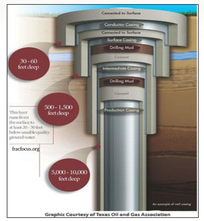

Graphic Courtesy of Texas Oil and Gas Association

Colorado's Natural Gas Exploration & Water Contamination

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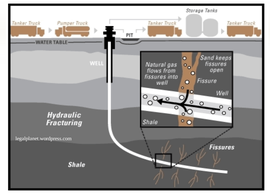
Environmental Studies
Fort Lewis College 2013

Is the water contamination that is attributed to natural gas exploration in Colorado caused by a problem of policies, a lack of enforcement, or something else?
This study was performed with the intention of answering that question



Map of Colorado Natural Gas Basins. Black Ovals Indicate Counties With Highest Number of Gas Wells. After, Colorado Geological Survey. (2011). Natural gas maps-basins, fields, and wells. http://geosurvey.state.co.us/energy/Natural%20Gas/Pages/NaturalGasMap.aspx

Abstract

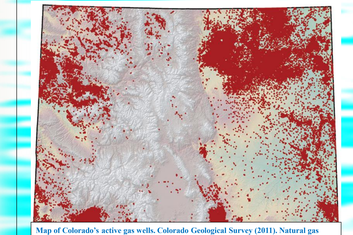
Colorado has a long history of natural gas exploration. More efficient processes for extracting natural gas have increased the amount of gas exploration in Colorado. This increase has coincided with economic gains to both the state and the natural gas industry, but it has come with the cost of water contamination . There are many laws and regulations in place to protect water resources from gas exploration processes. Unfortunately, the gas industry has been exempted from some of the country's major water protection laws. This, coupled with a meager enforcement staff at both the state and federal levels, has led to countless water contamination incidents in Colorado. The main issues that must be addressed to stop water contamination are the exemptions from federal laws, and the lack of enforcement at both the state and federal levels. Amending the Energy Policy Act, Clean Water Act, and Resource Conservation and Recovery Act are key steps towards protecting water resources. Once the gas industry is subject to the full force of these laws, the enforcement staff for the state and federal levels must be increased. This will ensure that Colorado's water is protected while natural gas exploration is occurring.

Methodology

- This project was completed using literature based research. To begin with, it was necessary to address the policies and regulations that govern the natural gas industry in Colorado. This involved researching the United States Environmental Protection Agency (EPA) and the Colorado Oil & Gas Conservation Commission (COGCC) databases. These sources provided descriptions of the rules that the gas industry must adhere to in Colorado. Digging deeper into these websites provided the names of different organizations that gather data for these larger agencies. These organizations were then used to expand the resource base of this project.
- Web based research using a combination of the FLC Library database and Google Scholar was performed. Information included natural gas history, hydraulic fracturing descriptions, and gas industry information specific to Colorado..
- Locating case studies linking natural gas to water contamination from agencies that gather EPA and COGCC information. This extended into different academic journals and university studies.
- Newspaper articles were used throughout this project. The New York Times and The Denver Post both provided relevant articles which reflect what kinds of things the public is aware of, the effects that the gas industry has had on specific areas, and some useful suggestions on how the public thinks regulation should be handled.
- In order to answer the research question, a mixture of library database research, in-library research, and Google Scholar web searches were used. Research focused on the EPA and COGCC rules, regulations, and exemptions, linking water contamination in Colorado to the gas industry, the effects that water contamination has had on citizens within the state, and what kinds of potential solutions there are to this ongoing problem.

Regulation

- **Clean Water Act**
  - Addresses spills that could possibly contaminate surface water, elevates the penalty of spills to a finable offense, and requires containment dikes around tanks and other storage facilities on natural gas sites in order to contain releases of contaminants from leaky storage units
- **Safe Drinking Water Act**
  - "Responsible for regulating the construction, operation, permitting, and closure of injection wells that place fluids underground" (EPA, 2013. p-1)
  - Passage of the Energy Policy Act of 2005 exempted the hydraulic fracturing process from the Safe Drinking Water Act. Hydraulic fracturing is a process where a drilling company injects a mixture of water, sand, and chemicals down a well at high pressure in order to fracture a geologic formation which allows natural gas to be recovered more easily (EPA, 2013)
- **Resource Conservation & Recovery Act**
  - Wastes produced by the natural gas industry contain constituents that are listed as hazardous under the Resource Conservation & Recovery Act, however the EPA does not classify these wastes as hazardous. Currently, natural gas industry waste is categorized as "special waste" and therefore not regulated at the federal level (Spence, 2011 & EPA, 2013)
- **Colorado Oil & Gas Conservation Commission (COGCC)**
  - New rules require drilling operators to take samples from up to four water wells within half a mile of the proposed drilling site before drilling occurs. These serve as baseline data to compare to later samples that must be taken between 6-12 months, and then 5-6 years. These are used to ensure that no harm to groundwater is occurring due to drilling activities (COGCC, 2013)
  - The 300 series of rules addresses the drilling, development, producing, and abandonment of natural gas wells
  - The 600 series of rules covers safety regulations
  - The 900 series of rules focuses on waste management


Map of Colorado's active gas wells. Colorado Geological Survey (2011). Natural gas maps-basins, fields, and wells. Image From: http://geosurvey.state.co.us/energy/Natural%20Gas/Pages/NaturalGasMap.aspx

OIL AND GAS TOTAL ECONOMIC IMPACT
(DIRECT, INDIRECT, INDUCED), 2010

Source	Employment	Wages (Millions)	Value Added (Millions)	Output (Millions)
Drilling	9,237	$584.5	$1,498.8	$3,334.5
Extraction	57,757	$4,088.8	$8,851.1	$17,344.8
Petroleum Refineries	9,692	$610.4	$1,911.3	$7,503.7
Transportation	3,493	$249.1	$383.3	$895.4
Gasoline Stations	16,617	$412.8	$778.7	$1,161.9
All Other	10,770	$618.9	$1,001.8	$1,679.7
Total	107,566	$6,564.4	$14,425.0	$31,920.0

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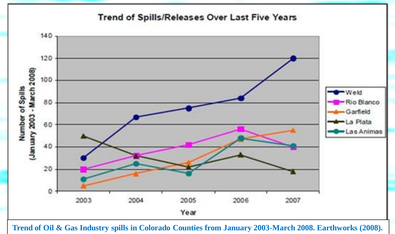

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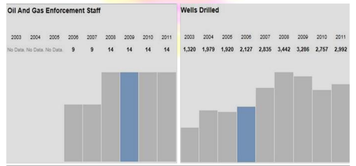
The Problems & Solutions

- **Enforcement**
  - The EPA's Enforcement & Compliance History Online (ECHO) water program shows that only 5 out of 32 major natural gas facilities in Colorado have been inspected in the last five years, and only 4 fines have been issued (ECHO, 2013)
  - In 2010, 16,228 state inspections of natural gas wells were performed. During this time, Colorado had over 43,000 wells (SourceWatch, 2013)
  - As of 2011, Colorado employed 14 inspectors to oversee 46,835 wells within the state (Larson, Lustgarten, Nankin, Schmidt, & Shankman, 2013)
  - Base fines for COGCC rule violations range from $500-$1,000 (COGCC, 2013)



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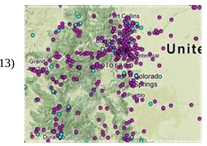
Summary of Spills/Releases and Water Impacts[iii]

Type of spill/release	How many	% Impacting water[iv]
All spills/releases	1549	20
Oil & gas	449	17
Produced water	767	11
"Other"	134	20
Unclassified	201	69

Oil & Gas Industry spills in Colorado from January 2003-March 2008. Earthworks (2008). Colorado Oil and Gas Conservation Commission, (2008). Colorado oil and gas industry spills: A review of cogcc data (January 2003-march 2008). *Oil & Gas Accountability Project*. Retrieved From: http://cogcc.state.co.us/RuleMaking/PartyStatus/FinalPrehearingStmts/OGAPExh1.pdf



Clean Water Act Facilities inspected (purple) vs. non-inspected (blue) in Colorado (top). Clean Water Act violations (bottom left). Penalties issued for Clean Water Act violations (bottom right). U.S. Environmental Protection Agency, Enforcement & Compliance History Online (ECHO). (2009). http://www.epa-echo.gov/echo/dashboard/dashboard_nonmajors.php?state=CO

- **Exemptions**
  - The EPA and COGCC both grant the natural gas industry exemptions from the Safe Drinking Water Act by allowing the industry to inject waste into aquifers that are too remote, too dirty, or too deep for feasible extraction. Over 1,100 aquifer exemptions have been permitted by the EPA's Rocky Mountain Regional Office. Some of these aquifers are are located in the same geologic formations as aquifers used by Denver area residents (SourceWatch, 2013)
  - The exemption of hydraulic fracturing from the Safe Drinking Water Act poses a large threat to groundwater resources in Colorado
  - 20% of waste fluid produced by the natural gas industry in Colorado is sent to water treatment plants. These plants are not equipped to treat this type of waste. The discharge of these still polluted waters into water sources throughout Colorado is due to the lack of regulation for the disposal of wastewater under the Clean Water Act (SourceWatch, 2013 & EPA, 2013)
  - A public health study was able to identify 353 out of 632 chemicals used by the natural gas industry. Of these chemicals, it was determined that over 75% could affect sensory organs, 40%-50% could affect the brain and nervous system, 37% could affect the endocrine system, and 25% were known to cause cancer. Exemptions from the Resource Conservation & Recovery Act by classifying wastes containing these chemicals as special, rather than hazardous, results in lighter regulation when it comes to the production, transportation, and disposal of gas industry waste (Colborn, Kwiatkowski, Schultz, & Bachran, 2011)
- **Amend Federal Legislation**
  - Amending the Energy Policy Act's decision to exempt hydraulic fracturing from the Underground Injection Control section of the Safe Drinking Water Act would ensure the reliability of injection wells and the segregation of the injection area from sources of drinking water
  - Due to the hazardous nature of chemicals used by the natural gas industry, the categorization of their waste under the Resource Conservation & Recovery Act must be changed from special to hazardous. This will ensure heavier regulation of the creation, transportation, and disposal of wastes containing the dangerous materials
  - The Clean Water Act's effluent guidelines program needs to be amended to include standards for the natural gas industry's wastewater disposal. This will prevent the waste from being sent to treatment plants that are not able to treat this type of waste, and the discharge of the still polluted water into Colorado water sources
- **Increase Enforcement**
  - The ratio of field inspectors to gas wells in Colorado is extremely out of balance. A bond between the federal government and the COGCC could help fix this problem. If funding from the government was combined with the funding the COGCC already receives, a larger enforcement staff could be employed. Training these new inspectors in both federal and state regulation would result in an effective regulating force on both the state and federal levels
  - Current base fines for COGCC rule violations are small. The fines can be raised for various reasons, but the base level must be increased. Fines of the current size are not significant to an industry that produces billions of dollars each year. Raising the base level to an amount that will catch the industry's attention will make them more likely to follow environmental protection rules

Conclusions

Five primary conclusions have been derived from this study.

1. Oil and gas development are of great economic importance to Colorado. To date, over 137,000 Colorado jobs are directly or indirectly related to the gas industry (Davis, 2012).
2. Colorado is rich in gas reserves, but poor when it comes to water quantity, ranking 44th in average annual precipitation (Current Results, 2013). This is why water contamination is such an important issue.
3. Colorado has extensive environmental protection laws regarding energy development which are admired by both industry and environmentalists (Center for Climate and Energy Solutions, 2011).
4. Federal legislative exemptions allow the Oil & Gas Industry to sidestep around U.S. water protection.
5. Enforcement at both the federal and state levels is not sufficient to properly regulate the Oil & Gas Industry. We can pursue energy exploration without contaminating our water resources, but only if we add more manpower and other mechanisms for strict enforcement of existing regulations, while developing new regulations that further protect water resources at the same time

Connections to Environmental Studies

- This study pulls knowledge from political science, economics, and environmental science. It is a good reflection of the interdisciplinary nature of Environmental Studies.
- Environmental Studies teaches one to view problems in a more holistic way, seeing every aspect that contributes to the problem. This study identifies the political and economic factors that have a role in Colorado gas industry exploration, it does not simply focus on the environmental impacts.
- The Environmental Studies Program engrains how important a "sense of place" is. My sense of place is what drove me to explore this topic. As a La Plata County resident, I have been exposed to gas exploration and the consequences that can follow it. With my education, I feel like I can develop solutions to lessen these consequences.
- Two of the goals of the Environmental Studies Program are to teach students to recognize mankind's role in environmental problems and to teach students how to develop creative solutions to mitigate these problems. This study touches on both of these learning objectives by demonstrating that the federal government's lax regulations and the lack of regulatory enforcement at the state and federal levels are contributing to water contamination and changes to these human-based issues are the only way to effectively solve the problem

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- Water issues are among the most complicated and important environmental problems that face us today. Solutions to these issues will have to be derived from a number of interdisciplinary studies, which weigh every potential positive and negative impact associated with the interaction between mankind and the environment. This is the only way to ensure that we can enjoy economic development while protecting our environment at the same time.

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