from hydraulic fracturing fluids that are injected directly into USDWs for CBM production (USEPA, 2003). Industry representatives estimate that these three companies perform approximately 95 percent of the hydraulic fracturing projects in the United States.

In evaluating the second mechanism, EPA considered the possibility that hydraulic fracturing could cause the creation of a hydraulic connection to an adjacent USDW. The low permeability of relatively unfractured shale may help to protect USDWs from being affected by hydraulic fracturing fluids in some basins. If sufficiently thick and relatively unfractured shale is present, it may act as a barrier not only to fracture height growth, but also to fluid movement. Shale's ability to act as a barrier to fracture height growth is primarily due to the stress contrast between the coalbed and the shale. Another factor controlling fracture height can be the highly cleated nature of some coalbeds. In some cases, when the fracturing fluid enters the coal seam, it is contained within the coal seam's dense system of cleats and the growth of the hydraulic fracture will be limited to the coal seam (see Appendix A).

Some studies that allow direct observation of fractures (i.e., mined-through studies) indicate many fractures that penetrate into, or sometimes through, one or more formations overlying coalbeds can be attributed to the existence of pre-existing natural fractures. However, given the concentrations and flowback of injected fluids, and the mitigating effects of dilution and dispersion, adsorption, and potentially biodegradation, EPA does not believe that possible hydraulic connections under these circumstances represent a significant potential threat to USDWs.

It is important to note that states with primary enforcement authority (primacy) for their UIC Programs implement and enforce their regulations, and have the authority under SDWA to place additional controls on any injection activities that may threaten USDWs. States may also have additional authorities by which they can regulate hydraulic fracturing. With the expected increase in CBM production, the Agency is committed to working with states to monitor this issue.

REFERENCES

- Alabama Oil and Gas Board. 2002. Public Comment OW-2001-0002-0029 to "Draft Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs." *Federal Register*. Vol. 63, No. 185. p. 33992, September 24, 2002.
- Andrews, R.D., B.J. Cardott, and T. Storm. 1998. The Hartshorne Play in Southeastern Oklahoma: regional and detailed sandstone reservoir analysis and coalbed-methane resources. Oklahoma Geological Survey, Special Publication 98-7.
- Bostic, J.L., L.L. Brady, M.R. Howes, R.R. Burchett, and B.S. Pierce. 1993. Investigation of the coal properties and the potential for coal-bed methane in the Forest City Basin. US Geological Survey, Open File Report 93-576.
- Close, Jay. C. 1993. Natural Fractures in Coal; Chapter 5 of AAPG Studies in Geology 38, "Hydrocarbons from Coal", pp. 119-133.
- Colorado Oil and Gas Conservation Commission. 2001. <http://www.oil-gas.state.co.us/>
- Condra, G.E. and E.C. Reed. 1959. The geological section of Nebraska. Nebraska Geological Survey Bulletin 14A, 1959.
- Cordova, R.M. 1963. Reconnaissance of the ground-water resources of the Arkansas Valley Region, Arkansas. Contributions to the Hydrology of the United States, Geological Survey Water-Supply Paper 1669-BB, 1963.
- DASC website. 2001a. Kansas elevation map.
<http://gisdasc.kgs.ukans.edu/dasc/kanview.html>
- DASC website. 2001b. Ozark Aquifer base map.
<http://gisdasc.kgs.ukans.edu/dasc/kanview.html>
- DeBruin, R.H., R.M. Lyman, R.W. Jones, and L.W. Cook. 2000. Information Pamphlet 7. Wyoming State Geological Survey.
- Dion, N.P. 1984. Washington Ground-Water Resources. In National Water Summary, US Geological Survey Water-Supply Paper No. 2275, pp. 433-438.
- Duigon, M.T. and M.J. Smigaj. 1985. First report on the hydrologic effects of underground coal mining in Southern Garrett County, Maryland, US Geological Survey Report of Investigations No. 41.

- Elder, C.H. and M. Deul. 1974. Degasification of the Mary Lee coalbed near Oak Grove, Jefferson county, Alabama, by vertical borehole in advance of mining; US Bureau of Mines Report 7968.
- Ellard, J.S., R.P. Roark, and W.B. Ayers. 1992. Geologic controls on coalbed methane production: an example from the Pottsville formation, Black Warrior Basin, Alabama USA. Symposium on Coalbed Methane Research and Development in Australia. James Cook University, p. 45-61.
- Eleventh Circuit Court of Appeals, 1997. *LEAF v. EPA*, 118F.3d 1467.
- Flowerday, C.F., R.D. Kuzelka, and D.T. Pederson, compilers. 1998. The Ground Water Atlas of Nebraska.
- Foster, J.B. 1980. Fresh and saline ground-water map of West Virginia. US Geological Survey, West Virginia Geological and Economic Survey, Map WV-12.
- Friedman, S.A. 1982. Determination of reserves of methane from coalbeds for use in rural communities in eastern Oklahoma. Oklahoma Geological Survey, Special Publication 82-3, 1982.
- Gas Technology Institute (GTI). 2001. Personal communication with GTI staff.
- Graham, G. 2001. Colorado Division of Water Resources, personal communication with staff.
- Halliburton, Inc. 2003. Personal communication with Halliburton staff, fracturing fluid expert, Steve Almond. April 2003.
- Hinkel, J.J., K.H. Nimerick, K. England, J.C. Norton, and M. Roy. 1991, Design and evaluation of stimulation and workover treatments in coal seam reservoirs; Proceedings 1991 Coalbed Methane Symposium, University of Alabama (Tuscaloosa), Tuscaloosa, p. 453-458.
- Holditch, S.A., J.W. Ely, M.E. Semmelbeck, R.H. Carter, J. Hinkle, and R.G. Jeffrey. 1988. Enhanced recovery of coalbed methane through hydraulic fracturing; SPE Paper 18250, Proceedings 1988 SPE Annual Technical Conference and Exhibition (Production Operations and Engineering), p. 689.
- Holditch, S.A., J.W. Ely, and R.H. Carter. 1989. Development of a coal seam fracture design manual; Proceedings, 1989 Coalbed Methane Symposium, Tuscaloosa, Alabama, pp. 299-320.
- Holditch, S.A., 1993, Completion methods in coal-seam reservoirs; Journal of Petroleum Technology, v.45 n.3 (March 1993), pp. 270-276.

- Hopkins, Herbert T. 1966. Fresh-saline water interface map of Kentucky. US Geological Survey, Kentucky Geological Survey, Series X.
- Jeu, S.J., T.L. Logan, and R.A. McBane. 1988, Exploitation of deeply buried coalbed methane using different hydraulic fracturing techniques; SPE paper 18253, Proceedings 63rd Annual Technical Conference (Houston).
- Jones, A.H., Bell, G.J., and Morales, R.H. 1987. Examination of potential mechanisms responsible for the high treatment pressures observed during stimulation of coalbed reservoirs; SPE Paper 16421, Proceedings, Department of Energy/SPE Symposium: Gas from Low Permeability Reservoirs, p. 317.
- Kaiser, W.R., Swartz, T.E., and Hawkins, G.J. 1994. Hydrologic framework of the Fruitland formation, San Juan Basin. New Mexico Bureau of Mines and Minerals Bulletin 146: Coalbed methane in the upper Cretaceous Fruitland formation, San Juan Basin, New Mexico and Colorado, pp. 133-164.
- Kelafant, J.R., D.E. Wicks, and V.A. Kuuskraa. March 1988. A geologic assessment of natural gas from coal seams in the Northern Appalachian Coal Basin. Topical Report – Final Geologic Report (September 1986 – September 1987).
- Macfarlane, A. 2001. Kansas Geological Survey, personal communication.
- Morales, R.H, McLennan, J.D., Jones, A.H., and Schraufnagel, R.A. 1990. Classification of treating pressures in coal fracturing; Proceedings of the 31st U.S. Symposium on Rock Mechanics, 31, pp. 687-694.
- National Water Summary. 1984. Hydrologic events, selected water-quality trends, and ground-water resources. United States Geological Survey Water-Supply Paper No. 2275.
- Nielsen, P. E. and Hanson, M. E. 1987. Analysis and Implications of Three Fracture Treatments in Coals at the USX Rock Creek Site Near Birmingham, Alabama, 1987 Coalbed Methane Symposium, Tuscaloosa, AL (Nov. 16-19, 1987).
- OCC (Oklahoma Corporation Commission), Depth to Base of Treatable Water Map Series, 2001.
- Palmer, I.D., N.S. King, and D.P. Sparks. 1991. The character of coal fracture treatments in Oak Grove field, Black Warrior basin, SPE paper no. 22914, Proceedings, 1991 Society of Petroleum Engineers annual technical conference and exhibition, pp.277-286.

- Palmer, I.D., N.S. King, and D.P. Sparks. 1993a. The character of coal fracture treatments in the Oak Grove field, Black Warrior basin; *In Situ, Journal of Coal Research*, v.17 (3), pp. 273-309.
- Palmer, I.D., S.W. Lambert, and J.L. Spitler. 1993b. Coalbed methane well completions and stimulations. Chapter 14 of *AAPG Studies in Geology* 38, pp. 303-341.
- Pashin, J.C. and F. Hinkle. 1997. *Coalbed Methane in Alabama*. Geological Survey of Alabama Circular 192, 71pp.
- Pashin, J.C., W.E. Ward, R.B. Winston, R.V. Chandler, D.E. Bolin, K.E. Richter, W.E. Osborne, and J.C. Sarnecki. 1991. Regional analysis of the Black Creek-Cobb coalbed methane target interval, Black Warrior Basin, Alabama. *Alabama Geological Survey Bulletin* 145, 127pp.
- Platt, S. January, 2001. US EPA Region 3, personal communication.
- Quarterly Review. 1993. Coalbed methane – state of the industry. *Methane From Coal Seams Technology*, August, 1993.
- Rice, C.A., M.S. Ellis, and J.H. Bullock, Jr. 2000. Water co-produced with coalbed methane in the Powder River Basin, Wyoming: preliminary compositional data. *US Geological Survey Open-File Report* 00-372.
- Sedam, A.C. and R.B. Stein. 1970. Saline ground-water resources of Ohio. *Hydrologic Investigations Atlas HA-366*, Department of the Interior, US Geological Survey.
- Tessin, R. 2001. Colorado Oil and Gas Conservation Commission, personal communication.
- Tyler, R., A.R. Scott, and W.R. Kaiser. 1998. Defining coalbed methane exploration fairways: An example from the Piceance Basin, Rocky Mountain Foreland. Western United States, Conference Document, March 23-25.
<http://georef.cos.com/cgi-bin/getRec?un=2001-012340>
- U.S. Department of Energy. 1999. Environmental Benefits of Advanced Oil and Gas Exploration and Production Technology, Office of Fossil Energy, p 8.
- U.S. Environmental Protection Agency. 2001. Personal communication with EPA Regional staff.

US Environmental Protection Agency. 2003. A Memorandum of Agreement Between The United States Environmental Protection Agency And BJ Services Company, Halliburton Energy Services, Inc., and Schlumberger Technology Corporation Elimination of Diesel Fuel in Hydraulic Fracturing Fluids Injected into Underground Sources of Drinking Water During Hydraulic Fracturing of Coalbed Methane Wells, December 12, 2003.

http://www.epa.gov/safewater/uic/pdfs/moa_uic_hyd-fract.pdf

United States Geological Survey (USGS). 1971. State of Ohio, 1:500,000 topographic map.

USGS. 1973. State of Kentucky, 1:500,000 topographic map. National Water Summary. 1984. Hydrologic events, selected water-quality trends, and groundwater resources. United States Geological Survey Water-Supply Paper No. 2275.

Utah Department of Natural Resources. 2002. Public Comment OW-2001-0002-0090 to "Draft Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs." *Federal Register*. Vol. 63, No. 185. p. 33992, September 24, 2002.

Virginia Department of Mines, Minerals, and Energy (VDMME). 2001. Personal communication with VDMME staff.

Wilson, R. February, 2001. Director, Virginia Division of Gas & Oil, Department of Mines, Minerals, and Energy, personal communication.

Winston, R.B. 1990. Vitrinite reflectance of Alabama's bituminous coal; Alabama Geological Survey Circular 139, 54 pp.

Zebrowitz, M.J., J.R. Kelafant, and C.M. Boyer. 1991. Reservoir characterization and production potential of the coal seams in Northern and Central Appalachian Basins. Proceedings of the 1991 Coalbed Methane Symposium, The University of Alabama/Tuscaloosa, May 13-16, 1991.

STATES EXPERIENCE WITH HYDRAULIC FRACTURING

A Survey of the Interstate Oil and Gas Compact Commission

July 2002

The Interstate Oil and Gas Compact Commission (IOGCC) has completed a survey of oil and natural gas producing states that provides an understanding of hydraulic fracturing and its role in the completion of oil and natural gas wells in the United States. The survey results are presented in the attached table. A copy of the survey questionnaire is also attached.

Principal findings of this survey reveal that the technique has been in widespread, common use for nearly 60 years – the technique gained its current widespread popularity as a production technique in the 1940s. Approximately 35,000 wells are hydraulically fractured annually in this country with close to one million wells having been hydraulically fractured in the United States since the technique's inception with no documented harm to groundwater. Hydraulic fracturing has been regulated by the states since its inception. A principal focus of state oil and gas regulatory programs is on protecting ground and surface water resources. The survey reveals hydraulic fracturing of natural gas and oil wells is a process that is well understood and well regulated by the petroleum producing states.

Hydraulic fracturing is used in many geological formations in order to make oil and gas flow freely to the well bore. Williams and Meyers' Manual of Oil and Gas Terms defines hydraulic fracturing as “a mechanical method of increasing the permeability of rock, and thus increasing the amount of oil or [natural] gas produced from it. The method employs hydraulic pressure to fracture the rock.” Under modern production techniques, hydraulic fracturing fluid (primarily water and sand) is injected under pressure into the rock through perforations in the well bore. The well is then allowed to flow back the injected fluid, leaving the sand to prop open the fractures in the rock. In a typical well, approximately eighty percent of the injected fluid is returned to the surface within a short period after fracturing, with an additional fifteen to twenty percent recovered through production. The injected sand material is left in the rock to create the pathway for the oil and/or natural gas to flow.

The IOGCC represents the governors of 37 states – 30 member and seven associate states – that produce virtually all the domestic oil and natural gas in the United States. The IOGCC's mission is to promote the conservation and efficient recovery of domestic oil and natural gas resources, while protecting health, safety and the environment.

SURVEY OF STATES RE: FRACTURING

STATE	YR STATE BEGAN REG.	FRACTURING DONE IN STATE?	HOW LONG FRACTURING ?	TYPE OF WELLS	APP. WELLS FRACKED ANNUALLY	APP. WELLS FRACTURED IN STATE TOTAL	% OF WELLS FRACKED	HARM ?
ALABAMA	1945	YES	1945	G,O,CSNG	285	5300	85%	NO
ALASKA	1958	YES	1981	G,O	55	1400	40%	NO
ARKANSAS	1939	YES	1980s	G,CSNG	150	N/A	75%	NO
CALIFORNIA	1915	YES	1970s	O,G	500	15,000	15%	NO
COLORADO	1951	YES	1980s	G,O,CSNG	1500	20,000	99%	NO
ILLINOIS	1939	YES	1950s	O	1,000	30 to 50,000	30%	NO
INDIANA	1947	YES	1950s	O,G	1,000	20,562	95%	NO
KANSAS	1933	YES	1960s	O,G,CSNG	900	50,000	40%	NO
KENTUCKY	1960	YES	1960s	G	1,000	30,000	50%	NO
LOUISIANA	1920s	YES	1960s	O,G	258	36,000	30%	NO
MICHIGAN	1927	YES	1970s	O,G	400	9,000	90%	NO
MISSISSIPPI	1939	YES	1960s	G	70	2 to 3,000	35%	NO
MONTANA	1954	YES	1950s	O,G	10	4,000	66%	NO
NEBRASKA	1959	YES	1950s	O,G	200	3,500	80%	NO
NEVADA	1954	YES	1980s	O	10	50	5%	NO
NEW MEXICO	1935	YES	1950s	O,G,CSNG	1,000	30,000	90%	NO
NEW YORK	1879	YES	1962	O,G	100	8,000	85%	NO
NORTH DAKOTA	1945	YES	1950s	O,G	15	290	10%	NO
OHIO	1965	YES	1950s	O,G	550	67,000	81%	NO
OKLAHOMA	1915	YES	1950s	O,G	1,150	58,000	60%	NO
PENNSYLVANIA	Pre-1900	YES	1950s	O,G,CSNG	2,000	118,000	99.9%	NO
SOUTH DAKOTA	1943	YES	1960s	O,G	10	195	90%	NO
TENNESSEE	1969	YES	1969	O,G	N/A	N/A	N/A	NO
TEXAS	1919	YES	1950s	O,G	20,220	361,000	50%	NO
UTAH	1955	YES	1970s	G,O	480	7,000	80%	NO
VIRGINIA	1950	YES	1970s	G,CSNG	300	3,000	100%	NO
WEST VIRGINIA	1929	YES	1960s	O,G,CSNG	1,000	25,000	95%	NO
WYOMING	1951	YES	1950s	O,G	500	25 to 30,000	66%	NO
TOTALS:					34,663	948,597	56.3%	

Types of wells: G=Natural Gas, O=Oil, CSNG=Natural gas from coal seams

N/A = Specific numbers not available

BEFORE THE OIL AND GAS CONSERVATION COMMISSION
OF THE STATE OF COLORADO

IN THE MATTER OF CHANGES TO THE RULES) CAUSE NO. 1R
OF PRACTICE AND PROCEDURE OF THE OIL)
AND GAS CONSERVATION COMMISSION OF) ORDER NO. 1R-114
THE STATE OF COLORADO)

REPORT OF THE COMMISSION

TO ALL INTERESTED PARTIES AND TO WHOM IT MAY CONCERN:

DEFINITIONS
(100 SERIES)

BASE FLUID shall mean the continuous phase fluid type, such as water, used in a hydraulic fracturing treatment.

CHEMICAL ABSTRACTS SERVICE shall mean the division of the American Chemical Society that is the globally recognized authority for information on chemical substances.

CHEMICAL ABSTRACTS SERVICE NUMBER OR CAS NUMBER shall mean the unique identification number assigned to a chemical by the chemical abstracts service.

CHEMICAL(S) shall mean any element, chemical compound, or mixture of elements or compounds that has its own specific name or identity such as a chemical abstract service number, whether or not such chemical is subject to the requirements of 29 Code of Federal Regulations §1910.1200(g)(2) (2011).

CHEMICAL DISCLOSURE REGISTRY shall mean the chemical registry website known as fracfocus.org developed by the Ground Water Protection Council and the Interstate Oil and Gas Compact Commission. If such website becomes permanently inoperable, then chemical disclosure registry shall mean another publicly accessible information website that is designated by the Commission.

CHEMICAL FAMILY shall mean a group of chemicals that share similar chemical properties and have a common general name.

HEALTH PROFESSIONAL shall mean a physician, physician assistant, nurse practitioner, registered nurse, or emergency medical technician licensed by the State of Colorado.

HYDRAULIC FRACTURING ADDITIVE shall mean any chemical substance or combination of substances, including any chemicals and proppants, that is intentionally added to a base fluid for purposes of preparing a hydraulic fracturing fluid for treatment of a well.

HYDRAULIC FRACTURING FLUID shall mean the fluid, including the applicable base fluid and all hydraulic fracturing additives, used to perform a hydraulic fracturing treatment.

HYDRAULIC FRACTURING TREATMENT shall mean all stages of the treatment of a well by the application of hydraulic fracturing fluid under pressure that is expressly designed to initiate or propagate fractures in a target geologic formation to enhance production of oil and natural gas.

PROPPANT shall mean sand or any natural or man-made material that is used in a hydraulic fracturing treatment to prop open the artificially created or enhanced fractures once the treatment is completed.

TOTAL WATER VOLUME shall mean the total quantity of water from all sources used in the hydraulic fracturing treatment, including surface water, ground water, produced water or recycled water.

TRADE SECRET shall have the meaning set forth in § 7-74-102(4) (2011) of the Colorado Uniform Trade Secrets Act.

GENERAL RULES
(200 SERIES)

205. ACCESS TO RECORDS

- a. All producers, operators, transporters, refiners, gasoline or other extraction plant operators and initial purchasers of oil and gas within this State, shall make and keep appropriate books and records covering their operations in the State, including natural gas meter calibration reports, from which they may be able to make and substantiate the reports required by the Commission or the Director.
- b. Beginning May 1, 2009 on federal land and April 1, 2009 on all other land, operators shall maintain MSDS sheets for any Chemical Products brought to a well site for use downhole during drilling, completion, and workover operations, excluding hydraulic fracturing treatments. With the exception of fuel as provided for in Rule 205.c., the reporting and disclosure of hydraulic fracturing additives and chemicals brought to a well site for use in connection with hydraulic fracturing treatments is governed by Rule 205A.
- c. Beginning June 1, 2009, operators shall maintain a Chemical Inventory by well site for each Chemical Product used downhole during drilling, completion, and workover operations, excluding hydraulic fracturing treatments, in an amount exceeding five hundred (500) pounds during any quarterly reporting period. Operators shall also maintain a chemical inventory by well site for fuel stored at the well site during drilling, completion, and workover operations, including hydraulic fracturing treatments, in an amount exceeding five hundred (500) pounds during any quarterly reporting period.

The five hundred (500) pound reporting threshold shall be based on the cumulative maximum amount of a Chemical Product present at the well site during the quarterly reporting period. Entities maintaining Chemical Inventories under this section shall update these inventories quarterly throughout the life of the well site. These records must be maintained in a readily retrievable format at the operator's local field office. The Colorado Department of Public Health and Environment may obtain information provided to the Commission or Director in a Chemical Inventory upon written request to the Commission or the Director.

- d. Where the composition of a Chemical Product is considered a Trade Secret by the vendor or service provider, Operators shall only be required to maintain the identity of the Trade Secret Chemical Product and shall not be required to maintain information concerning the identity of chemical constituents in a Trade Secret Chemical Product or the amounts of such constituents. The vendor or service provider shall provide to the Commission a list of the chemical constituents contained in a Trade Secret Chemical Product upon receipt of a letter from the Director stating that such information is necessary to respond to a spill or release of a Trade Secret Chemical Product or a complaint from a potentially adversely affected landowner regarding impacts to public health, safety, welfare, or the environment. Upon receipt of a written statement of necessity, information regarding the chemical constituents contained in a Trade Secret Chemical Product shall be disclosed by the vendor or service provider directly to the Director or his or her designee.

The Director or designee may disclose information regarding those chemical constituents to additional Commission staff members to the extent that such disclosure is necessary to allow the Commission staff member receiving the information to assist in responding to the spill, release, or complaint, provided that such individuals shall not disseminate the information further. In addition, the Director may disclose information regarding those chemical constituents to any Commissioner, the relevant County Public Health Director or Emergency Manager, or to the Colorado Department of Public Health and Environment's Director of Environmental Programs upon request by that individual. Any information so disclosed to the Director, a Commission staff member, a Commissioner, a County Public Health Director or Emergency Manager, or to the Colorado Department of Public Health and

Environment's Director of Environmental Programs shall at all times be considered confidential and shall not become part of the Chemical Inventory, nor shall it be construed as publicly available. The Colorado Department of Public Health and Environment's Director of Environmental Programs, or his or her designee, may disclose information regarding the chemical constituents contained in a Trade Secret Chemical Product to Colorado Department of Public Health and Environment staff members under the same terms and conditions as apply to the Director.

- e. The vendor or service provider shall also provide the chemical constituents of a Trade Secret Chemical Product to any health professional who requests such information in writing if the health professional provides a written statement of need for the information and executes a Confidentiality Agreement, Form 35. The written statement of need shall be a statement that the health professional has a reasonable basis to believe that (1) the information is needed for purposes of diagnosis or treatment of an individual, (2) the individual being diagnosed or treated may have been exposed to the chemical concerned, and (3) knowledge of the chemical constituents of such Trade Secret Chemical Product will assist in such diagnosis or treatment. The Confidentiality Agreement, Form 35, shall state that the health professional shall not use the information for purposes other than the health needs asserted in the statement of need, and that the health professional shall otherwise maintain the information as confidential. Where a health professional determines that a medical emergency exists and the chemical constituents of a Trade Secret Chemical Product are necessary for emergency treatment, the vendor or service provider shall immediately disclose the chemical constituents of a Trade Secret Chemical Product to that health professional upon a verbal acknowledgement by the health professional that such information shall not be used for purposes other than the health needs asserted and that the health professional shall otherwise maintain the information as confidential. The vendor or service provider may request a written statement of need, and a Confidentiality Agreement, Form 35, from all health professionals to whom information regarding the chemical constituents was disclosed, as soon as circumstances permit. Information so disclosed to a health professional shall not become part of the Chemical Inventory and shall in no way be construed as publicly available.
- f. Such books, records, inventories, and copies of said reports required by the Commission or the Director shall be kept on file and available for inspection by the Commission for a period of at least five years except for the Chemical Inventory, which shall be kept on file and available for inspection by the Commission for the life of the applicable oil and gas well or oil and gas location and for five (5) years after plugging and abandonment. Upon the Commission's or the Director's written request for information required to be maintained or provided under this section, the record-keeping entity or third-party vendor shall supply the Commission or the Director with the requested information within three (3) business days in a format readily-reviewable by the Commission or the Director, except in the instance where such information is necessary to administer emergency medical treatment in which case such information shall be provided as soon as possible. Information provided to the Commission or the Director under this section that is entitled to protection under state or federal law, including C.R.S. § 24-72-204, as a trade secret, privileged information, or confidential commercial, financial, geological, or geophysical data shall be kept confidential and protected against public disclosure unless otherwise required, permitted, or authorized by other state or federal law. Any disclosure of information entitled to protection under any state or federal law made pursuant to this section shall be made only to the persons required, permitted, or authorized to receive such information under state or federal law in order to assist in the response to a spill, release, or complaint and shall be subject to a requirement that the person receiving such information maintain the confidentiality of said information. The Commission or the Director shall notify the owner, holder, or beneficiary of any such protected information at least one (1) business day prior to any required, permitted, or authorized disclosure. This notification shall include the name and contact information of the intended recipient of such protected information, the reason for the

disclosure, and the state or federal law authorizing the disclosure. Information so disclosed shall not become part of the Chemical Inventory and shall in no way be construed as publicly available. 200-4 As of May 30, 2009

- g. The Director and the authorized deputies shall have access to all well records wherever located. All operators, drilling contractors, drillers, service companies, or other persons engaged in drilling or servicing wells, shall permit the Director, or authorized deputy, at the Director's or their risk, in the absence of negligence on the part of the owner, to come upon any lease, property, or well operated or controlled by them, and to inspect the record and operation of such wells and to have access at all times to any and all records of wells; provided, that information so obtained shall be kept confidential and shall be reported only to the Commission or its authorized agents.
- h. In the event that the vendor or service provider does not provide the information required by Rules 205.d, 205.e, or 205.f directly to the Commission or a health professional, the operator is responsible for providing the required information.
- i. In the event the operator establishes to the satisfaction of the Director that it lacks the right to obtain the information required by Rules 205.d, 205.e, or 205.f and to provide it directly to the Commission or a health professional, the operator shall receive a variance from these rule provisions from the Director.

205A. HYDRAULIC FRACTURING CHEMICAL DISCLOSURE.

a. Applicability. This Commission Rule 205a applies to hydraulic fracturing treatments performed on or after April 1, 2012.

b. Required disclosures.

(1) Vendor and service provider disclosures. A service provider who performs any part of a hydraulic fracturing treatment and a vendor who provides hydraulic fracturing additives directly to the operator for a hydraulic fracturing treatment shall, with the exception of information claimed to be a trade secret, furnish the operator with the information required by subsection 205A.b.(2)(A)(viii) – (xii) and subsection 205A.b.(2)(B), as applicable, and with any other information needed for the operator to comply with subsection 205A.b.(2). Such information shall be provided as soon as possible within 30 days following the conclusion of the hydraulic fracturing treatment and in no case later than 90 days after the commencement of such hydraulic fracturing treatment.

(2) Operator disclosures.

A. Within 60 days following the conclusion of a hydraulic fracturing treatment, and in no case later than 120 days after the commencement of such hydraulic fracturing treatment, the operator of the well must complete the chemical disclosure registry form and post the form on the chemical disclosure registry, including:

- (i) the operator name;
- (ii) the date of the hydraulic fracturing treatment;
- (iii) the county in which the well is located;
- (iv) the API number for the well;
- (v) the well name and number;
- (vi) the longitude and latitude of the wellhead;

(vii) the true vertical depth of the well;

(viii) the total volume of water used in the hydraulic fracturing treatment of the well or the type and total volume of the base fluid used in the hydraulic fracturing treatment, if something other than water;

(ix) each hydraulic fracturing additive used in the hydraulic fracturing fluid and the trade name, vendor, and a brief descriptor of the intended use or function of each hydraulic fracturing additive in the hydraulic fracturing fluid;

(x) each chemical intentionally added to the base fluid;

(xi) the maximum concentration, in percent by mass, of each chemical intentionally added to the base fluid; and

(xii) the chemical abstract service number for each chemical intentionally added to the base fluid, if applicable.

B. If the vendor, service provider, or operator claim that the specific identity of a chemical, the concentration of a chemical, or both the specific identity and concentration of a chemical is/are claimed to be a trade secret, the operator of the well must so indicate on the chemical disclosure registry form and, as applicable, the vendor, service provider, or operator shall submit to the Director a Form 41 claim of entitlement to have the specific identity of a chemical, the concentration of a chemical, or both withheld as a trade secret. The operator must nonetheless disclose all information required under subsection 205A.b.(2)(A) that is not claimed to be a trade secret. If a chemical is claimed to be a trade secret, the operator must also include in the chemical registry form the chemical family or other similar descriptor associated with such chemical.

C. At the time of claiming that a hydraulic fracturing chemical, concentration, or both is entitled to trade secret protection, a vendor, service provider or operator shall file with the commission claim of entitlement, Form 41, containing contact information. Such contact information shall include the claimant's name, authorized representative, mailing address, and phone number with respect to trade secret claims. If such contact information changes, the claimant shall immediately submit a new Form 41 to the Commission with updated information.

D. Unless the information is entitled to protection as a trade secret, information submitted to the Commission or posted to the chemical disclosure registry is public information.

(3) Ability to search for information.

A. If the Commission determines, as of January 1, 2013, that:

(i) The chemical disclosure registry does not allow the Commission staff and the public to search and sort the registry for Colorado information by geographic area, ingredient, chemical abstract service number, time period, and operator; and

(ii) There is no reasonable assurance that the registry will allow for such searches by a date certain acceptable to the Commission,

Then the provisions of subsection 205A.b.(3)(B) below shall apply.

B. Beginning February 1, 2013, any operator who posts a chemical disclosure form on the chemical disclosure registry shall also submit the form to the Commission in an electronic format acceptable to the Commission. As soon thereafter as

practicable, the Commission shall make such forms available on the Commission's website in a manner that allows the public to search the information and sort the forms by geographic area, ingredient, chemical abstract service number, time period and operator, as practicable.

(4) Inaccuracies in information. A vendor is not responsible for any inaccuracy in information that is provided to the vendor by a third party manufacturer of the hydraulic fracturing additives. A service provider is not responsible for any inaccuracy in information that is provided to the service provider by the vendor. An operator is not responsible for any inaccuracy in information provided to the operator by the vendor or service provider.

(5) Disclosure to health professionals. Vendors, service companies, and operators shall identify the specific identity and amount of any chemicals claimed to be a trade secret to any health professional who requests such information in writing if the health professional provides a written statement of need for the information and executes a confidentiality agreement, Form 35. The written statement of need shall be a statement that the health professional has a reasonable basis to believe that (1) the information is needed for purposes of diagnosis or treatment of an individual, (2) the individual being diagnosed or treated may have been exposed to the chemical concerned, and (3) knowledge of the information will assist in such diagnosis or treatment. The confidentiality agreement, Form 35, shall state that the health professional shall not use the information for purposes other than the health needs asserted in the statement of need, and that the health professional shall otherwise maintain the information as confidential. Where a health professional determines that a medical emergency exists and the specific identity and amount of any chemicals claimed to be a trade secret are necessary for emergency treatment, the vendor, service provider, or operator, as applicable, shall immediately disclose the information to that health professional upon a verbal acknowledgement by the health professional that such information shall not be used for purposes other than the health needs asserted and that the health professional shall otherwise maintain the information as confidential. The vendor, service provider, or operator, as applicable, may request a written statement of need, and a confidentiality agreement, Form 35, from all health professionals to whom information regarding the specific identity and amount of any chemicals claimed to be a trade secret was disclosed, as soon as circumstances permit. Information so disclosed to a health professional shall in no way be construed as publicly available.

c. Disclosures not required. A vendor, service provider, or operator is not required to:

(1) disclose chemicals that are not disclosed to it by the manufacturer, vendor, or service provider;

(2) disclose chemicals that were not intentionally added to the hydraulic fracturing fluid; or

(3) disclose chemicals that occur incidentally or are otherwise unintentionally present in trace amounts, may be the incidental result of a chemical reaction or chemical process, or may be constituents of naturally occurring materials that become part of a hydraulic fracturing fluid.

d. Trade secret protection.

(1) Vendors, service companies, and operators are not required to disclose trade secrets to the chemical disclosure registry.

(2) If the specific identity of a chemical, the concentration of a chemical, or both the specific identity and concentration of a chemical are claimed to be entitled to protection as a trade secret, the vendor, service provider or operator may withhold the specific identity, the concentration, or both the specific identity and concentration, of the chemical, as the case may be, from the information provided to the chemical disclosure registry. Provided, however, operators must provide the information required by Rule 205A.b.(2)(B) & (C).

The vendor, service provider, or operator, as applicable, shall provide the specific identity of a chemical, the concentration of a chemical, or both the specific identity and concentration of a chemical claimed to be a trade secret to the Commission upon receipt of a letter from the Director stating that such information is necessary to respond to a spill or release or a complaint from a person who may have been directly and adversely affected or aggrieved by such spill or release. Upon receipt of a written statement of necessity, such information shall be disclosed by the vendor, service provider, or operator, as applicable, directly to the Director or his or her designee and shall in no way be construed as publicly available.

The Director or designee may disclose information regarding the specific identity of a chemical, the concentration of a chemical, or both the specific identity and concentration of a chemical claimed to be a trade secret to additional Commission staff members to the extent that such disclosure is necessary to allow the Commission staff member receiving the information to assist in responding to the spill, release, or complaint, provided that such individuals shall not disseminate the information further. In addition, the Director may disclose such information to any Commissioner, the relevant county public health director or emergency manager, or to the Colorado Department of Public Health and Environment's director of environmental programs upon request by that individual. Any information so disclosed to the Director, a Commission staff member, a Commissioner, a county public health director or emergency manager, or to the Colorado Department of Public Health and Environment's director of environmental programs shall at all times be considered confidential and shall not be construed as publicly available. The Colorado Department of Public Health and Environment's director of environmental programs, or his or her designee, may disclose such information to Colorado Department of Public Health and Environment staff members under the same terms and conditions as apply to the director.

e. Incorporated materials. Where referenced herein, these regulations incorporate by reference material originally published elsewhere. Such incorporation does not include later amendments to or editions of the referenced material. Pursuant to section 24-4-103 (12.5) C.R.S., the Commission maintains copies of the complete text of the incorporated materials for public inspection during regular business hours. Information regarding how the incorporated material may be obtained or examined is available at the Commission's office located at 1120 Lincoln Street, Suite 801, Denver, Colorado 80203.

DRILLING, DEVELOPMENT, PRODUCTION AND ABANDONMENT (300 SERIES)

RULE 305.E.(1).A CONTENT OF NOTICES.

A. Landowner Notice. The landowner notice shall include the Form 2A itself (without attachments), a copy of the information required under Rule 303.d.(3).B, 303.d.(3).C, 303.d.(3).E, the COGCC's information sheet on hydraulic fracturing treatments and any additional information the operator deems appropriate and inform the recipient that the complete application (including attachments) may be reviewed on the COGCC website and that he or she may submit comments to the Director, as provided on the COGCC website. The operator need not provide the COGCC's information sheet on hydraulic fracturing treatments where hydraulic fracturing treatments are not going to be applied to the well in question. For the surface owner, this notice shall include a copy of the COGCC Informational Brochure for Surface Owners, a postage-paid, return-addressed post card whereby the surface owner may request consultation pursuant to Rule 306, and, where the oil and gas location is not subject to a surface-use agreement, a copy of the COGCC Onsite Inspection Policy (See Appendix or COGCC website).

RULE 316C. NOTICE OF INTENT TO CONDUCT HYDRAULIC FRACTURING TREATMENT.

Operators shall give at least 48 hours advance written notice to the Commission of a hydraulic fracturing treatment at any well. Such notice shall be provided on a Form 42 notice of hydraulic fracturing treatment. The Commission shall provide prompt electronic notice of such intention to the relevant local governmental designee (LGD).

**RULES OF PRACTICE AND PROCEDURE
(500 SERIES)**

523.c. BASE FINE SCHEDULE

Rule 523c. Base fine schedule

Base fine schedule. The following table sets forth the base fine for violation of the rules listed

Rule Number 205A

Base Fine \$1000

Attached, as **Exhibit A**, is a statement giving the basis and purpose of the revisions and such statements are incorporated herein by reference.

DONE AND PERFORMED by the Oil and Gas Conservation Commission of the State of Colorado this 13th day of December, 2011.

IN THE NAME OF THE COLORADO
OIL AND GAS CONSERVATION COMMISSION
OF THE STATE OF COLORADO

By 
Peter J. Gowen, Acting Secretary

Dated at Suite 801
1120 Lincoln Street
Denver, Colorado 80203
December 13, 2011

Exhibit A

Proposed Statement of Basis, Specific Statutory Authority, and Purpose

AMENDMENTS TO 100 SERIES DEFINITIONS, 200 SERIES GENERAL RULES, 300 SERIES DRILLING, DEVELOPMENT, PRODUCTION AND ABANDONMENT RULES and 500 SERIES PRACTICE AND PROCEDURE RULES

2 CCR 404-1

This statement sets forth the basis, specific statutory authority, and purpose for the new rules and amendments to Rules 100, 205, 305, 316 and 523 of the Rules of the Colorado Oil and Gas Conservation Commission promulgated by the Colorado Oil and Gas Conservation Commission ("Commission" or "COGCC").

In adopting the new rules and amendments, the Commission relied upon the entire administrative record for this rulemaking proceeding, which formally began in the fall of 2011 and informally began in the summer of 2011. The new rules and amendments were initially discussed with representatives of the oil and gas industry and conservation community during informal meetings in August 2011. These discussions continued during September 2011, and the Commission staff held work sessions with these groups during October 2011 to help develop the proposed rules. The administrative record includes the proposed rules and recommended modifications and alternatives; public comments, testimony, and exhibits; and one day of public and party hearings.

Statutory Authority

The new rules and amendments are based on: 1) general Commission jurisdiction and rulemaking authority granted in section 34-60-105 (1) C.R.S; and 2) specific statutory authority of sections 34-60-106(2), 34-60-106(4) and 34-60-106(10) C.R.S. The Commission adopted the following statement of basis and purpose consistent with section 24-4-103(4), C.R.S., of the Administrative Procedure Act. This statement is incorporated by reference in the rules adopted. The rulemaking hearing for these new rules and amendments was held by the Commission on December 5, 2011. These amendments become effective twenty days after publication in the *Colorado Register*.

Basis and Purpose

INTRODUCTION

A major reason for adopting the new rules and amendments was to address concerns regarding hydraulic fracturing. Members of the public have expressed interest in learning the identity of chemicals in hydraulic fracturing fluids. Many oil and gas operators are currently providing such information through the FracFocus.org website, and several other states have adopted or are adopting similar regulations.

Hydraulic fracturing, commonly referred to as *fracing*, is the process of creating small cracks, or fractures, in underground geological formations providing pathways to allow oil and natural gas to flow into the wellbore and thereby increase production. Prior to initiating hydraulic fracturing, engineers and geoscientists study and model the physical characteristics of the hydrocarbon bearing rock formation, including its permeability, porosity and thickness. Using this information, they design the process to keep the resulting fractures within the target formation. In Colorado, the target formation is often more than 7,000 feet below the ground surface and more than 5,000 feet below drinking water aquifers.

To fracture the formation, fracturing fluids are injected down the well bore and into the formation. These fluids typically consist of water, sand, and chemical additives. The pressure created by injecting the fluid opens the fractures. Sand is carried into the fractures by the fluid and keeps the fractures open to increase the flow of oil or natural gas to the well bore. The chemicals serve a variety of purposes, including increasing viscosity, reducing friction, controlling bacteria, and decreasing corrosion. Following the treatment, much of the fracturing fluid flows back up the well bore and is collected at the surface in tanks or lined pits.

Fracture treatment of oil and gas wells in Colorado began in the 1970s and has evolved since then. Most of the hydrocarbon bearing formations in Colorado would not produce economic quantities of hydrocarbons without hydraulic fracturing.

The Commission Staff believes the new rules and amendments will significantly increase the transparency of hydraulic fracturing operations. The proposed rules require service companies and vendors to disclose all known chemicals in hydraulic fracturing fluids to operators and require operators to disclose such chemicals to the public via the website FracFocus.org or, with respect to an operator's trade secrets, directly to the Commission or health professionals. FracFocus.org is a hydraulic fracturing chemical registry website created by the Ground Water Protection Council and the Interstate Oil and Gas Compact Commission.

The new rules and amendments reflect staff discussions with those intergovernmental organizations, as well as other states, industry associations, individual operators, and conservation groups. Although states have taken different approaches to disclosure, and the industry and conservation groups disagree on several issues, the Commission believes the proposed new rules and amendments strike a responsible balance.

The following discussion summarizes the new rules and amendments and explains their purpose.

IDENTIFICATION AND EXPLANATION OF AMENDMENTS

The new rules and amendments make substantive amendments and additions to the Rules and Regulations of the Colorado Oil and Gas Conservation Commission, 2 CCR 404-1 ("Commission Rules"). The general authority for adoption of these rules is set out in the Statutory Authority section set forth above and is generally applicable to all the new rules and amendments. The most specific authority and a summary of the purpose for each rule change are set forth below. References to particular factors or testimony are intended to be illustrative and not comprehensive.

100 Series Definitions

The Commission's 100 Series Rules contain many definitions that occur throughout the Commission Rules and throughout the Oil and Gas Conservation Act, § 34-60-100 C.R.S. *et seq.*

Amendments

The following definitions were substantively amended:

Chemical(s)

Basis: The statutory basis for this amendment is § 34-60-106 (2)(d) C.R.S.

Purpose: The purpose of this amendment is to clarify the scope of disclosure obligations under the new and amended rules. Under the proposed Colorado rule, all chemicals used in hydraulic fracturing treatments must be disclosed irrespective of whether the chemical is listed on a Material Safety Data Sheet pursuant to the federal Occupational Safety and Health Act.

Trade Secret

Basis: The statutory basis for this amendment is § 34-60-106 (2)(d) C.R.S.

Purpose: The purpose of this amendment is to conform the definition of trade secret in the rules to the statutory definition set forth in the Uniform Trade Secrets Act, § 7-74-102(4).

The following definitions were added:

Base Fluid; Chemical Abstracts Service; Chemical Abstracts Service Number or CAS Number; Chemical Disclosure Registry; Chemical Family; Health Professional; Hydraulic Fracturing Additive; Hydraulic Fracturing Fluid; Hydraulic Fracturing Treatment; Proppant; and Total Water Volume.

Basis: The statutory basis is § 34-60-106 (2)(d) C.R.S.

Purpose: These definitions are necessary as terms of art to give meaning to Colorado's disclosure regime.

200 Series Rules

Amendments to 200 Series Rules: Rule 205., Access to Records

Basis: The statutory basis is § 34-60-106 (2)(d) C.R.S.

Purpose: Rule 205 requires operators, among other things, to maintain chemical inventories for chemical substances brought to a well site for use downhole. Under amended Rule 205, chemicals used for hydraulic fracturing treatments are exempted from this requirement and are instead addressed in new Rule 205A, which requires the public disclosure of chemicals used in hydraulic fracturing. Public disclosure under Rule 205A would be limited to hydraulic fracturing fluids, while other chemical products used downhole, other than hydraulic fracturing fluids, would continue to be inventoried and disclosed upon request to the Commission and health professionals under Rule 205. Operators will still need to maintain inventories of fuel regardless of whether such fuel is used in connection with hydraulic fracturing treatments or other activities. Further, if diesel or other fuel is used as a hydraulic fracturing fluid, such use shall be disclosed pursuant to Rule 205A.

Additions to 200 Series Rules: Rule 205A., Hydraulic Fracturing Chemical Disclosure

Basis: The statutory basis is § 34-60-106 (2)(d) C.R.S.

Purpose: New Rule 205A would require public disclosure of hydraulic fracturing chemicals using the FracFocus.org website, which has been voluntarily used by numerous Colorado operators to report information on about 50% of the wells hydraulically fractured in Colorado this year. It is similar to regulations recently proposed in Texas. Other states have similarly adopted or are considering adopting regulations mandating the public disclosure of hydraulic fracturing chemicals through the FracFocus.org website.

Rule 205A, Subpart a: Applicability. Rule 205A provides that the new fracturing chemical disclosure requirements will apply to all hydraulic fracturing treatments performed on or after April 1, 2012. As previously noted, many Colorado operators are already submitting information to the FracFocus.org website. Therefore, the COGCC staff believes that it is feasible and fair for Rule 205A to apply to all treatments performed on or after April 1, 2012. If an operator finds that, despite diligent efforts, it is unable to satisfy the requirements of Rule 205A beginning April 1, 2012, then it may seek a temporary variance under Rule 502.b(1).

Rule 205A, Subpart b: Required Disclosures. Rule 205A imposes disclosure obligations on suppliers, service companies, and operators. The supplier or service company must, as soon as possible within 30 days following the conclusion of a hydraulic fracturing treatment, furnish the operator of the well with the information necessary for the operator to meet its disclosure obligations. Provided, however, vendor and service providers need not provide information claimed to be a trade secret to operators. The operator must, within 60 days following the conclusion of a hydraulic fracturing treatment, complete and post the chemical registry disclosure form with FracFocus. The FracFocus form includes information about the well, the volume of water used, and the chemicals and their concentrations. The Commission acknowledges concerns expressed by industry that certain formats for disclosure may present the possibility of competitors "reverse engineering" proprietary formulas for hydraulic fracturing additives. Accordingly, the rule permits operators to report the required information in a format that does not link chemical ingredients (including chemical names, CAS numbers and concentrations) to their respective hydraulic fracturing additive. If a chemical is entitled to trade secret protection, then the operator must still provide information on its chemical family. The supplier, service company, or operator, as applicable, must also provide the identity of a trade secret chemical to a health professional that satisfies certain conditions (immediate disclosure is required in medical emergencies).

At the time of claiming that a chemical, concentration, or both is a trade secret, the vendor, service provider or operator must file with the Commission a Claim of Entitlement, Form 41, containing the claimant's name, authorized representative, mailing address, and phone number. Among other things, this is intended to assist

the Commission and health professionals in promptly obtaining trade secret information where appropriate.

FracFocus currently allows the public to search and sort information by well, geographic area and operator, but not by ingredient, chemical abstract service number or time period. In the event FracFocus does not permit searching and sorting by ingredient, chemical abstract service number and time period by January 1, 2013, and there is no reasonable assurance that FracFocus will allow for such searches by a date certain acceptable to the Commission, then the proposed rules require operators to also file their disclosure reports with the Commission by February 1, 2013. As soon thereafter as practicable, the Commission will make the forms available on the Commission's website in a manner that enables the public to search and sort them by geographic area, ingredient, chemical abstract service number, time period, and operator, as practicable.

The requirement that information claimed to be a trade secret be disclosed to health professionals under certain circumstances is patterned after existing Rule 205. In addition, most other states have required or are proposing to require similar disclosure, and several of them have patterned their requirements after Rule 205 as well. The Commission staff believes that this type of disclosure is generally well accepted and just as appropriate for hydraulic fracturing chemicals as for other downhole chemicals.

Rule 205A, Subpart c: Disclosures Not Required. Rule 205A will not require suppliers, service companies or operators to disclose chemicals which are not disclosed to them, were not intentionally added to the hydraulic fracturing fluid, or occur incidentally or are otherwise unintentionally present. This part of Rule 205A is similar to the proposed Texas disclosure rule and is intended to ensure that requiring disclosure of all chemicals will not impose unfair or unreasonable burdens on companies.

Rule 205A, Subpart d: Trade Secret Protection. As previously noted, Rule 205A will protect information claimed to be a trade secret from disclosure. Under the Commission Rules, a trade secret is defined as "any confidential formula, pattern, process, device, information, or compilation of information that is used in an employer's business, and that gives the employer an opportunity to obtain an advantage over competitors who do not know or use it." Unless the information is entitled to protection as a trade secret, information submitted to the Commission or posted through FracFocus is public information.

The Colorado Open Records Act, the Colorado Uniform Trade Secrets Act, all other states that require hydraulic fracturing chemical disclosure and the FracFocus website protect trade secrets. The trade secret provisions of the proposed rule are patterned after existing Rule 205, which was the subject of extensive comment, review, and deliberation by the Commission in 2008. It allows suppliers, service companies, and operators to withhold trade secret information. But they must still provide such information to the Commission if the Commission determines the information is necessary to respond to a spill, release, or complaint.

Trade Secret Challenges Whether and under what circumstances a vendor, service company or operator's use of the trade secret provisions of Rule 205A could be challenged was the subject of much discussion during the rulemaking.

Section 114 of the Oil and Gas Conservation Act provides: "In the event the commission fails to bring suit to enjoin any actual or threatened violation of this article, or of any rule, regulation, or order made under this article, then any person or party in interest adversely affected and who has notified the commission in writing of such violation or threat thereof and has requested the commission to sue, may, to prevent any or further violation, bring suit for that purpose in the district court of any county in which the commission could have brought suit. If, in such suit, the court holds that injunctive relief should be granted, then the commission shall be made a party and shall be substituted for the person who brought the suit, and the injunction shall be issued as if the commission had at all times been the complaining party." § 34-60-114, C.R.S. This allows an adversely affected individual to notify the COGCC if they believe that a trade secret claim is invalid. The COGCC could issue an order

requiring the claimant to substantiate the validity of its claim. If the COGCC declines to act, or if the adversely affected individual disagrees with a COGCC determination that a claim is valid, then such individual could seek judicial review.

In addition, Rule 522.(a)(1) authorizes any person who may be directly and adversely affected or aggrieved as a result of an alleged violation of any COGCC Rule to file a complaint requesting that the Director issue a Notice of Alleged Violation (NOAV). If the Director, after investigating the complaint, decides not to issue an NOAV, the complainant may file an application to the COGCC requesting the COGCC to enter an Order Finding Violation. Such a proceeding could be resolved without disclosure of the chemical identity or concentration. The issue would be whether the claimant can substantiate that the information constitutes a trade secret as defined in Rule 100.

For purposes of determining public challenges to trade secret designation under Section 114 of the Oil and Gas Conservation Act and under Commission Rule 522, the COGCC believes the question of whether someone has been directly and adversely affected or aggrieved should be broadly construed.

The Commission determined that the foregoing statutory and regulatory provisions allowed the COGCC, in its discretion, to receive, investigate, assess and determine claims that a vendor, service company or operator has improperly claimed a trade secret. The COGCC's exercise of these powers will be utilized on a case-by-case basis. In some circumstances, the COGCC may exercise its authority to investigate and challenge a trade secret claim. In other circumstances, the COGCC may abstain from such a challenge to allow for immediate resolution by a court, which should have more experience, and better procedural tools and protections.

Designation of Trade Secrets Whether the COGCC should review and approve trade secret claims was likewise the subject of much discussion during the rulemaking. The Commission considered and rejected a trade secrets regime that would have required the COGCC to review and approve all trade secret claims. Such a regime raised a number of concerns, including the COGCC's general lack of experience in evaluating trade secret claims, the risk of inadvertent disclosure, and the reprioritization of COGCC objectives and reallocation of COGCC resources, potentially at the expense of other priorities, many of which directly or indirectly involve environmental protection.

Additionally, the Commission was also concerned that a review and approval process would enable any person to request, under the Colorado Open Records Act, all documents concerning a trade secret designation from the COGCC, including the identity or concentration of the chemical and any internal staff documents evaluating the trade secret claim. In the event of such a request, the COGCC would be obligated to either disclose such information to the requesting party, or withhold it as a trade secret. Under the latter scenario, the requesting party could sue the COGCC in district court to challenge the trade secret designation. Although the trade secret claimant would likely intervene in the lawsuit to preserve the confidentiality of the information, the COGCC would nonetheless be a party and would have to devote resources to the litigation. Further, the requesting party could be entitled to its attorneys' fees and costs from the COGCC under CRS § 24-72-204(5). The Commission wished to avoid these risks.

Rule 205A.b.(2).B. provides, among other things, that a vendor, service provider, or operator, as applicable, "shall submit to the director a Form 41, Claim of Entitlement, to have the specific identity of a chemical, the concentration of a chemical, or both withheld as a trade secret." The Commission has adopted a Form 41, Claim of Entitlement, for this purpose. A copy of Form 41 is attached as Appendix IX to these Rules and may be modified only through the Commission's rulemaking procedures as provided in Rule 529.

The Commission also notes that, in the event of a spill or release of a trade secret chemical, or for purposes of investigating a complaint alleging such a spill or release, the COGCC Director can demand the trade secret information. The COGCC, in turn, may disclose this information to its Commissioners, certain county officials, and the Colorado Department of Public Health and Environment.

The Commission expects the Director to issue a report identifying, among other relevant information, the number of trade secret claims made under Rule 205A and identifying the vendors, service providers and operators making such claims. The Commission expects the Director to issue such a report within twelve months of the effective date of the proposed rules.

The Commission considered the foregoing issues carefully and determined that the proposed rules reflect an appropriate policy choice balancing numerous interests.

Rule 205A, Subpart e: Incorporated Material. This is boilerplate language that Colorado law requires where a regulation incorporates by reference material published elsewhere, e.g., the OSHA regulations.

300 Series Rules

Additions to 300 Series Rules:

Rule 305.e.(1).A, Landowner Notice.

Basis: The statutory basis is § 34-60-106 (2)(d) C.R.S.

Purpose: An operator making application for approval of an Oil and Gas Location Assessment, Form 2A, must provide the surface owner and owners of surface property within five hundred (500) feet of the proposed oil and gas location with various information. These information requirements are broadened under the amendment to include a new COGCC information sheet on hydraulic fracturing. This information sheet will, among other things, advise surface owners that most wells in Colorado are hydraulically fractured, provide general information on hydraulic fracturing treatments, and offer instruction in the collection of baseline water samples if the surface owner is concerned about potential impacts from hydraulic fracturing. However, such notice will not be required if hydraulic fracturing treatments are not going to be applied to the well in question.

Rule 316C., Notice of Intent to Conduct Hydraulic Fracturing Treatment.

Basis: The statutory basis is § 34-60-106 (2)(d) C.R.S.

Purpose: New Rule 316C will require operators to provide the Commission with 48 hours advance written notice of their intention to hydraulically fracture a well. The COGCC shall then provide prompt electronic notice of such intention to the relevant local governmental designee. The COGCC staff would develop a new form for this purpose, which would be designated Form 42, Notice of Hydraulic Fracturing Treatment. This notification would assist the COGCC in arranging inspections to observe hydraulic fracturing where appropriate.

500 Series Rules

Addition to 500 Series Rules: Rule 523C., Base Fine Schedule.

Basis: The statutory basis is § 34-60-106 (2)(d) C.R.S.

Purpose: Amended Rule 523C was proposed in order to establish a base line fine for violations of the new and amended rules. A fine of \$1000 per day, subject to adjustment by the Commission, is consistent with the fines imposed by the Commission for violations of the majority of the Commission's Rules.

CONCLUSION

The new rules and amendments are expected to increase the transparency of hydraulic fracturing operations in the State of Colorado and, at the same time, afford appropriate protections for vendor, service provider and operator trade secrets. The new rules and amendments are also expected to increase the Commission Staff's ability to inspect and oversee hydraulic fracturing operations.

APPENDIX IX

FORM 41

Form 41

Section A - Classification of Entity Asserting Trade Secret Claim

Operator Vendor Service provider Other - specify in detail: _____

Section B – Entity Asserting Trade Secret Claim

The entity below submits this form to claim that it is entitled under COGCC Rule 205A to withhold certain information from disclosure as a trade secret:

Entity name: _____

Street Address: _____

City/State/Zip Code: _____

Contact person: _____

Contact phone: _____ Contact fax: _____

Contact email: _____

Section C – Claim of Entitlement to Trade Secret Protection

Rule 205A requires disclosure of all chemicals intentionally added to base fluid as part of a hydraulic fracturing treatment, as well as the maximum concentrations and (if applicable) CAS numbers for those chemicals, except in those limited situations where the specific identity or concentration of a chemical are permitted to be withheld as a trade secret. For purposes of Rule 205A, the term "trade secret" is defined in the COGCC Series 100 Definitions.

The Entity identified in Section B claims that the (____) identity or (____) maximum concentration, or (____) both, of the following chemical qualifies as a trade secret:

_____ (Chemical identifier). You may use a descriptive label, such as "Company TS1," for a chemical identifier in lieu of identifying the chemical. This chemical identifier may be used to reference the chemical in subsequent disclosures filed with the Chemical Disclosure Registry.

In order to claim that information is entitled to protection as a trade secret, you must check all the affirmations below and submit specific information regarding each of the following (can be attached on separate pages).

- 1. The entity holding the trade secret information has not disclosed the information to any other person, other than a member of a local emergency planning committee, an officer or employee of the United States or a state or local government, an employee of such person, or a person who is bound by a confidentiality agreement, and such person has taken reasonable measures to protect the confidentiality of such information and intends to continue to take such measures, or disclosure has otherwise been limited such that the information is not readily available to competitors.
- 2. The information is not required to be disclosed, or otherwise made available, to the public under any other Federal or State law.
- 3. Disclosure of the information is likely to cause harm to the competitive position of the entity holding the trade secret information.
- 4. The information is not readily discoverable through reverse engineering.

CERTIFICATION

This form must be signed by an authorized agent of the entity identified in Section B.

I declare under penalty of perjury that this report has been examined by me and to the best of my knowledge is true, correct and complete.

Signature

Name and title



INTERSTATE OIL AND GAS COMPACT COMMISSION

P.O. Box 53127, Oklahoma City, OK 73152-3127

Phone: 405/525-3556 • Fax: 405/525-3592 • E-mail: iogcc@iogcc.state.ok.us

World Wide Web <http://www.iogcc.state.ok.us>

Chairman:

Gov. John Hoeven, North Dakota

Vice Chairman:

Lynn D. Helms, North Dakota

Second Vice Chairman:

Donald L. Mason, Ohio

Chairman-Elect:

Gov. Bill Richardson, New Mexico

Executive Director:

Christine Hansen

Sue O'Brien
Editorial Page Editor
Denver Post
1560 Broadway
Denver, CO 80202

Re: Bill exempts disputed drilling process, *Denver Post*, Sept. 7, 2003

To the Editor:

This article has so many errors and misleading statements that it is difficult to know where to begin. Let's start with the headline: the bill does not exempt the process (hydraulic fracturing, which is not a drilling process) from state law. The proposed clarification of federal law is not a political favor or in support of the oil and gas industry, it is a testament to the confidence that Congress and the White House have in the effectiveness of longstanding state regulation of this process. It is a statement in support of eliminating the over-the-top federal regulation that has always taken a one-size-all approach that is in total opposition to the rights of states to regulate resources within their borders. The EPA proposal to create wasteful, duplicitous regulations at the federal level for a technique that has never (yes, never) damaged drinking water sources is a total waste of taxpayers' dollars.

The statement that "agencies have an interest in not finding contamination" and would intentionally ignore the contamination of drinking water is a flat lie and an insult to state environmental officials. These hardworking officials understand their obligations to the protection of the environment, human health and to their vow to uphold state law. After all, state regulators, unlike federal officials and profiteering fund raisers, live in the environment they regulate. I would challenge Mr. Ludder to produce one documented case of a state official who intentionally ignored contamination of drinking water sources. Of course, he can not. Mr. Ludder, on the other hand, has much to gain by claiming there has been contamination when no proof of any kind exists to support his statement. He has a personal stake in securing funding for his organization. Using outrageous statements are effective in scaring people into writing big checks for phantom or overstated causes, which is precisely his tactic.

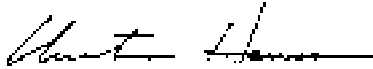
The real story is that state regulatory programs, in cooperation with the U.S. Environmental Protection Agency, have been effectively regulating hydraulic fracturing for more than 50 years without a single case of damage to drinking water sources. This issue has nothing to do with a partisan politics or the White House. Even the author, in a rare statement that contradicts the article's "guilty until proven innocent" premise, concedes that Carol Browner and the Clinton Administration also found "there was no reason to regulate hydraulic fracturing because there was no evidence it had contaminated drinking water." To then mislead readers into thinking that this is some oil industry or political conspiracy is on its face absurd. Both political camps agree regulation belongs at state agencies.

Sue O'Brien
Editorial Page Editor
Denver Post
Page 2

The author, we found, did speak to at least two state regulators who eloquently defended state regulatory programs. Unfortunately, their comments – which were contrary to the author’s preconceived storyline, did not appear in the article.

Propagating the lie that hydraulic fracturing is a serious threat to drinking water are those individuals interested in an ever-expanding role for the federal government in massive environmental overregulation. After all, it does create jobs for bureaucrats, big possibilities for opportunistic fund raisers – and stories for “reporters” who are spoon fed by the same.

Sincerely,

A handwritten signature in black ink, appearing to read 'Christine Hansen', with a horizontal line extending to the right.

Christine Hansen
Executive Director
Interstate Oil and Gas Compact Commission

MCM 2009-087

Resolution Opposing US Representatives DeGette and Polis Fracturing Responsibility and Awareness for Chemicals Act of 2009

WHEREAS US Representatives DeGette and Polis have recently submitted for consideration by Congress the Fracturing Responsibility and Awareness for Chemicals Act of 2009 (FRAC Act) "to repeal the exemption for hydraulic fracturing in the Safe Drinking Water Act and for other purposes and

WHEREAS, Congresswoman DeGette represents Colorado's House District 1 and Congressman Polis represents Colorado's House District 2 both on the front range of Colorado consisting largely of the Greater Denver Metro and Boulder Area, and

WHEREAS Representatives DeGette and Polis House Districts have little to no oil and natural gas development activity employing fracing technology and should at least extend the courtesy to fellow Congressmen in districts where this act would be applicable to sponsor it and

WHEREAS the United States Congress passed the Safe Drinking Water Act (SDWA) of 1974 to assure the protection of the nation's drinking water sources, and

WHEREAS, since the enactment of the SDWA the United States Environmental Protection Agency has never interpreted hydraulic fracturing as constituting underground injection within the SDWA, and

WHEREAS, in 2004, the EPA published a final report stating that minimal threat was posed to underground sources of drinking water by hydraulic fracturing and

WHEREAS the Ground Water Protection Council (GWPC) is a non-profit organization dedicated to the protection of our Nation's ground water resources and made up of state ground water protection agencies regulating hydraulic fracturing have produced findings from studies indicating that there are no documented cases of contamination involving hydraulic fracturing technology or fluids and

WHEREAS the United States Congress in the Energy Policy Act of 2005, explicitly exempted hydraulic fracturing from the provisions of the SDWA and

WHEREAS hydraulic fracturing has been used more than one million times in the last 60 years in exploration and production activities by the oil and gas industry across the nation with no harm to ground water supplies and

WHEREAS the regulation of oil and gas exploration and production activities including hydraulic fracturing is strictly regulated by the Colorado Oil and Gas Conservation Commission and

WHEREAS the SDWA was never intended to grant to the federal government authority to regulate oil and gas drilling and production operations such as hydraulic fracturing and

WHEREAS the issue of hydraulic fracturing is critical to natural gas exploration and development in Mesa County and the neighboring Piceance Basin, and

WHEREAS due to the nature of the geology within the surrounding area natural gas fields natural gas extraction could not efficiently take place without hydraulic fracturing and

WHEREAS Mesa County is a regional trade center and is the location of many industrial support companies that service the natural gas industry and

WHEREAS, onerous new regulations regarding hydraulic fracturing could stymie energy development in Mesa County and surrounding areas, cause detriment to Mesa County residents, increase costs to all consumers and decrease the economic vitality of the State, and

WHEREAS, hydraulic fracturing technology has opened up natural gas basins that would otherwise not be producible and has increased reserves resulting in lower commodity prices for consumers,

WHEREAS due to the ignorance of elected officials in positions of authority introducing legislation that does nothing for the environment or protect public safety but only raises the cost of production and development of natural resources we will most certainly be paying higher energy costs in the future impacting hard working men and women of our Country and County the most and

WHEREAS we in Mesa County and the Piceance Basin of Colorado have managed to contribute successfully and very significantly to our Nation's energy demands in a manner respectful of the environment without the added oversight or regulation of Congress and

WHEREAS, Mesa County has worked diligently on an Energy Master Plan to allow for energy development at the same time respecting our County's Natural assets, promoting a viable economy while maintaining or increasing the quality of life for County residents, and

WHEREAS Mesa County supports encourages and embraces best available technologies such as hydraulic fracturing and best management practices that mitigate the impacts of energy development or any other kind of human activity necessary to maintain our quality of life and

WHEREAS Mesa County respects and honors all the hard working men and women of the natural gas industry working, living recreating, and raising families in Mesa County for providing a vital resource to our County and Nation with no appreciation by any Federal State or Local elected officials for your innovation, technology and tireless efforts to keep our houses warm and illuminated

NOW THEREFORE BE IT RESOLVED that Mesa County urges our federal legislators to maintain the exemption for hydraulic fracturing from the provisions of the SDWA and to not pass unneeded legislation that would negatively impact Mesa County's economy and increase our Nation's energy insecurity and dependence of foreign sources Mesa County urges Congress and specifically Representatives DeGette and Polis to actually visit these areas where this technology is employed and learn about its historical use and current practice before enacting legislation that does nothing but empower government increase bureaucratic controls raise commodity prices to consumers and further discourage technology and innovation in an area much needed to promote our Country's future energy independence and security



ATTEST

Janice Kien

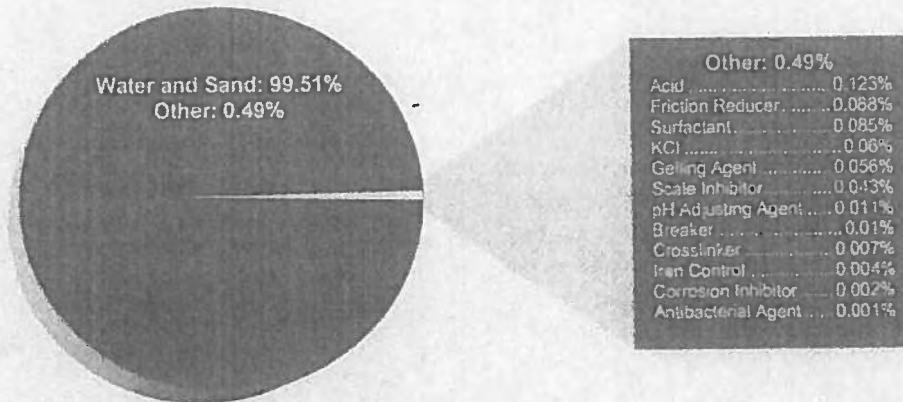
Clerk and Recorder

S:\DRFT\AGN\RESO\Opposing change to fracturing 2009.doc

by Roberto Raley, deputy

Mesa County Board of County Commissioners

Steven Acquafresca
Steven Acquafresca Chairman



Example of Typical Deep Shale Fracturing Mixture Makeup

A representation showing the percent by volume composition of typical deep shale gas hydraulic fracture components (see graphic) reveals that over 99% of the fracturing mixture is comprised of freshwater and sand. This mixture is injected into deep shale gas formations and is typically confined by many thousands of feet of rock layers.

FRACTURING FLUID ADDITIVES, MAIN COMPOUNDS AND COMMON USES

Additive Type	Main Compound	Purpose	Common Use of Main Compound
Acid	Hydrochloric acid or muriatic acid	Helps dissolve minerals and initiate cracks in the rock	Swimming pool chemical and cleaner
Antibacterial Agent	Glutaraldehyde	Eliminates bacteria in the water that produce corrosive by-products	Disinfectant; Sterilizer for medical and dental equipment
Breaker	Ammonium persulfate	Allows a delayed break down of the gel	Used in haircoloring, as a disinfectant, and in manufacture of common household plastics
Corrosion inhibitor	n,n-dimethyl formamide	Prevents the corrosion of the pipe	Used in pharmaceuticals, acrylic fibers and plastics
Crosslinker	Borate salts	Maintains fluid viscosity as temperature increases	Used in laundry detergents, hand soaps and cosmetics
Friction reducer	Petroleum distillate	"Slicks" the water to minimize friction	Used in cosmetics including hair, make-up, nail and skin products
Gel	Guar gum or hydroxyethyl cellulose	Thickens the water in order to suspend the sand	Thickener used in cosmetics, baked goods, ice cream, toothpaste, sauces, and salad dressings
Iron control	Citric acid	Prevents precipitation of metal oxides	Food additive; food and beverages; lemon juice ~7% citric acid
Clay stabilizer	Potassium chloride	Creates a brine carrier fluid	Used in low-sodium table salt substitute, medicines and IV fluids
Oxygen scavenger	Ammonium bisulfite	Removes oxygen from the water to protect the pipe from corrosion	Used in cosmetics, food and beverage processing and water treatment
pH adjusting agent	Sodium or potassium carbonate	Maintains the effectiveness of other components, such as crosslinkers	Used in laundry detergents, soap, water softener and dish washer detergents
Proppant	Silica, quartz sand	Allows the fractures to remain open so the gas can escape	Drinking water filtration, play sand, concrete and brick mortar
Scale inhibitor	Ethylene glycol	Prevents scale deposits in the pipe	Used in household cleansers, de-icer, paints and caulk
Surfactant	Isopropanol	Used to increase the viscosity of the fracture fluid	Used in glass cleaner, multi-surface cleansers, antiperspirant, deodorants and hair color