

## **Introduction to LWVCO Fracking Study Consensus Session**

**2/7/13**

[Slide 1 on screen]

During the 2011 League of Women Voters state convention a two-year study on hydraulic fracturing, or fracking, was adopted by the convention. A state study committee, co-chaired by Jeanette Hillery, Boulder County LWV member, former state board member, and long time water specialist, and Sally Bellerue of our League, was created and began investigations on the topic in order to prepare materials for local LWVs to use in their study of the issues.

Before we go on a word about the handouts: you should have a packet including an agenda for this morning's session with projected times for each part, a list of acronyms on the back of that, and a copy of the consensus questions we will answer. There are also several copies of a legal document from Sullivan Green and Seavy LLC in Denver and Boulder, who contributed research into local government powers to regulate land use impacts of oil and gas operations. This is the second of two Sullivan et al., opinions the state LWV supplied to local LWVs to study. We have links on our website to all documents supplied by LWVCO for local LWVs to use and many links to documents and videos we ourselves uncovered or learned about from other local LWVs. If there aren't enough paper copies of the handouts for everyone, please share.

The scope of the study [slide 2] is 'to investigate the impact of the practice of hydraulic fracturing for natural gas, oil, and methane on the State of Colorado and its citizens, and to discern what public policies are in place or need to be in place for this activity'. Very quickly it became clear that the industry has a very narrow definition of fracking, whereas the LWV really meant to include drilling, fracking

and disposal of waste products of fracking, the current expanded focus of the study. Dan Randolph's column in *The Durango Herald* January 30<sup>th</sup> did a great job of explaining the three different current interpretations of 'hydraulic fracturing' or 'fracking' that are facing the public. To use his words, 'The term "fracking" is now used in at least three ways. One is limited to hydraulic fracturing in the narrow and technical sense [the way the industry uses it and what you'll see in the first video]. Another refers to shale oil or gas development, in its entirety, but as a separate and distinct thing from all other gas and oil development. A third is to describe all gas and oil development. Much confusion in the public debates about fracking comes from these various uses.' So, whenever you see any reference to either 'hydraulic fracturing' or 'fracking', be sure you understand what meaning is being used. We have a link to Dan's column on our website.

Basic materials for LWVs to use were ready in September 2012. We are most grateful to Sally because in her collection of info for our state study, she broke ground for us here in La Plata County and passed on to us an excellent list of potential local contacts and some good background work on the type of drilling in La Plata County.

Local committee members are [slide 3]

We formally interviewed the following local people [slide 4])

We also contacted informally the following people [slide 5]

[slide 6] Since we have a relatively mature oil and gas industry here in La Plata County, the committee felt that we could use materials supplied by the state LWV as background and focus our efforts on interviewing local players. The consensus results from today's discussion will be forwarded to the state LWV office by February 15 after our local board has certified them. The state study committee

will prepare a draft consensus position statement, which will be discussed and approved by the state board at their March meeting. After that point we can begin using the position for advocacy at the state or local level.

Several issues [slide 7] more or less specific to La Plata County need to be discussed before launching into our formal presentations. The LWVCO study scope includes both 'natural gas' and 'methane'. Methane is the principal component of natural gas and we need to know that methane is explosive and is a greenhouse gas twenty times more potent than carbon dioxide. In La Plata County, our situation is complicated by the naturally occurring methane seeps at the outcrop of the formation in the San Juan Basin that is so rich in coal bed methane.

Methane in coal bed formations is associated with large amounts of water that comes up with the gas and is called produced water. Much of this water is used and re-used for fracking as long as possible, reducing the need for fresh water. Due to the greatly reduced current price of natural gas, very little new drilling is ongoing in La Plata County right now. There are 3347 producing wells in La Plata County.

Production of natural gas from coal bed methane with limited vertical fracking has been conducted in La Plata County for as many as 40 years. The kind of horizontal fracking being done elsewhere has not been done yet in La Plata County because of the propensity of coal bed methane formations to collapse.

Although nine CO counties have coal bed methane wells, most of the drilling that we hear about north of Denver in the Niobrara formation is shale gas and oil, with the focus on oil right now. To date we have not had drilling for shale gas or oil down here in our county; however, Swift Energy Company recently applied to do

exploratory drilling to determine content of the Mancos shale in the western section of La Plata County. It would likely have to be extracted by horizontal drilling and fracking, which takes considerably more water.

Another complication that we face in La Plata County is jurisdictional due to the presence of checkerboarded tribal lands. The CO Gas and Oil Conservation Commission (COGCC) controls all aspects of oil and gas production except surface issues, like roads, dust, camouflage, on private lands throughout the county, including fee (private) lands within the traditional boundaries of the S. Ute tribal lands, i.e., south of U.S. 160. The surface issues on these lands are the purview of the county. On S. Ute tribal lands, where about 15% of the producing wells in La Plata County are located, the EPA and BIA control drilling. Control of air pollution issues on tribal lands has been delegated to the tribe. We are lucky to have such diligent stewards of environmental issues controlling the gas and oil production on the tribal lands south of us.

Drilling on BLM lands in La Plata County is controlled by the EPA and BLM, which owns and leases the mineral rights on those lands.

A further complication results from the concept of 'split estate' which means that the mineral rights on a piece of property may be owned or controlled by different parties from the owners of the surface rights. This means that buyers purchasing property are wise to find out whether the mineral rights go with the property or whether they are owned by someone else. In the west the rights of mineral owners always trump the rights of the surface owner when issues cannot be solved by negotiation. However, the surface owner owns the water produced by the extraction of the minerals.

Over the years Congress has exempted the oil and gas industry from a number of environmental laws, the most notorious being the Halliburton Loophole in the Energy Policy Act of 2005, which exempts the oil and gas industry from the Safe Drinking Water Act and from the Clean Water Act (the latter, as regards storm-water runoff issues). Other acts from which the industry is exempt include Resource Conservation and Recovery Act Hazardous Waste Regulations (1988), i.e., the waste from oil and gas operations is not deemed hazardous enough to be covered by this legislation; and the Comprehensive Environmental Response, Compensation, and Liability (Superfund) Act, which holds ‘responsible parties’ liable for cleanup costs of a ‘hazardous substance’ but the legislation defines ‘hazardous substance’ to exclude the oil and gas industry. The exemptions to federal legislation do not mean that the oil and gas industry is exempt from regulation at the state or local level.

Also in 2005 Congress exempted certain oil and gas drilling activities from the need to conduct environmental impact statements under the EPA. The BLM has granted this exemption to 25% of the wells approved on public lands in the West.

The oil and gas industry is not exempt from the Occupational Health and Safety Act (OSHA), which requires the availability of Material Safety Data Sheets (MSDS) at a worksite upon request of a worker for all materials OSHA covers. It appears that there is confusion as to whether all chemicals have MSDSs and where the MSDS are required to be (at the well site v. corporate/regional office) and this has implications when medical issues from contamination arise.

Unfortunately, since our study is a state study, these federal exemptions are beyond the scope of our study and subsequent advocacy on any position that comes out of it.

FracFocus Chemical Disclosure Registry ([fracfocus.org](http://fracfocus.org)) is the national hydraulic fracturing chemical registry. FracFocus is managed by the Ground Water Protection Council and Interstate Oil and Gas Compact Commission, two organizations whose missions both revolve around conservation and environmental protection. The site was created to provide the public access to reported chemicals used for hydraulic fracturing of particular wells within their area. To help users put this information into perspective, the site also provides objective information on hydraulic fracturing, the chemicals used, the purposes they serve and the means by which groundwater is protected. The COGCC is participating in the FracFocus website on a one-year trial basis beginning last April and has mandated that operators in CO register the chemicals they use in fracking on the FracFocus website within 30 days after fracking. Special provisions for proprietary chemicals are in place. FracFocus deals only with chemicals used for fracking and does not include chemicals used in drilling or maintenance/cleaning of the well pad.

Who are the important players in La Plata County? [slide 8]

Colorado Oil and Gas Conservation Commission (to be discussed in the first section)

La Plata County Board of Commissioners has bottom line responsibilities for the requirements imposed on the oil and gas industry in the unincorporated parts of the county relating to the surface issues related to the oil and gas extraction that fall within the purview of the county. These are guided by the county land use plan. La Plata County, by virtue of its extensive experience with the industry, has been an

active part of the development and definition of the relationship between what is controlled by the state and what is controlled by the county.

La Plata County Local Government Designee (LGD) Courtney Roseberry. The COGCC encourages all counties, municipalities and governmental districts to designate an individual, usually a local government staff person, to serve as a conduit between the COGCC and the local government and its residents concerning oil and gas activities within their jurisdiction. Courtney serves in this capacity for unincorporated areas of La Plata County. All LGDs are listed on the COGCC website.

La Plata County Energy Council is a nonprofit trade organization that promotes safe and responsible natural gas development in La Plata County. Individual and company members work to build community relations, increase public understanding, and address public issues relative to the industry. Current membership of approximately 44 producers, operators, transporters and service providers includes the S. Ute Tribe related Red Willow Production Company and Red Cedar Gathering Company. The Energy Council actively seeks participation of all operators within La Plata County.

San Juan Citizens Alliance (SJCA), a local non-profit environmental group based in Durango, has been active in monitoring the oil and gas industry, among other things, in the Four Corners area for 25 years. SJCA organizes people to protect the water and air, lands, and the character of rural communities in the San Juan Basin. SJCA also promotes social, economic and environmental justice. They have successfully used grants and lawsuits to force changes to support their mission.

State Review of Oil and Natural Gas Environmental Regulations (STRONGER) is a non-profit, multi-stakeholder national organization begun in 1999 whose purpose is to assist states in documenting the environmental regulations associated with exploration, development and production of crude oil and natural gas. Its nine-member board represents stakeholders from across the country, 3 oil and gas representatives, 3 environmentalists and 3 staff people. STRONGER, the successor to an effort started by the EPA and Interstate Oil and Gas Compact Commission, shares innovative techniques and environmental protection strategies and identifies opportunities for program improvement. The state review process is a non-regulatory program, relying on states to volunteer for reviews. La Plata County's Bruce Baizel serves as treasurer of the organization.

For our discussion today we have grouped the 7 consensus questions as reflected in your handout (agenda) and will present the information for each group, prior to discussion of the related questions before moving on to the next set. We also have two short videos to show you: the first describing the process of fracking and the second looking at water issues around fracking. We've also developed a series of ground rules [slide 9] to help us complete this process in the allotted time.

Are there any questions about the process we will use for today's discussion? Please keep in mind that your study committee members are not experts! We wear two hats, one as member of the study committee and the other, which we wear when participating in the discussion of the consensus questions, as regular LWV members. When we have that latter hat on, our opinions are worth no more than those of any other LWV member.



We turn now to the first video, *Animation of Hydraulic Fracturing*, produced by the Marathon Oil Company, about 6 minutes long.

COGCC/Public Process

**Presentation COGCC/county Public Process (20 minutes)**

**Consensus questions 1, 2, 3**

The processes by which the oil and gas industry is regulated in CO continue to evolve and seem to be a constant struggle between what the Colorado Oil and Gas Conservation Commission (COGCC), an agency of the state of CO, controls and what a county regulates as regards the drilling, fracking, and production. The mission of the COGCC is as follows [slide 14]:

*The mission of the Colorado Oil and Gas Conservation Commission (COGCC) is to foster the responsible development of Colorado's oil and gas natural resources.*

*Responsible development results in:*

- *The efficient exploration and production of oil and gas resources in a manner consistent with the protection of public health, safety and welfare*
- *The prevention of waste*
- *The protection of mineral owners' correlative rights*
- *The prevention and mitigation of adverse environmental impacts*

*The COGCC seeks to serve, solicit participation from, and maintain working*

*relationships with all those having an interest in Colorado's oil and gas natural resources.*

## **Organization [slide 15]**

The composition of the 9-member COGCC is governed by state statute:

The directors of the Department of Natural Resources and of CO  
Department of Public Health and Environment are ex officio directors  
2 must reside west of Continental Divide  
3 must have substantial oil and gas experience  
(2 of above 3 must have a college degree in petroleum geology or petroleum  
engineering)  
1 must be a local government official  
1 must have substantial soil conservation or reclamation experience  
1 must be engaged in agricultural production and be a royalty owner  
A maximum of 4 directors can be from same political party (excepting the  
ex officio directors)

All directors except the ex officio directors, are appointed by the governor with consent of the state senate for 4 year terms. At present Tom Compton, a Republican rancher in La Plata County, is serving as chairman of the Commission.

## **Staff**

Matt Lepore, director, oversees a large number of technical personnel, of whom some are dedicated to specific parts of the state. In our case we interface with Karen Spray, SW Region Environmental Protection Specialist and

Mark Weems, SW Region Engineer.

COGCC has recently set up two local government liaison positions, one for the eastern part of the state and one for the western part, Marc Morton. Both Karen Spray and Marc Morton have been very open to communication and responsive to our questions.

While only the COGCC controls the actual permitting process, the local government designee (LGD), an employee of the local governmental unit, not of the COGCC, has a big role as focal point of communication with COGCC and funnel of information on oil and gas drilling and permitting activities within his/her jurisdiction to appropriate governmental agencies and to the public. *While the LGD does not have the right to ask that a permit be denied*, the LGD can ask for various conditions of approval to be attached to a permit.

In La Plata County the Local Government Designee (LGD), Courtney Roseberry, a county planner, covers oil and gas activities in unincorporated La Plata County. Drew Simmons, also a county planner, is her understudy. In our interview with the county planners they assured us that sufficient resources are currently devoted to this effort and that should the amount of drilling in La Plata County increase, the Board of Commissioners would step up to fund adequate resources. The towns of Ignacio and Bayfield also have LGDs (Michael Lee and Chris LeMay, respectively) and Marc Morton is encouraging Durango to designate one.

Courtney maintains a notebook of all permit related communications in the planning office, which is available to the public during normal working hours. As she receives information, she funnels it on to the appropriate county department,

for example, the Public Works Department for road issues; the Building Department for compressor sites; the Finance Department if there are road fees. The Office of Emergency Management for emergency preparedness.

In 2008 the county adopted an ordinance when they overhauled their Oil and Gas code, which would regulate chemical products used in gas production [Code Section: 90-123]. This ordinance is a backup in case the state or federal governments does not regulate chemicals. The ordinance reads very similarly to the regulations in place by OSHA and COGCC with regard to MSDSs and treatment of proprietary materials. The county code relies heavily on the ‘county public health department’s director of environmental programs or designee’. At the present time the San Juan Basin Health Department does not have a person designated to follow health issues related to the oil and gas production in La Plata County.

### **Permitting Process:**

When an operator desires to drill a well, the operator files two forms with COGCC

Form 2-Application for Permit to Drill (noting well location, geologic formations and spacing, drilling plans/procedures, casing, cementing, blowout preventer, etc.)

Form 2A- Location Assessment for well pad and related facilities (noting equipment to be used, surface and groundwater, access roads, current and future land uses, soils, etc.)

Notices go to the LGD and to surface owners within 500’ (county rule: 1320’) and into the notebook of all permits and related documents in planning office open to public. A 20 day comment period plus possible 10-day extension begins. In La

Plata County the LGD begins working with operator immediately to settle surface issues, so that these issues are resolved and a county permit is ready by the time the COGCC comes through with its permit to drill.

Concurrently, the operator works directly with the surface owner to resolve issues re specific location of pad, dust mitigation, burial of pipeline, use/maintenance of road on surface property. A Surface Use Agreement usually results. The surface owner may be offered compensation for crop damage, etc.

Through the county land use code the county permit process provides for adjacent landowner notice, neighborhood compatibility meetings, planning commission and BOCC meetings on major facility permits and informal dispute resolution.

*[Recently, when Swift Energy Company applied for a permit to the COGCC to do exploratory work in the Mancos shale in the western part of the county, the Board of County Commissioners elected to 'intervene', in the COGCC process. Under the relevant rule 509a, the local government, the CDPHE and CO Parks and Wildlife have the right to 'intervene' or protest and must spell out their specific concerns. Contrary to what the word sounds like, it is a commonly used process and usually results in a memorandum of understanding covering land use issues, such as road maintenance, and allow the county to negotiate what responsibility each party has.]*

A landowner is allowed to sign a waiver to the setback rule but this can cause problems for future landowners. Conversely, the county doesn't prevent homeowners from building within the setback after a well is drilled.

The operator is required to give 48-hours notice of actual start of drilling.

As I mentioned when discussing the handouts, our LWVCO materials contain two communications from a Front Range law firm, Sullivan Green Seavy LLC, who was asked by the legislative coordinator of Colorado Counties, Inc., to analyze/clarify what counties control v. what is preempted by COGCC. While both documents are very good, the second, dated November 2012 updates the first and presents in tabular format a summary of its legal findings, giving the legal basis of their opinion. (We should note parenthetically that several findings cite rulings in which La Plata County was a party.) The document makes clear that ‘preemption of local regulations by state law is not presumed’. Here are a couple of examples:

Not preempted (meaning that the county can regulate): impacts to wildlife, vegetation, livestock, geologic hazards, cultural and historic resources, wildfire protection, and recreation. Several important subjects are preempted (in other words, the COGCC takes priority): regulation of injection of fracking fluids into aquifers, noise regulations, total ban on oil and gas development. Several other interesting things are preempted if they lead to ‘operational conflict’: installation of monitoring wells as a condition of permit approval and regulating noise. While counties cannot enact a total ban on oil and gas development, the question of whether they can ban fracking may be yes, unless an operational conflict is shown. As to whether oil and gas operations in certain zoning classifications can be banned remains an open question. In other words, these findings indicate that counties should not automatically assume the COGCC takes precedence.

*Is this process working? Is this process protecting our environment while facilitating the extraction of oil and gas?*

**Christi Zeller**, executive director of the industry trade association La Plata County Energy Council, and **Julie Levy**, president of the Energy Council and director, Government and Public Affairs, agree that yes, the process is working. They attribute most of the dust-ups to inadequate communication among the parties, rather than failure of the process. The Energy Council maintains a hot line, which anyone can call for information about drilling activities. The hot line is monitored at least every 24 hours. The larger operators, such as BP, are making an effort to educate the public about their activities. Zeller and Levy admit that smaller operators may need to be reminded of their obligations. The existence of the Council is a positive thing and appears to be responsible for a certain amount of industry self-monitoring.

Because the county planners with whom we spoke were unwilling to make any judgmental statements about the process, suggesting that we instead ask elected officials, we attempted to contact Wally White for comment. However, due to holidays and his personal obligations immediately following the end of his term of service on BOCC, we were unable to discuss this with him.

**Josh Joswick**, former San Juan Citizen Alliance oil and gas director and former La Plata County commissioner, says it is too early to tell whether the current process is working, particularly from the environmental standpoint. Do we know exactly what is being pumped down into the disposal wells in La Plata County? Do we know the chronic and reproductive toxicity risks to residents, workers or school children spending their days or lives living near wells at any stage in the wells' life cycle? What exactly is being tested when water testing is done? What long-term air pollution studies are being conducted? He feels that for counties like La Plata, with

years of experience with oil and gas development, there is no need for state involvement at all. He does agree that COGCC can be an important baseline for counties new to oil and gas development.

**Bruce Baizel**, STRONGER board member, director of Oil and Gas Accountability Project, believes that the current process can work to within 1% failure rate, which means we must be prepared to remediate those 1% failures. He would like to see oversight inspections moved to the county level.

More evidence of the success of the current COGCC/county process will come up in other parts of this discussion.

Are there any questions for clarification so far?

[Consensus Questions 1, 2, 3]

## **Health Impacts of Fracking in La Plata County**

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Though fracking enables cost effective production of natural gas for the gas companies and according to the American Lung Association, natural gas has helped reduce air pollution as many dirtier coal-fired power plants shift to natural gas, fracking also comes with risks to public health and the environment. One of the least documented risks has been from air pollution caused by fracking compounds during their use, storage, or waste disposal. Air pollution is generated at all stages of oil and gas development including well pad construction and



drilling, work-overs, fracking and completion, gas compression, evaporation of chemicals from produced water and frack flowback, dehydration, separation, waste treatment and disposal, transmission and processing.

The extent to which an individual is harmed by air pollution usually depends on the total exposure to the damaging chemicals, i.e., the *duration of exposure* and the *concentration of the chemicals*. Total exposure must be taken into account when assessing air pollution risks. Examples of short-term acute effects include irritation to the eyes, nose, and throat, and upper respiratory infections such as bronchitis and pneumonia. Other symptoms can include headaches, nausea, and allergic reactions. Short-term air pollution can aggravate the medical conditions of individuals with asthma and emphysema. Long-term health effects can include chronic respiratory disease, lung cancer, heart disease, and even damage to the brain, nerves, liver, or kidneys.

A report compiled by Colorado School of Public Health, University of Colorado, Anschutz Medical Campus in Aurora found that while methane, a potent greenhouse gas and precursor to fog and health problems, is the primary constituent of natural gas, natural gas contains many other chemicals, including alkanes, benzene, and other aromatic hydrocarbons. Also natural chemicals that are in the ground, such as radon, which is the second leading cause of lung cancer, can be released during the entire fracking process. As shown by ambient air studies in Colorado, Texas, and Wyoming, the natural gas development (NGD) process results in direct and fugitive air emissions (unintentional leaks of gases) of a complex mixture of pollutants from the natural gas resource itself as well as diesel engines, tanks containing produced water, and on site materials used in production and cleaning, such as drilling muds and fracking fluids. This complex

mixture of chemicals and resultant secondary air pollutants, such as ozone, can be transported to nearby residences and population centers.

Multiple studies have been done on the health effects of inhalation exposure to petroleum hydrocarbons in occupational settings as well as residences near refineries, oil spills and petrol stations. [Slide #21] Those effects associated with benzene, ethylbenzene, toluene, and xylene, referred to as BTEX which are some of the VOCs, volatile organic compounds, found near natural gas production sites, include various types of leukemia, bleeding disorders, birth defects, respiratory and nervous system problems. [Slide # 22] Other VOCs, of which diesel exhaust (from truck traffic, etc.) is the main source along with petroleum-based byproducts of fracking also affect the nervous system. Fine particulate matter released into the air from flaring, which is the burning off of raw gas which has leaked during the fracking process, has been linked to human heart and lung diseases and disruption to the endocrine system which includes reproductive and developmental effects. The endocrine system is susceptible to chemical impacts at very low concentrations, far less than government safety standards. It gets even more complicated without information on the interactions between these chemicals and others already existing in the environment.

Theo Colborn, an environmental health analyst and former director of the World Wildlife Fund's wildlife and contaminants program, identified 632 chemicals used in natural-gas production. These chemicals have the potential to affect sensory organs and the respiratory, gastrointestinal, nervous, immune, cardiovascular, hormone and renal systems and are linked with cancer or mutations. Small amounts of some of the chemicals cause fetal problems in pregnant women if they are also endocrine (hormone system) disrupters. For more detailed information on this subject you can go to Theo Colborn presentation on our website.

Preliminary results from the Colorado School of Public Health study indicate that health effects resulting from air emissions during development of unconventional natural gas resources, that is, gas that is more difficult or less economical to extract, are most likely to occur in residents living nearest to the well pads, which they describe as a half a mile or less, and warrant further study. Risk prevention efforts should be directed towards reducing air emission exposures for persons living and working near wells during all stages of well construction and production.

Fracking can also have an impact on mental health. Fracking operations may be under way 24 hours a day, seven days a week for several months, which can cause stress, disturb sleep and lead to problems with focus.

Dr. Lyn Patrick, a licensed Naturopathic Physician, focusing on environmental medicine, who lives in Montezuma County and has practiced medicine in La Plata County for many years, reports that a Pennsylvania study showed an increase in the number of low birth weight babies and other fetal impacts near fracking sites. She feels that the impacts from air pollution need more attention and that monitoring of air for a wide array of contaminants, especially including endocrine disrupters, should be mandatory and regular. She also noted that chemicals on the well site for cleaning equipment and well pads are not being examined like those used in the actual fracking process. She expressed greatest concern about the biocides used in the fracking fluids to kill the bacteria in the mud in the fracking environment.

Besides impacts on humans, domestic and wildlife can also be affected. One example that Dr. Patrick presented is that since benzene is sweet tasting, if on the ground, an animal may lick it and ingest it leading to the same problems with

blood disorders as in humans. Also due to the dust and exhaust produced by the vehicles involved in fracking, animals have been known to die of “dust pneumonia” more formally known as bovine respiratory disease. The COGCC now requires operators to mitigate their impact on wildlife. BP, which controls 62% of the producing wells in La Plata County, decided to take a county-wide approach and worked with The Nature Conservancy and Colorado Division of Wildlife (DOW) to place wildlife sensitive lands in conservation easements with the (DOW) as the monitor. No gas and oil development or development of any kind can take place on these lands.

Although clusters of health problems exist throughout the county, according to Dr. Patrick, it is difficult to prove the cause of the problems. Testing and staffing is expensive which limits follow up by the COGCC and BLM. San Juan Basin Health Department is not currently involved in testing air emissions involving fracking. The Southern Ute Indian Tribe is self-governing on air emissions and has more stringent regulations and fines than are in place by Colorado Department of Public Health and Environment (CDPHE). Because of limited governmental testing of sites, local community groups have at times performed their own tests. Global Community Monitor (GCM), founded in 2001, organizes community-based groups internationally to develop the skills, expertise, and experience to win demands around environmental health and justice. They organize bucket brigades which provide evidence and hard science to support the anecdotal stories of health impacts. [Show bucket picture.] The testing is done using the ‘bucket’, which is portable, requiring only a tedlar bag and vacuum to take the grab sample. Air is “grabbed” out of the air for two to three minutes and captured in the bag. Once the sample is taken, the tedlar bag is sealed, removed from the bucket and sent to the lab for analysis, which is conducted by Columbia Analytical Services in Simi

Valley, California. A day long training provided by GCM to members of the Western Colorado Congress, the San Juan Citizens Alliance and other community members, included background on pollution and environmental health, how to document pollution incidents, hands on training and how to use monitoring equipment. The training and plans emphasized standard scientific methods. Community members learned how the monitoring equipment works, the best time to use it, and the appropriate paperwork to fill out before shipping a sample to the lab. The bucket brigade's work is strengthened by following stringent Quality Assurance/Quality Control (QA/QC) protocols and the use of EPA approved labs.

A May 2010 report by the U.S. Environmental Protection Agency found safe levels of air toxins around Sunnyside Elementary School, which is located 9 miles south of Durango on HWY 550. Sunnyside is surrounded by natural gas production sites, with the closest well pad located across the street from the preschool playground. [Slide #23] On January 7, 2011 two members of the bucket brigade team in La Plata County, Colorado, overseen by Mike Meschke, the then environmental health director at San Juan Basin Health Department, took an air sample less than 50 feet from a natural gas dehydrator that was frequently a suspected source of unknown chemical odors and is located less than 200 feet from the Sunnyside Elementary School playground. The testing showed elevated levels associated with an increased risk of cancer from long-term exposure of four VOCs and known carcinogens, benzene, acrylonitrile, methylene chloride and ethylbenzene.

Follow up testing commissioned by 9R school district and conducted by Walsh Environmental Scientists and Engineers, showed that levels of volatile organic compounds (VOC) and other gasses in the air around the elementary school were

well below the levels considered safe by the Occupational Safety and Health Administration.

The Colorado Department of Public Health and Environment found several technical deficiencies when it reviewed *Gassed!*, the report written after the testing performed by the bucket brigade. Concerns included the size and duration of the air samples, types of materials used, and lack of meteorological measurements. Christi Zeller, the executive director of the La Plata Energy Council, said the council also had concerns with the testing methods. Zeller cited an extended gas analysis by Williams Midstream, a natural-gas gatherer and processor, that found several chemicals found in the *Gassed!* report were not detected in the gas stream near Sunnyside. According to Kathleen Morris, 9R's regional school safety coordinator, the school is "satisfied" with the results of the follow up testing.

Regulators contend that overall, water and air pollution problems are rare, but environmental groups and some scientists say there hasn't been enough research on those issues. However, some industry leaders also say more needs to be done to address concerns.

The Obama administration in April 2012 announced long awaited and first ever air pollution rules for fracking that would be phased in over more than two years. These rules would require companies to use a process known as green completion whereby portable equipment is used to capture gas that otherwise would be flared. The same equipment would capture methane, the primary constituent of natural gas, and make it available for sale. The rules went into effect 60 days after the initial announcement was made, and cover the period when a well is first drilled when natural gas is still venting but before it begins actual production. In a compromise with the industry, regulators said the drillers can flare the gas for now,

a process that can last for weeks. But starting in 2015 they would lose that option and be required to collect it. Other parts of the EPA's plan would require equipment on compressors, storage tanks and new pneumatic controllers, the instruments that control pressure and other conditions. The EPA estimates the rules will cut 95% of the smog-related chemicals released by fracking wells. Half of all new fracking wells already collect gases from the initial drilling of the well but only Colorado and Wyoming explicitly prohibit flaring and require such green completions. The American Lung Association was quick to tout the rules' health benefits.

In Colorado a new air pollution study is designed to track pollution from wells and see how it affects human health. Colorado State University will perform the study, which will begin in June and run through 2016. The study's second phase will develop a health-risk assessment for people who live near gas fields. The \$1.3 million study will be paid for by fees levied on natural gas and oil companies. Governor John Hickenlooper told lawmakers on January 25, 2013 that they should spend about \$11 million of unanticipated tax money for the state health department to study the effects of gas and oil extraction on environmental air quality. This includes about \$1 million to study the drilling practice known as hydraulic fracturing, or fracking. The Legislature makes the final call on budgeting, but the governor's suggestions are taken seriously because he will ultimately sign or veto the budget.

The bottom line is that we simply do not know what exposure levels humans, wildlife and domestic animals living nearby a well are receiving. Are the right chemicals being monitored? Are the federal maximum safe levels of exposure too high for some of these materials?

## [Consensus Questions 5, 6]

### **Second video *Realities of Drilling: Part II***

You-Tube video (7 minutes or so)

Rational Middle Energy Series (sponsored by Shell Oil Company, partnered with other non-industry players, media partner the Atlantic and media sponsor New York Times)

### **Consensus Question # 4 Information: Environmental and Safety Regulation of Water Quality in Oil and Gas Operations by State and Local Agencies**

#### **Potential Impact of Fracking on Water Quality (Power Point 27)**

One of the most publicized concerns of fracking is the potential impact on water quality. In response to public concern, the US House of Representatives requested that the EPA conduct scientific research to examine fracking and water resources. In 2011, the EPA began research under its *Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources*. A progress report is expected in September 2013 and a final draft report is expected to be released for public comment in 2014.

There are over 450 different chemicals used for fracking. The composition of fluids used to frack a well depends on the company drilling and the geological composition of the well. COGCC requires operators to list the chemicals used in fracking a given well on the FracFocus website within thirty days after the fracking process is complete.

Many of the fracking chemicals are also used in commercial products such as paints, solvents, pesticides and toilet bowl deodorizers and result from everyday



activities such as smoking and filling your car with gasoline. Most of these chemicals have warning labels and you'd never want to drink them. Also, the quantity used in the fracking process is much larger than is used in a household. According to a Congressional committee report, there are four compounds of particular concern.

- 2-butyl ethylene
- Benzene
- Naphthalene
- Polyacrylamide (PAM)

While PAM is considered safe, the other chemicals can cause cancer or be dangerous to organs such as the spleen, liver and bone marrow. But these and other chemicals used in fracking can make surface and groundwater sources unsafe to use, depending on the volume concentration. While we will discuss water testing in a few minutes, it should be noted that proprietary chemicals did not have to be disclosed in Colorado until 2012, are still not required to be disclosed nationally, and that past and current water testing does not look for “exotic chemicals” used in fracking.

### **Fracking Fluids Spills (Power Point 28)**

Spills can occur in oil and gas development from the initial chemical mixing and drilling of the well, through wastewater treatment and disposal and the production phase. A spill or release can be caused from failure of the well casing integrity, corrosion holes in pipelines, leaks from storage tanks, equipment failure, tanker truck accidents, vandalism and operator error.

The COGCC requires that spills over 5 barrels (or 210 gallons) be reported. Smaller spills must be reported if they threaten surface water, a residence or occupied structure, livestock, or public byway. The operator reporting the spill is also required to notify the affected surface owner. Earthworks, an environmental group estimates that spills are under-reported by as much as 30% to 40% nationwide. Christi Zeller, an industry representative told our study committee that all spills are reported in La Plata County as a matter of practice. Spills are listed on the COGCC website with detailed information on location, volume, operator, and whether there was any groundwater or surface water contamination. Well sites have berms for containment of spilled fluids and whether the berm was breached or not is also documented. There is telemetry at well sites to alert operators of pressure fluctuations indicating a potential spill or release.

In the entire state of Colorado, there have been 2078 spills in the past 5 years. In La Plata County there were 17 spills in 2012 with no groundwater contamination, 2 incidents of surface water contamination, and 6 failures of berm containment.

### **Groundwater and Surface Water Contamination (Power Point 29)**

The potential for contamination of groundwater and surface water and potential human health and environmental effects has been debated in the press since the release of the movie *Gasland* in 2010. Water and soil contamination can come from release of fracking fluids or chemicals. Another source of water contamination comes from seismic activity resulting from drilling which Marilyn Holland will discuss.

The leading cause of water contamination is from methane which can be naturally occurring or result from migration along fissures from fracking. Methane is not

regulated in drinking water but is dangerous because as it collects in enclosed spaces it can asphyxiate people or lead to an explosion. In the mid-to-late 1980s, there was an occurrence of water wells being contaminated by methane in La Plata County that led to improved procedures for cementing well casings and to the Bradenhead testing program which tests for gas tight well head casing. Marilyn Holland will discuss methane contamination in more detail.

There has been baseline sampling of water wells in La Plata County by BP for 15 years. According to a local BP rep, it is the only data in the U.S. on long-term water well testing associated with oil and gas development. In 2012, a Colorado Gas and Oil Association Voluntary Baseline Groundwater Quality Sampling Program went into effect including domestic water wells and other groundwater features such as seeps and springs.

A recent area of environmental focus and little studied is the impact on vegetation and animals from oil and gas development. Earlier this year, a peer-reviewed report by a veterinarian and Cornell professor suggested a link between fracking and illness in food animals. The concern is that the chemicals may appear in milk and meat products made from these animals. A January 20, 2013 article in the *Pueblo Chieftain* cited examples of private ponds, lakes, and holding ponds in the area supplemented with water released from coal bed methane wells and used to provide water for cattle and wildlife in the drought stricken area west of Trinidad.

There is recognition by some oil and gas companies of the importance in protecting lands and waters for wildlife. BP, in conjunction with the Nature Conservancy and the Colorado Department of Fish and Wildlife, identified important wildlife corridors in La Plata County and set them aside, protecting them from future

development. For this effort, BP was named “Operator of the Year” in Colorado in 2012.

### **Spill Management (Power Point 30)**

The COGCC has regulatory authority for spill management. The regulatory requirements are designed to protect state waters and land from spill and releases of waste products.

In general, if a spill occurs the area is closed off, leaks repaired and soil and groundwater samples are sent for laboratory analysis. Affected soils are excavated and moved to an authorized disposal site. Groundwater is removed by a vacuum truck. Affected areas could be pressure washed and wash water recovered by a vacuum. Reports are prepared and the COGCC approves cleanup and remediation plans.

Unfortunately, we don’t live in a perfect world. Anecdotally, in 2012 an operator attempted to cover up with gravel an unreported spill in La Plata County, which had potential to migrate into groundwater. The COGCC discovered the spill during an inspection, did follow-on inspections and subsequently issued a Notice of Violation. We will follow this situation through resolution along with the COGCC, the county and the industry.

The COGCC has the option to assess operator fines. According to an environmental group representative, fines are seldom issued and the dollar amount of fines has not changed since the 1930s. However, the COGCC has made a concerted effort to reduce their backlog of environmental enforcement actions.

From January 2010 through June 2011, they assessed more than \$1.6 million in penalties associated with spills and releases.

### **Rules and Regulations (Power Point 31)**

La Plata County has no official responsibility for water quality. Protection from contamination of ground water wells in the vicinity of oil and gas drilling is the primary responsibility of the Colorado Oil and Gas Conservation Commission. In January of this year, the Commission passed new ground-water protection rules requiring operators to sample nearby water wells both before and after drilling activities to provide assurance that water supplies are not affected by energy development. Rule changes occur because of public pressure. As fracking has become more prevalent in oil and gas production, people living near these operations have become more alarmed over, not only water quality, but air quality, effects on the environment and wildlife, as well as the amount of water used to frack these wells. It is through discussions between industry, environmental groups, government entities, and local participants, both pro and con, that good rules can be adopted over time.

### **New Water-Quality Regulation (Power Point 32)**

Colorado's new ground-water protection rules will require sampling of up to 4 water wells within ½ mile of any new oil and gas well prior to drilling, and 2 more samples of each well between 6 and 12 months, and again between 5 and 6 years after production has begun. These tests will look for heavy metals, salts, arsenic, lead, pH content, etc. Industry is not required to report chemicals used until after the well is drilled. Drillers may post the chemicals they expect to use, and then follow up after fracking with a corrected list if changes were made. As you can imagine, some groups feel that the new rules aren't strict enough, while others

believe they are too strict. But, it is a step in the right direction and was enacted to reassure the public that their concerns were being heard and were being addressed. The Commission has now put its water-quality data base online so that the public can review the same sampling data accessed by Commission regulators. The data can be found on the COGCC website. These new ground-water protection rules are considered to be among the most stringent in the United States.

However, there still remain concerns about potential contamination of ground water by oil and gas drilling operations. One concern is that there is no standard for the maximum depth to which surface casing should be set in place. Currently a report published in 2011 for Colorado by the State Review of Oil and Natural Gas Environmental Regulations called the STRONGER report expressed concerns about well casings which do not extend below aquifers thus opening the way for potential contamination by the oil and gas drilling. The report recommended that good drilling practices require that a well be drilled and casing be set to 100 feet below any potentially usable ground water. The COGCC rule that is currently in place requires that an oil or gas well be drilled 50 feet below the deepest water well in the area.

Most water-well contamination is caused by methane in the ground water. This is not necessarily a result of oil and gas drilling. Some concentrations of methane are natural occurrences caused by bacterial activity and are not related to oil and gas operations. Other times methane found in water wells has been caused by methane migrating into ground-water aquifers via fractures creating a natural pathway, or pre-1988 conventional gas wells in which the aquifers and/or Fruitland Formation were not isolated by adequate casing protection. There have been no documented cases of water-well contamination with fracking fluids in La Plata County.

Fracking is not currently being done in the County. In fact, in 2012 only 2 wells

were drilled even though 71 permits were issued and Industry filed no notices of fracking. If a well is to be fracked, the operator must give at least 48 hours advanced written notice to the COGCC using Form 42. The Commission then shall provide electronic notification to the Local Government Designee in whose area the well is to be fracked.

### **Fracking Waste Disposition (Power Point 33)**

Most of the wells drilled in La Plata County are coal-bed methane wells. These methane gas wells produce huge amounts of waste water containing fracking fluids along with salts and other minerals. Most of the produced water is used in fracking other wells until so polluted that it must be disposed of. It is too expensive to treat this produced water so that it could be reused for another purpose, so it must be disposed of by either hauling it to a disposal site, usually an open air pit, or re-injecting it into a new formation through an injection well used only for that purpose. An injection well takes injected waste fluid and places it deep underground into a porous rock formation. Most injection wells are new wells drilled for this purpose. There are currently about 20 injection wells in the County including some on Tribal land. Occasionally an old well can be converted into an injection well. Most injection wells are privately owned by an oil and gas company, but there are some commercial wells that can be used for a fee. In La Plata County, 99.9% of fracking waste water is injected into disposal formations.

In early 2000, a strange phenomenon occurred along CR 203 north of 32<sup>nd</sup> street. During the winter, the snow melted along a stretch of land and the elk would congregate in the area because the ground was warm and the grass was green. People living in this vicinity reported that their basement temperatures were rising, the Hickerson Hot Spring's flow increased dramatically, and the Spring's

temperature also rapidly increased. The trees in this area began to die, along with other vegetation. The source of this phenomenon was traced to an injection well about 8 miles away from the location of disruption in a south-southeast direction (just west of the Pastorius Reservoir). When the well was shut in, the temperatures cooled off and the Spring's flow returned to normal. It was concluded that the wastewater being injected had been diverted by a fault that crossed the injection formation and allowed the disposal water to return to the surface at this location.

Injection wells are permitted and monitored by the COGCC. When injected formations reach 70% to 80% of capacity, the injection well operator must look for another injection well with spare capacity that can be shared with other operators or find an alternate way to dispose of the produced water, such as hauling it to a disposal site, or applying for a new injection well permit with the COGCC. A recent example of how long it takes to get a new injection well permitted is 3 years through the EPA and 3 years through the County due to geologic testing required for certification of an appropriate formation for disposal and calculation of the appropriate amount of waste water the site can take.

Over the past several years, earthquakes related to fracking have been reported in the Raton Basin in southeast Colorado,, Oklahoma, Ohio, Texas, and Arkansas. More studies are now being done to determine whether those earthquakes are being caused by injecting fluids into porous formations through injection wells. Colorado's Oil and Gas Conservation Commission asked State geologists in 2011 to review all permits for new disposal wells to assess earthquake risk.

The USGS is also studying the effects of injection wells to decide whether they could be a cause of earthquakes. Federal scientists discovered that most quakes



this past decade were located within 3 miles of active disposal wells and that these wells contained exceptionally large volumes of wastewater. A 2012 study by a USGS team of the Raton Basin in Colorado concluded that "...the majority of the earthquakes since August 2001 have been triggered by the deep injection of wastewater related to the production of natural gas from the coal-bed methane field here."

As hydraulic fracking has become more widely used in the production of oil and gas, it has increasingly been connected to earthquake activity. However, it appears that more earthquakes are caused by re-injecting the produced water deep into underground formations than fracking the well. The USGS report stated that the sequence triggering the earthquakes in the Ration Basin was threefold.

First, from 1970 through July of 2001, only 5 earthquakes of magnitude 3 and higher were recorded in the Raton Basin. From August of 2001 through the end of 2011, as fracking and injection-well activity increased in the area, 95 earthquakes of magnitude 3 or higher were recorded. Second, the vast majority of seismic activity is located within 5 kilometers to active disposal wells in this region. And, third, these wells have injected exceptionally high volumes of wastewater. Obviously, more studies need to be done, but it is a wake-up call that prudence needs to be taken into consideration when these drilling practices are being conducted in an area, and especially if any increase in seismic activity is noted.

[Consensus Question 4]

## **Water Quantity Presentation**

## Consensus Question #7

You all know the old saying: ‘Whisky is for drinking; water is for fighting’, attributed to Mark Twain although they can’t prove he ever said it. In any case: Water is a very contentious emotional issue in CO, especially when the public is not unanimous in support of a particular use. We interviewed Rege Leach, Division 7 Engineer for the CO Dep't of Water Resources, which has the mission to oversee water laws for the state. He deals only with questions of water quantity: other state agencies deal with water quality, health issues, and environmental impacts. Like any other water user, oil and gas companies must adhere to CO water laws, which take precedence over federal laws. Colorado water laws are complicated, and we will just touch on some of them in this discussion.

La Plata County is on the northern edge of the Fruitland Coal Formation. There are about 3800 wells (~3347 producing) in the county, 15% of which are on the Southern Ute Reservation, and on water issues the state has a good working relationship with the tribe. Historically, the local wells have produced mainly coal bed methane, a form of natural gas from coal beds. They have been vertical wells, fracked using only high pressure and steam, with no added chemicals needed. Coal bed methane formations have water already embedded with the methane in the coal formation, so not much extra water has been needed to produce the gas and the produced water can be re-used for fracking other wells. The techniques of horizontal drilling and the use of chemicals in fracking are new to La Plata County.

Most of the water in CO is already spoken for under the state’s prior appropriation system. If the produced water from coal bed methane drilling is determined to be tributary to the state’s system of rivers and streams, it is assumed to contribute to

somebody's downstream water right. In that case, the operator must purchase water from a storage facility to replace the produced water. Most of the produced water from drilling in La Plata County has been determined to be tributary; therefore, industry has assumed that all of it is tributary and, therefore, augments with annual water allotments from Vallecito and Lemon Reservoirs.

The amount of water needed for fracking varies from well to well, depending on the amount of water already in the formation and the geology of the region. An average for Colorado is 15 acre feet per well or 5 million gallons.

Earthworks Action website states that coal bed methane wells typically use from 50,000 to 350,000 gallons of water per well for fracking, whereas deeper horizontal shale wells can use anywhere from 2 to 10 million gallons, or thirty to forty times more water on average. Last May Christi Zeller, director of La Plata Energy Council, prepared an analysis of water used in La Plata County fracking for the Durango Chamber of Commerce from the FracFocus website. She aggregated the water gallon counts for 19 local wells fracked between May 2011 and February 2012; most were worked by WPX Energy. The average water use was 195,199 gallons per well. If two outliers are excluded, each using about 70,000 gallons, the average is just under 210,000 gallons per well. Zeller explained that the two 'outliers' are Conoco wells and after the Missionary Ridge fire, Conoco decided to use nitrogen to reduce the amount of water they needed.

Keep in mind that all these figures include only fracking, not drilling, data and that the La Plata County data includes only wells in coal bed methane formations or conventional natural gas production in Mesa Verde or Dakota formations, because, thus far, we've had no horizontal drilling in shale. There is no question that if La

Plata County gets into horizontal drilling in shale, a whole lot more water will be used for drilling and fracking, mostly because the well bore are so much longer. Swift Energy Company's request to conduct exploration in Mancos shale on the west side of the county, recently in the news, is likely to present significant water issues because the shale is much denser, containing less water, so more water will be needed for drilling and fracking if the exploratory work proves the presence of significant recoverable gas or oil.

[Slide 36, 37] Although we hear a lot about the amount of water used by the oil and gas industry, it really doesn't amount to very much when compared with agricultural use. According to a report of water consumed in CO *Water Sources and Demand for Hydraulic Fracturing of Oil and Gas Well in CO from 2010 Through 2015*, produced jointly by the CO Division of Water Resources, the CO Water Conservation Board and the COGCC, of the amount of water consumed in CO in 2010, only 0.08% was used for fracking. The major water uses are 85% for agriculture, 7.4% for municipal and industrial, with the remainder for 'other uses'. Note that oil shale development (drilling for kerogen, which requires heat and energy to get it out), as opposed to shale oil, is not being conducted in CO at this time.

The main difference between water use for fracking and all other water uses is that water that goes into the oil and gas industry is considered lost to the hydrological cycle. It cannot be cost-effectively cleaned up enough to return it to the hydrological cycle. Fortunately, it can often be re-used for re-fracking the well or fracking a new well. Water used by all the other water uses can be cleaned up over time and re-used. So effectively we are losing only a small amount of water to the oil and gas industry; however, it is gone realistic future. Actually, that assumption

is currently being challenged by farmers and ranchers west of Trinidad, who are using produced water from coal bed methane gas extraction to water stock and wildlife and irrigate fields, as mentioned in the water quality section.

The same document lists potential sources of water for fracking. Water can be

1. transported from out of state.
2. irrigation water leased or purchased from a land owner, and if necessary the land owner and an oil and gas operator may need to apply to have the water right changed or expanded from an irrigation use to industrial use.
3. leased or purchased from a municipality or other water provider which has a surplus.
4. leased or purchased from a waste water treatment plant, but only with approval by the Division of Water Resources Division Engineer.
5. diverted from a stream or river if there is a surplus, which is not common in Colorado.
6. diverted from designated ground water basins with an agreement with the owner of a water well.
7. produced water, with a proper permit from the State Engineer's Office, which may require full augmentation by the oil or gas operator for the water used.
8. reused or recycled well construction/drilling water.

Note that the transfer of water usually does not mean transfer of the water right as well. Producers are required to report to the state the amount and source of water being used for drilling and fracking each well.

[Slide 38] Future demands for water in CO for the period 2010 to 2015 have been

predicted by the COGCC using the following assumptions:

The demand for new gas wells will remain relatively flat

The number of drilling rigs in the state will remain relatively flat

The number of wells drilled will remain relatively flat because of rig count

The number of horizontal oil wells drilled will increase approximately 20% each year

The number of vertical wells drilled will decrease proportionally with the increase in horizontal wells drilled.

[We suspect that several of these assumptions result from the belief that natural gas prices will not rise for several years.]

[Slide 39] Based on these assumptions COGCC estimates the following demand for water for fracking to be

<b>Year</b>	<b>Acre Feet</b>	<b>Growth</b>
2010	13,900 (actual)	-
2011	14,900 (actual)	7.2 %
2012	16,100	8.1 %
2013	16,900	5.0 %
2014	17,800	5.3 %
2015	18,700	5.1%

As for the permanent removal of the amount of water consumed by fracking each year from the hydrological cycle, especially in the light of reduced availability of

water due to climate change, Rege Leach of the Department of Water Resources contends that the free market system and current water law will take care of this by increasing the price of water. The view of the CO Department of Water Resources is that the use of water for fracking will have no greater impact on the availability of water in times of shortage than will any other use. Leach also pointed out that water is heavy and difficult to transport and dispose of so the industry on its own is trying to reduce its water usage. Earlier we saw evidence of other reasons for Conoco, for example, to reduce its water usage in 2002 after the Missionary Ridge Fire.

The amount of money drilling operators are paying to purchase water from the cities of Loveland and Fort Collins (\$1000 - \$2000 per acre foot) compared to \$40 - \$100 per acre foot that farmers are currently paying ensures that the value of water will increase wherever fracking occurs. On the local level, with oil and gas operators requesting access to potential shale oil acreage, we can be sure that all of us will be more increasingly cognizant of the expanding demands for our unpredictable future water supply.

[Consensus Question 7]

[Additional Consensus Questions, if time]