Comments on the Shell Western Exploration and Production, Inc. (SWEPI) Fortune 4-9, Freeman 3-24, Seibert 3-8, and State 2-36 Applications for Permit to Drill, submitted by Ceal Smith on behalf of the Citizens for Huerfano County.

The Colorado Department of Health, Water Quality Control Commission (WQCC), Water Quality Control Division (WQCD), the Colorado Department of Natural Resources (DNR) and the Colorado Oil and Gas Conservation Commission (OGCC), share responsibilities to **"**foster the responsible, balanced development, production, and utilization of the natural resources of oil and gas in the state of Colorado in a manner consistent with protection of public health, safety, and welfare, including protection of the environment and wildlife resources (§ CRS 34-60-102(1)(a)(I)).

The dismal failure of state agencies, and especially the COGCC[1] to adequately oversee and inspect the tens of thousands of wells currently under their jurisdiction, and enforce existing laws and rules, has resulted in irresponsible development in Colorado that significantly endangers the public health, welfare, safety and environment.

A recent report from Earthworks[2] concludes that the COGCC has failed to achieve its mission to "foster the responsible development of Colorado's oil and gas natural resources." due to its inadequate enforcement of its own rules. Under current regulatory enforcement:

- Inspection capacity is inadequate;
- Violations are not consistently assessed;
- Violations are inadequately reported and tracked;
- Fines are rarely issued to violators;
- Fines are inadequate to punish or prevent irresponsible behavior by oil and gas operators;
- The environment is not protected.

The COGCC must not permit more wells than it can competently inspect. Therefore, the Gardner wells must not be permitted until the COGCC can prove its ability to:

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[1] Inadequate enforcement means current Colorado oil and gas development is irresponsible, COGCC Enforcement Report, Earthworks, March 2012, http://www.earthworksaction.org/issues/detail/colorado_oil_gas_enforcement

[2] Ibid

1. Adequately enforce existing regulations,
2. Publicly and consistently assess, report, and track the resolution of violations (in addition to NOAVs),
3. Publish online violation-related data that is easy for the public to access and evaluate
4. Improve its use of penalties so as to provide a credible deterrent to irresponsible operation. Fines should be assessed more frequently; maximum and minimum fine amounts should be significantly increased.

SWEPI commitment not to frack

SWEPI announced in public (http://www.huerfanojournal.com/node/3879) and indicated in its Applications for Permit to Drill that hydraulic fracturing will not be applied to the Fortune 4-9, Freeman 3-24, Seibert 3-8, and State 2-36 wells. Yet Conditions Of Approval for fracking have been proposed on all 4 wells by COGCC. This discrepancy is confusing and more clarity is needed. A No Fracking requirement needs to be attached as a Condition of Approval to the 4 Gardner wells stating that new APDs will be required if SWEPI decides at a later date to frack. This COA is vital to the publics right to know and due process right to review and comment on fracking.

RISKS

Groundwater contamination, cement casing failure

Sustained casing pressure and gas migration are chronic problems in the oil and gas industry. The potential for uncontrolled drilling and production fluid and methane migration along well casings is high and increase in areas of spatially intense development and (potentially) geologically complex environments like the Gardner area.

Mechanisms of Gas Migration include[3]:
• Gas Migration Through Cement: percolation during curing
• Cement Sheath Failure: high temp, high pressure, perforation
• Improper Cement Design and Placement: poor chemistry, poor mud cleanup, low

[3] Ingraffea, A.R. Ph.D, P.E., *Unconventional gas development from Shale Plays: Myths and Realities Related to Human Health Impacts.* Presentation given on Dec. 2, 2011, Halifax, Nova Scotia, http://newfield-pause.org/Resources/newfield_May_2011_**Ingraffea**.pdf

cement top
• Casing Failure: Corrosion, joint failure or fracture

Other factors that can cause uncontrolled fluid and gas migration include:
• Cross Flow Between Adjacent Wells

Complex, hazardous hydrogeology

The geology of the deep Raton Basin in Huerfano County is characterized by deep vertical dikes, undetected natural faulting, interconnected meandering paleo-sand channels and a history of coal and coal bed methane mining that present unique and complex geological hazards[4]. Together these conditions substantially increase the probability of unintended consequences.

According to hydrologist Thad McLaughlin, an expert on Huerfano County ground water, "**shale that normally has little or no permeability may be highly permeable where it lies adjacent to the intrusive rocks** [i.e. dikes]"[5].

Thus, the dikes create conduits between geological zones, otherwise assumed to be isolated. How deep the dikes go in the Gardner area is unknown, but because they are derived from magma, they are certain to extend several miles down. In 2009, Spoon Valley Energy lost control of the drill-head when it struck an intrusive dike 6,200 feet below the surface while drilling for gas near La Veta.

"Leaky dikes" (McLaughlin, 1966, Barkman, 2004), previously undetected faults (USGS, 2001) and sand channels (Denney, 2007), are three types of conduits that could allow contaminants and fracking fluids to migrate in unexpected ways. Without a better scientific understanding of the risks of drilling and fracking in Huerfano's complex

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[4] Denney, Paul. Possible Pathways of Vertical Conductivity at the Petroglyph Little Creek Coalbed Methane Project, Walsenburg, Colorado. November 2008, http://www.scribd.com/doc/71350939/Paul-Denney-11-15-2008-Presentation

[5] http://pubs.er.usgs.gov/publication/wsp1805

geological environment, Shell's claim that "deeper is safer" is unfounded.

The potential for oil and gas drilling to dislodge and release naturally occurring, but highly toxic substances like hydrogen sulfide (known seeps occur on Middle Creek Road, Indian Creek and Sulphur Springs Road west of La Veta) and radioactive vanadium and uranium (there are 11 known radioactive occurrences in Huerfano County, Minedat.com) is also troubling, especially since the EPA and COGCC don't require monitoring of radioactive substances in flow back or production fluids.

Many impacts from oil and gas activities occur on the surface, irrespective of the depth of the well. Deep drilling and fracking require enormous water and chemical inputs that must be trucked over rural back roads increasing the danger of surface spills and accidents. A 2008 ProPublica investigation found more than 1,000 documented cases of contamination in the US, including cases in Huerfano County.

Pollution from flowback and open production water pits leak and are subject to flooding. Even worse, they release harmful chemicals into the air we breathe. Methane contamination of drinking water accompanying gas-well drilling and hydraulic fracturing increase with distance to the nearest gas well[6]

Until measures and assurances are in place ***that are proven to protect*** the public health, safety, welfare and environment, COGCC should not permit these, or other wells in Huerfano County.

Should the COGCC decide to proceed to permit the SWEPI Fortune 4-9, Freeman 3-24, Seibert 3-8, and State 2-36 Applications for Permit to Drill anyway, they need to clearly indicate how they will monitor, prevent and mitigate impacts on citizens, communities and the environment resulting from the following activities[7]:

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[6] Osborn, Stephen G., et al. Methane contamination of drinking water accompanying gas-well drilling and hydraulic fracturing, *Proceedings of the National Academy of Sciences,* April 14, 2011, http://www.pnas.org/content/108/20/8172

[7] http://www.rff.org/centers/energy_economics_and_policy/Pages/Shale-Matricies.aspx

1. Site development and drilling preparation,
2. Drilling activity, fracturing and completion (if allowed without additional approvals as CHC requests),
3. Well operation and production,
4. Fracturing fluids, flowback, and produced water storage and disposal,
5. Disposal
6. Shutting-in, plugging and abandonment (including abandonment liability),
7. Workovers and downsteam activities including pipelines

1. Site Development and Drilling Preparation

After locating a site for shale gas development, the area must be excavated and prepared for drilling. Preparation activity also often includes leveling of the site.

Activity	Intermediate Impacts					
	Groundwater	**Surface Water**	**Soil Quality**	**Air Quality**	**Habitat Disruption**	**Community Disruption**
Clearing of land/construction of roads, well pads, pipelines, other infrastructure		Stormwater flows Invasive species	Stormwater flows	Conventional air pollutants and CO_2	Habitat fragmentation Invasive species	Industrial landscape Light pollution Noise pollution
On-road vehicle activity		Stormwater flows		Conventional air pollutants and CO_2	Other	Noise pollution Road congestion/accidents
Off-road vehicle activity		Stormwater flows		Conventional air pollutants and CO_2	Other	Noise pollution

2. Drilling Activities

Drilling begins by boring a single well shaft vertically into the desired formation. One or more lateral wells are then drilled from the end of the vertical wellbore, angling to run horizontally through the shale formation.

Activity	Intermediate Impacts					
	Groundwater	**Surface Water**	**Soil Quality**	**Air Quality**	**Habitat Disruption**	**Community Disruption**
Drilling equipment operation at surface	Drilling fluids/cuttings	Drilling fluids/cuttings	Drilling fluids/cuttings	Conventional air pollutants and CO_2		Industrial landscape Light pollution Noise pollution

Drilling of vertical and lateral wellbore	Methane Drilling fluids/cuttings Intrusion of saline-formation water into fresh groundwater	Drilling fluids/cuttings		Methane		
Casing and cementing	Methane Drilling fluids/cuttings Intrusion of saline-formation water into fresh groundwater	Drilling fluids/cuttings	Drilling fluids/cuttings	Methane		
On-road and off-road vehicle activity		Stormwater flows		Conventional air pollutants and CO_2	Other	Noise pollution Road congestion/accidents
Use of surface water and groundwater	Freshwater withdrawals	Freshwater withdrawals Invasive species			Freshwater withdrawals Invasive species	
Venting of methane				Methane Hydrogen sulfide		
Flaring of methane				Conventional air pollutants and CO_2 Methane Hydrogen sulfide		Industrial landscape
Storage of drilling fluids at surface	Drilling fluids/cuttings	Drilling fluids/cuttings	Drilling fluids/cuttings	Volatile organic compounds	Drilling fluids/cuttings	Industrial landscape
Disposal of drilling fluids, drill solids, cuttings	Drilling fluids/cuttings	Drilling fluids/cuttings	Drilling fluids/cuttings	Volatile organic compounds	Drilling fluids/cuttings	

Fracturing and Completion

During hydraulic fracturing (one component of the completion process), a mix of sand, water, and additives are pumped into the wellbore at very high pressure to fracture the shale rock.

Activity	Intermediate Impacts					
	Ground water	**Surface Water**	**Soil Quality**	**Air Quality**	**Habitat Disruption**	**Community Disruption**
Use of surface water/groundwater	Freshwater withdrawals	Freshwater withdrawals Invasive species			Freshwater withdrawals Invasive species	
Perforation of well casing/cementing						Seismic vibrations
Hydraulic fracture intiation	Fracturing fluids	Fracturing fluids			Fracturing fluids	Seismic vibrations
Introduction of proppant	Fracturing fluids Proppants	Fracturing fluids Proppants		Silica	Fracturing fluids Proppants	Seismic vibrations
Flushing of wellbore	Fracturing fluids Proppants Methane	Fracturing fluids Proppants	Fracturing fluids	Volatile organic compounds Methane	Fracturing fluids Proppants	
Flowback of reservoir fluids	Flowback/produced water Methane Hydrogen sulfide	Flowback/produced water Hydrogen sulfide	Flowback/produced water Hydrogen sulfide	Volatile organic compounds Methane Hydrogen sulfide	Flowback/produced water	
Venting of methane				Methane Hydrogen sulfide		
Flaring of methane				Conventional air pollutants and CO_2 Methane Hydrogen sulfide		Industrial landscape
Storage of fracturi	Fracturing fluids	Fracturing fluids	Fracturing fluids	Volatile organic compounds	Fracturing fluids	Industrial landscape

ng fluids at drill site					
On-road and off-road vehicle activity	Stormwater flows Invasive species	Conventional air pollutants and CO_2	Invasive species Other	Noise pollution Road congestion/accidents	
Fracturing equipment operation		Conventional air pollutants and CO_2		Industrial landscape Light pollution Noise pollution	

Well Operation and Production

In this stage, shale gas is being brought up from the ground through the borehole and separated from other gases and liquids before being sent to pipelines.

Activity	Intermediate Impacts					
	Groundwater	**Surface Water**	**Soil Quality**	**Air Quality**	**Habitat Disruption**	**Community Disruption**
Well production	Flowback/produced water	Flowback/produced water	Flowback/produced water	Volatile organic compounds Methane Hydrogen sulfide	Flowback/produced water	
Condensate tank, dehydration unit operation	Condenser and dehydration additives	Condenser and dehydration additives	Condenser and dehydration additives	Conventional air pollutants and CO_2 Volatile organic compounds Methane		Industrial landscape
Compressor operation				Conventional air pollutants and CO_2		Industrial landscape Noise pollution
Flaring of methane				Conventional air pollutants and CO_2 Methane Hydrogen sulfide		Industrial landscape

Fracturing Fluids, Flowback, and Produced Water Storage and Disposal

Fracturing a well can require several million gallons of water. Storing, treating, and disposing of the large amounts of freshwater, produced water, and flowback water are key activities in this stage.

Activity	Intermediate Impacts					
	Groundwater	**Surface Water**	**Soil Quality**	**Air Quality**	**Habitat Disruption**	**Community Disruption**
On-site pit or pond storage	Fracturing fluids Flowback/produced water	Fracturing fluids Flowback/produced water	Fracturing fluids Flowback/produced water	Volatile organic compounds	Fracturing fluids Flowback/produced water	Fracturing fluids Flowback/produced water
On-site tank storage	Fracturing fluids Flowback/produced water	Fracturing fluids Flowback/produced water	Fracturing fluids Flowback/produced water	Volatile organic compounds	Fracturing fluids Flowback/produced water	Fracturing fluids Flowback/produced water
Transport off-site	Fracturing fluids Flowback/produced water	Fracturing fluids Flowback/produced water Invasive species		Conventional air pollutants and CO_2	Fracturing fluids Flowback/produced water Invasive species	Fracturing fluids Road congestion/accidents Noise pollution Flowback/produced water
On-site treatment and re-use	Fracturing fluids Flowback/produced water	Fracturing fluids Flowback/produced water		Volatile organic compounds		
Treatment, release by industrial wastewater treatment plants	Fracturing fluids Flowback/produced water	Fracturing fluids Flowback/produced water				Fracturing fluids Flowback/produced water
Treatment, release by municipal wastewater treatment plants	Fracturing fluids Flowback/produced water	Fracturing fluids Flowback/produced water				Fracturing fluids Flowback/produced water
Removal of sludge	Fracturing fluids	Fracturing fluids	Fracturing fluids	Volatile organic		Fracturing fluids

and other solids to landfills	Flowback/produced water	Flowback/produced water	Flowback/produced water	compounds		Road congestion/accidents Flowback/produced water Noise pollution
Deep underground injection	Fracturing fluids Flowback/produced water	Fracturing fluids Flowback/produced water		Volatile organic compounds		Seismic vibrations
Application of wastewater for road de-icing, dust suppression	Fracturing fluids Flowback/produced water	Fracturing fluids Flowback/produced water	Fracturing fluids Flowback/produced water	Volatile organic compounds	Fracturing fluids Flowback/produced water	Fracturing fluids Flowback/produced water

Other Activities

Once a well is in production, well workovers may be necessary to perform maintenance or remedial treatments, including removing production tubing. At the end of a well's lifetime, preparing it to be permanently abandoned includes plugging and integrity testing. Consideration is also given here to upstream activities that supply inputs to the development process, and downstream activities that move the gas to markets.

Activity	Intermediate Impacts					
	Groundwater	**Surface Water**	**Soil Quality**	**Air Quality**	**Habitat Disruption**	**Community Disruption**
Shutting-in	Drilling fluids/cuttings	Drilling fluids/cuttings	Drilling fluids/cuttings	Conventional air pollutants and CO_2		
	Fracturing fluids	Fracturing fluids	Fracturing fluids	Methane		
	Flowback/produced water	Flowback/produced water	Flowback/produced water			
	Intrusion of saline-formation water into fresh groundwater					
Plugging and abandonment	Drilling fluids/cuttings	Drilling fluids/cuttings	Drilling fluids/cuttings	Conventional air pollutants and CO_2	Habitat fragmentation	Industrial landscape
	Fracturing fluids	Fracturing fluids	Fracturing fluids	Methane		
	Flowback/produc	Flowback/produc	Flowback/produc			

	ed water	ed water	ed water		
	Intrusion of saline-formation water into fresh groundwater				
Workovers	Drilling fluids/cuttings	Drilling fluids/cuttings	Drilling fluids/cuttings	Conventional air pollutants and CO_2	
	Flowback/produced water	Flowback/produced water	Flowback/produced water	Methane	
	Intrusion of saline-formation water into fresh groundwater			Hydrogen sulfide	
Downstream activities (e.g., pipelines)				Methane	Odor

The Best Management Plan (BMPs) outlined in the Stormwater Management Plans (SWMP) should be made irrevocable Conditions Of Approval. The BMPs prescribed for the initial construction phase include, but are not limited to construction diversion ditch, sediment reservoirs, check dams, level spreaders, stabilized construction entrances and slash.

Reviewing and responding to four complicated APD's in sensitive sites never before impacted by oil and gas development is a complicated and time consuming process. For members of the impacted and concerned public, 20 days is not enough time to adequately review and prepare comments.

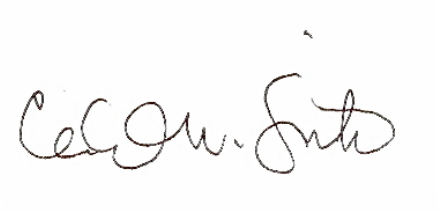
Despite requests from more than 600 concerned citizens[8], the Local Government Designee (LGD) failed to request a 10-day extension allowed under rule 305.c. According to the LGD, he was instructed by the Huerfano County Board of Commissioners and Acting COGCC Director, Thom Kerr, not to request the extension.

Because of the resulting time constraints, Citizen for Huerfano County did not have time to review of all the documents posted on the COGCC website related to the four SWEPI

[8] http://www.change.org/petitions/people-need-more-time-to-comment-on-shell-drilling-in-huerfano-county

APD's. Consequently, these comments do not reflect the full spectrum of our member concerns.

Sincerely,



Ceal Smith, MSci

TIERRA Consultants

On behalf of the Citizens for Huerfano County