Addressing Water Well 'Problems' and Complaints in Areas of Unconventional Resource Development: Appearances are Deceiving and Solutions Are Many*

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Key Comments

Industry's image

Results of misinformation--Bans on hydraulic fracturing in countries, numerous states, provinces, and cities

Some domestic water well facts

95% rural Americans get their drinking water from a groundwater source. Although Well Owner Associations recommend annual maintenance and testing, most owners do not do any; few test for methane).

Leading-up to the complaint of water well problems

Play develops. Well stimulation. Landowners access misinformation.
Landowner's well problem develops after oil or gas well development.
Complaints follow.

Water quality complaints

Odor, taste, color, sediment and/or gas

Symptoms, causes, and results of water well problems

Low yield due to tight aquifer. Dry season. Drawdown. Fouling of well screen or pump. Pump damage. Poor design and/or age of well.
Naturally occurring bacteria, minerals, etc.
New releases, casing leaks, spills (least common).

Methane in ground water

Septic field, fuel storage, barn animals, garage

Preparing and handling complaints that *will* come:

Establish a baseline program. Educate water well owners. Distinguish methane in aquifer from produced gas. Some water well symptoms may be related to vibrations from construction, seismic exploration, and hydraulic fracturing activities.

Summary

- Lack of maintenance and testing (most common)
- Poor construction, poor aquifer or lifespan of a well
- Historic drilling or mining activities
- Natural in place gas, migration or seepage
- Proper designed baseline and monitoring program can:
  - Educate stakeholders
  - Establish pre-drill baseline conditions
  - Monitor variability
  - Prepare you with answers to the complaints
  - Mitigate risk.

Selected References

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Outline

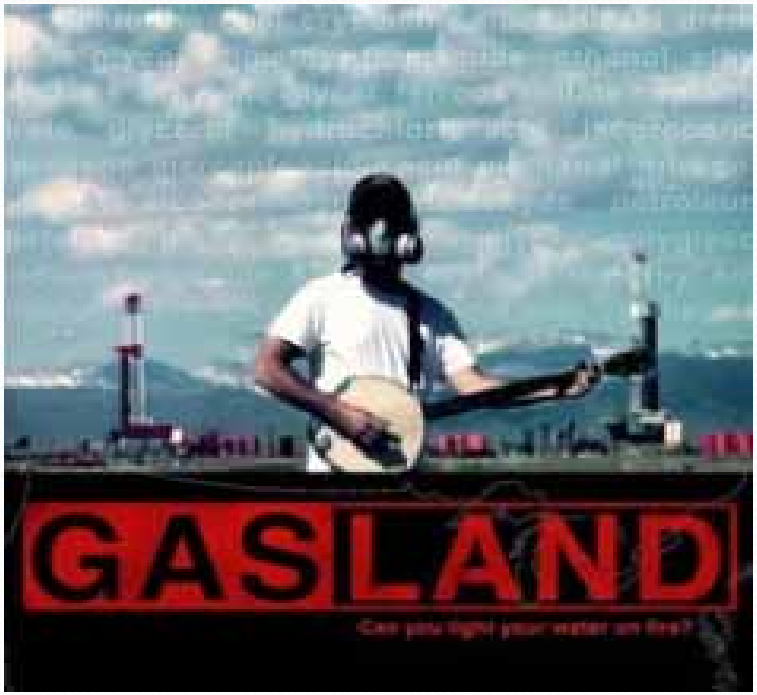
- Industry's Image
- Domestic Water Well Facts
- Leading up to the Complaint
- The Water Well Symptoms & Causes
- How to Prepare for and Handle the Complaints that *Will* Come.

The Environmental Rules

- **Environmental Problems are Emotional**
- **Environmental Solutions are Technical**
- **Environmental Decisions are Political**

Author Unknown

The Public Image of Oil and Gas Development

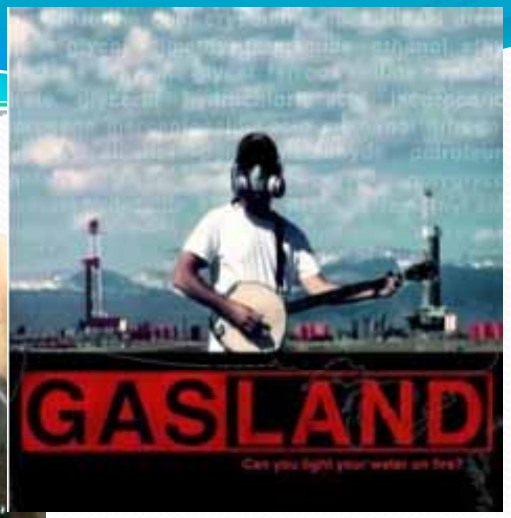


SWITCH TO A SMARTER ENERGY FUTURE

TRUTH LAND

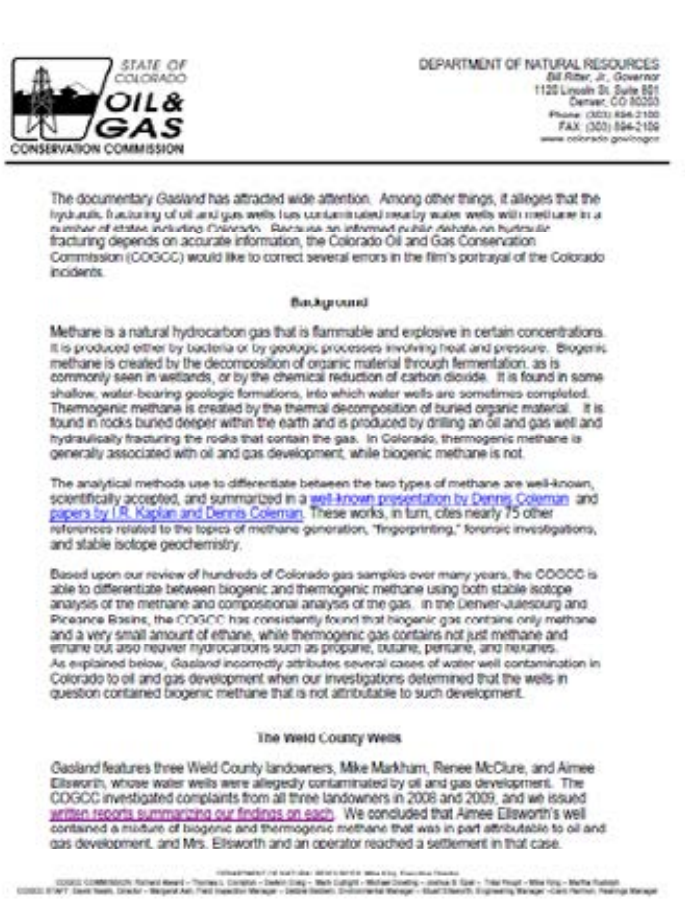
spOILed

Google Images (1st page) Fracking, Water



GASLAND Debunked

- Several cases in Piceance & Denver Basins, Colorado, USA
- Colorado Oil & Gas Conservation Commission publishes a letter correcting inaccuracies in Gasland.
- Only one case related to oil & gas operations, (but not shown to be from fracking.)
- Others all showed biogenic shallow or coal bed gas.
- How many people who saw the movie heard about that?



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The documentary *Gasland* has attracted wide attention. Among other things, it alleges that the hydraulic fracturing of oil and gas wells has contaminated nearby water wells with methane in a number of states including Colorado. Because an informed public debate on hydraulic fracturing depends on accurate information, the Colorado Oil and Gas Conservation Commission (COGCC) would like to correct several errors in the film's portrayal of the Colorado incidents.

Background

Methane is a natural hydrocarbon gas that is flammable and explosive in certain concentrations. It is produced either by bacteria or by geologic processes involving heat and pressure. Biogenic methane is created by the decomposition of organic material through fermentation, as is commonly seen in wetlands, or by the chemical reduction of carbon dioxide. It is found in some shallow, water-bearing geologic formations, into which water wells are sometimes completed. Thermogenic methane is created by the thermal decomposition of buried organic material. It is found in rocks buried deeper within the earth and is produced by drilling an oil and gas well and hydraulically fracturing the rocks that contain the gas. In Colorado, thermogenic methane is generally associated with oil and gas development; while biogenic methane is not.

The analytical methods use to differentiate between the two types of methane are well-known, scientifically accepted, and summarized in a well-known presentation by Dennis Coleman and papers by I.R. Kaplan and Dennis Coleman. These works, in turn, cites nearly 75 other references related to the topics of methane generation, "fingerprinting," forensic investigations, and stable isotope geochemistry.

Based upon our review of hundreds of Colorado gas samples over many years, the COGCC is able to differentiate between biogenic and thermogenic methane using both stable isotope analysis of the methane and compositional analysis of the gas. In the Denver-Julesburg and Piceance Basins, the COGCC has consistently found that biogenic gas contains only methane and a very small amount of ethane, while thermogenic gas contains not just methane and ethane but also heavier hydrocarbons such as propane, butane, pentane, and hexanes. As explained below, *Gasland* incorrectly attributes several cases of water well contamination in Colorado to oil and gas development when our investigations determined that the wells in question contained biogenic methane that is not attributable to such development.

The Weld County Wells

Gasland features three Weld County landowners, Mike Markham, Renee McClure, and Aimee Ellsworth, whose water wells were allegedly contaminated by oil and gas development. The COGCC investigated complaints from all three landowners in 2008 and 2009, and we issued written reports summarizing our findings on each. We concluded that Aimee Ellsworth's well contained a mixture of biogenic and thermogenic methane that was in part attributable to oil and gas development, and Mrs. Ellsworth and an operator reached a settlement in that case.

Results of Misinformation?

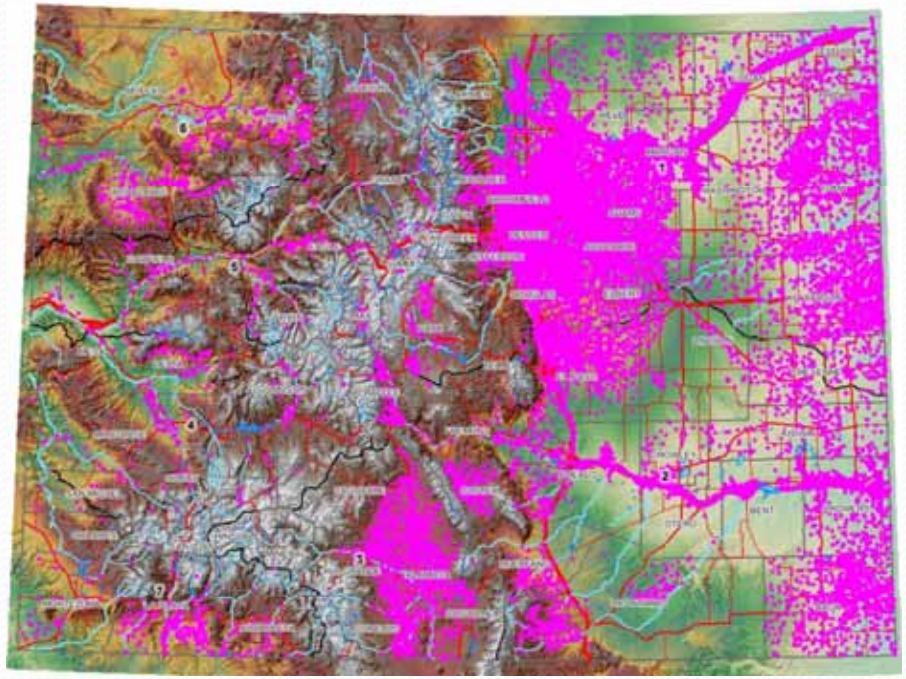
- Bans on Hydraulic Fracturing
- Countries
  - France
  - Bulgaria
- Many States, Provinces & Cities

Water Well Owner Facts

- About 95% of all rural Americans get their drinking water from a groundwater source
- 42 million depend on wells for their water
- Groundwater provides:
  - 37% of public water supplies
  - 95% of self-supplied household water
- Well Owner Associations Recommend Annual Maintenance and Testing
  - *Most Owners Don't Do Any!*
- Few Test for Methane

Colorado

- 25,700 Active Wells
- 40,000 P&A Wells
- 270,000 Water Wells
- 203,000 Residential/Household



Common Well Problems

1. **Poor Water Production (Quantity)**
   - **Well Goes Dry or has Low Yield Rates**
2. **General Water Quality**
   - **Odors, Taste, Color, Staining, etc.**
   - **Sediment**
   - **Bacteria - Slime**
3. **Gases in the Water**

Reasons for Problems are Many

- Lack of Routine Testing & Maintenance
- Poor Installation & Construction Practices
- Poor Aquifer Conditions

Photos Courtesy Anthony Gorody

Private Wells Exceed EPA Standards

- ***Private water wells are not required to meet US-EPA drinking water standards.***
- **Many exceed primary or secondary standards.**
- **Most Domestic Water Wells Contain Measurable Dissolved Hydrocarbons (Mostly Methane)**
  - **Majority Contain Bacterial Gas**
  - **Some Contain Gas From Natural Seeps or Historic Production Activities**

U.S. Geological Survey's National Water-Quality Assessment Program

USGS News Release, 2011

- **About 20% of untreated water samples from public, private, and monitoring wells across the nation contain concentrations of at least one trace element, such as arsenic, manganese and uranium, at levels of potential health concern, according to a new study by the U.S. Geological Survey.**
- **10% actually contained two or more trace elements exceeding human health benchmarks.**
- **Trace elements in groundwater exceed human health benchmarks at a rate that far outpaces most other groundwater contaminants, such as nitrate, pesticides, and volatile organic compounds (VOCs).**
  - **5,000 well sample set in USGS NWQAP**
  - **http://www.usgs.gov/newsroom/article.asp**
  - **http://water.usgs.gov/nawqa/trace/pubs/sir2011-5059**

The Complaint Sequence

1. CBM, Tight Sand, or Shale Play Develops
2. + Hydraulic Fracturing Well Stimulation
   - No Previous Production History, or…
   - Previous History Drilling – Possibly Old, or….
   - Severed Mineral Rights
3. Leasing Acquisition
4. Owners Google “Fracking” and see the images
5. Operator Begins Drilling Program, then…
6. A Landowner’s Water Well Develops a Problem….
7. The Land Owner Calls and Complains

The Complaint

- **After they drilled that oil/gas well, my water well _____!!!!!** ***(Fill in the Blank)***
  - **… Stopped Working**
  - **… Went Dry**
  - **… Has Sediment, or Slimy Stuff**
  - **… Has Gas Bubbles, or Methane**
  - **… Tastes Awful, Salty**
  - **… Smells**
  - **… Blew Up!**