Results from a Pre- and Post-Presentation Opinion Survey on Hydraulic Fracturing in Allegany County

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ABSTRACT

An informational presentation on the positives, negatives, and uncertainties of hydraulic fracturing in the Marcellus Shale was given by Mountain Ridge's AP Environmental Science class to a group of educators from diverse fields on February 21, 2012. The educators were assembled for a meeting on a variety of education-related topics. Pre-presentation and post-presentation surveys were administered to gather opinions on hydraulic fracturing in Western Maryland.

Of 65 respondents, 84.8% resided in Allegany County. The pre-presentation results showed that over half of the respondents (51.5%) did not feel they knew enough to make informed decisions on this topic. Of those who did come with enough prior knowledge, a large majority (81.8%) provided answers that indicate support for the Governor's current moratorium. In the post-presentation survey, a larger majority (92.1%) provided answers that indicate support for the Governor's current moratorium. In the post-presentation survey, 96.9% of respondents felt they had enough knowledge to make informed decisions. Other policy-relevant questions were asked as part of the pre- and post-surveys, including questions about fracking in sensitive watersheds, county taxation policy on extracted gas, and state taxation policy. An open-ended response section was also part of the survey.

The researchers recommend that increased efforts be made to properly inform the public on the positives, negatives, and areas of uncertainty regarding hydraulic fracturing. The researchers also recommend that elected officials encourage more polling of larger population sets so that they can ensure that their policy recommendations coincide with the will of the public they represent.

INTRODUCTION

In both our local and state government, there is quite a lot of controversy over the topic of drilling in the Marcellus Shale. Some officials want to start drilling now, while others want to observe the experiences of other states and then take measures to improve drilling methods in Maryland.

The County Commissioners of Garrett and Allegany Counties want to see fracking start as soon as possible. They are quoted in a recent letter to the Governor encouraging "the Advisory Commission to expedite their review"(Commissioners, 2011). Senator Edwards and Delegate Beitzel share their pro-fracking perspective. They would like to boost the local economy as soon as possible.

Yet, Governor O'Malley has held firm on his moratorium and is not the only one with this opinion. U.S. Senator Ben Cardin and U.S. Senator Barbara Mikulski support O'Malley's moratorium and encourage more research. This will improve safety of the fracking methods to avoid spills, leaks, and other damaging accidents.

President Barack Obama has taken a "middle-of-the-road" approach. He supports drilling in the Marcellus Shale but "will take every possible action to safely develop this energy" (Obama, 2012).

The weighing of the pros and cons has divided many on the issue of Marcellus Shale drilling. Pennsylvania and West Virginia have been fracking for over two years, while New York and Maryland have each maintained a moratorium.

In a poll taken for the Maryland Petroleum Council, 74% of respondents "favored the development of natural gas resources in Western Maryland" (Maryland Petroleum, 2011). Yet, the question asked made no mention of hydraulic fracturing. A Cumberland Times-News poll taken in January concluded that 66% of their readers opposed hydraulic fracturing (Goldsworthy, 2011). It appears that the wording of the questions, the level of information provided to participants, and the demographics of the population polled all play a part in the results. This has been a difficult issue for gauging public opinion.

In order to determine public opinion more accurately, the following study was completed. Also, a key purpose of this study was to determine the level of comfort that citizens have with this subject. Finally, we hoped to determine if increased knowledge affects public opinion.

METHOD

An informative presentation regarding hydraulic fracturing in the region was given by Mountain Ridge's AP Environmental Science students to a group of educators. The educators were assembled for a day of meetings on a variety of current topics in secondary education. This presentation was a required event on the day's schedule.

Before the presentation, an anonymous pre-presentation survey was distributed and collected. This was followed by a 35-minute informational PowerPoint presentation providing the positives, negatives, and areas of uncertainty regarding hydraulic fracturing for natural gas in the Marcellus Shale of Maryland (See Appendix for a full text copy of the speech). The presentation contained information contributed by scientists, environmentalists, politicians, and members of the gas drilling industry. A strong effort was made to present a balanced and unbiased perspective. After the presentation, an anonymous post-presentation survey was distributed and collected.

The survey questions and results are as follows:

RESULTS

Total Respondents: 65

A) In which county are you a citizen?
84.8% Allegany
4.5% Garrett
6.1% Mineral, WV
3.0% Prince Georges
1.5% Charles

B)What is your age?
13.6% 18-30 **48.5%** 31-50 **37.8%** 51-70 **0%**70+

C) What is the highest level of education you have completed?
7.6% H.S. **1.6%** AA **15.6%** BA **75%** MA **0%** PhD

D) What is your gender?
42.4% Male **57.6%** Female

E)Check all of the following statements that describe you:
7.7% (5) I own a parcel of land in Allegany County that is 10 acres +
1.5% (1) I own a parcel of land in Garrett County that is 10 acres +
90.8% (59) None of the above apply to me.

Of the six people who owned 10+ acres:
50.0% (3) I have been approached by a drilling company for a lease.

Of the three people who were approached for a gas lease:
66.6% (2) I have accepted a gas lease on my property.
33.3% (1) I have declined a gas lease on my property.

Question 1-When should we begin fracking in Allegany County and Garrett County?

Pre	Post	
8.8%	**4.7%**	Begin fracking now.
2.9%	**10.9%**	Wait until 2014 for EPA and MDE Study Results, and then begin fracking.
29.4%	**70.3%**	Wait until 2014 for EPA and MDE Study Results, and then make a decision to frack or not frack.
7.4%	**10.9%**	Never frack.
51.5%	**3.1%**	I do not know enough about this topic to vote right now.

**Pre-Survey-If we remove the 51.5% who answered Question 1, "I do not know enough…" and then calculate percentages on the other four answers, the results are as follows:*
18.1% Begin fracking now. **6.0%** Wait until 2014 and then begin fracking**.**
60.6% Wait until 2014 and then decide. **15.2%** Never frack.

***If we add the two selections that say "wait until 2014" and the "never frack" selection, the following results emerge:*

Pre-Survey: **6.0% + 60.6% + 15.2% = 81.8%** of informed respondents support the current moratorium

Post-Survey: **10.9% + 70.3%+ 10.9% = 92.1%** of respondents support the current moratorium

Question 2-Should fracking be permitted in the Piney Run Reservoir area that supplies drinking water to 10,000+ residents of Allegany County and other areas that supply water to large numbers of people?

Pre	Post	
3.1%	**1.6%**	Begin fracking there now.
3.1%	**7.9%**	Wait until 2014 for EPA and MDE Study Results, then begin fracking.
26.6%	**60.3%**	Wait until 2014 for EPA and MDE Study Results, then make a decision to frack or not frack.
15.6%	**27.0%**	Never frack.
51.6%	**3.2%**	I do not know enough about this topic to vote right now.

**-If we remove the 51.6% from the Pre-Survey who answered Question 2, "I do not know enough…", and then calculate percentages on the other four answers the results are as follows:*
6.4% Begin fracking now. **6.4%** Wait until 2014 and then begin fracking.
55.0% Wait until 2014 and then decide. **32.2%** Never frack.

Question 3-If fracking begins, should Allegany and Garrett County impose a tax on extracted gas resources? The revenue generated from this tax would be directed towards schools, hospitals, police and fire services, and infrastructure improvements, etc. in Allegany and Garrett County.

Pre	**Post**	
57.6%	**90.5%**	Yes
3.0%	**7.9%**	No
39.4%	**1.6%**	I do not know enough about this topic to vote right now.

Question 4-Should the State of Maryland impose a tax on extracted gas resources? The revenue generated from this tax would be directed towards paying for proper oversight of the industry, research on the impacts of fracking, and other fracking-related expenses.

Pre	**Post**	
51.5%	**85.7%**	Yes
6.1%	**12.7%**	No
42.4%	**1.6%**	I do not know enough about this topic to vote right now.

RESULTS OF THE OPEN-ENDED QUESTIONS BELOW WILL BE EXPLAINED IN THE "DISCUSSION SECTION"

Question 5-What other positives, negatives, interesting ideas, or questions do you want to share at this time? You may also use this space to provide rationale for any answers above.

_____
_____
_____
_____
_____

Question 6- In YOUR OPINION, what are the top three possible hazards that concern you dealing with the Marcellus Shale drilling? With "one" being the most important and "three" being the least.

1_____

2_____

3_____

Question 7- In YOUR OPINION, what are the top three benefits that you are eager to witness dealing with the Marcellus Shale drilling? With "one" being the most important and "three" being the least.

1_____

2_____

3_____

DISCUSSION

Population Demographics

The sample group was made of sixty-five individuals. A majority of the population surveyed (84.8%) was from Allegany County. A large amount of respondents were between the ages of 31 to 50 (48.5%) or between the ages of 51 to 70 (37.8%). 75% of the respondents possessed a master's degree as their highest level of education. A large majority of the people (90.8%) did not own a parcel of land that was 10+ acres, meaning they would not be approached by gas companies for a gas lease. 9.2% of respondents did own 10+ acres of land. Of these, 50% had been approached for a gas lease. Of these, 66% accepted a lease it and 33% declined the lease.

Question 1 – Pre-Survey Discussion

Question 1 asks whether fracking should begin in Allegany County and Garrett County. A majority of the participants answered: "I do not know enough about this topic to vote right now (51.5%)." Initially 8.8% answered "begin fracking now", and 7.4% answered "never frack". However, if the answers of people who did not feel comfortable enough to vote are eliminated, 18.1% want to begin fracking now, 6.0% want to "wait until 2014 and then begin fracking", 60.6% want to "wait until 2014 and then decide," and 15.2% stated "never frack". These statistics show that of those who felt comfortable enough to vote, 81.8% are in agreement with our state's moratorium. .

Question 1 – Post-Survey Discussion

In the post-survey for question 1, the number of participants who thought that Maryland should wait until 2014 for EPA and MDE Study Results, and then make a decision to frack or not, increased by approximately 40%, going from 29.4% in the pre-survey to 70.3% in the post survey. A combined total of 92.1% of participants answered that they think we should wait for the 2014 EPA and MDA Study results and then frack, wait for the results and then decide whether or not to frack, or never frack at all. This statistic indicates that a vast majority of the population surveyed seem to be in favor of Governor O'Malley's moratorium on fracking for Marcellus Shale in Maryland. Lastly, participants' comfort levels regarding the amount of information they knew about the topic increased after viewing the presentation, seeing as only 3.1% of the participants decided they still did not know enough to answer the question (compared to a previous 51.5%). After the presentation, 4.7% of respondents wanted to "frack now."

Question 2 – Pre-Survey Discussion

The question, "Should fracking be permitted in the Piney Run Reservoir that supplies drinking water to 10,000 plus residents of Allegany County and other areas that supply water to large numbers of people?" was asked. A little over half (51.6%) of the respondents answered that "they did not know enough about the topic to answer the question at the time." If the 51.6% that answered "they did not know enough," were removed, the results would then indicate that 6.4% want to "frack now", 6.4% want to "wait until 2014 and then begin fracking", 55.0% want to "wait until 2014" and then decide about the topic, and 15.2% want to "never frack". As a total, after subtracting the 51.6% who did not feel comfortable voting, 92.8% were in favor of the moratorium or in favor of never fracking at all in sensitive watersheds.

Question 2 – Post-Survey Discussion

In response to question two of the post-survey, which asks whether fracking should be permitted near the Piney Run Reservoir that supplies water to 10,000+ residents of Allegany County, 60.3% of the population surveyed said that we should wait until 2014 for the EPA report and then decide. Twenty-seven percent of the population felt that we should never frack near the reservoir. Overall 95.2% of the populations is in support of Governor O'Malley's moratorium, while 1.6% wanted to begin fracking now in sensitive watersheds.

Question 3 – Pre- and Post-Survey Discussion

We asked the group of citizens if Allegany and Garrett County should impose a tax on extracted gas resources, directing the revenue to schools, hospitals, and other infrastructure improvements. On the pre-survey, 39.4% of respondents said they didn't feel like they had enough knowledge on the subject to vote. Out of the people who felt as if they knew enough to vote, 95.0% said yes to have these counties impose a tax. On the post survey, 90.5% of the group said there should be a tax. Only 1.6% said they didn't think they knew enough to vote at this time. This shows that a very large majority think there should be a tax imposed by Allegany and Garrett County.

Question 4 – Pre- and Post-Survey Discussion

Before giving the PowerPoint presentation, a group of respondents gave their opinions in a pre-survey on the question, "Should the State of Maryland impose a tax on extracted resources?" Stated in the question was, "The revenue generated from this tax would be directed towards paying for proper oversight of the industry, research on the impacts of fracking, and other fracking-related expenses." Given this information, 42.4% did not feel they had enough knowledge to vote. Approximately half the group of citizens (51.5%) voted "Yes," and only 1.6% voted "No', feeling that there should not be taxes imposed. After the presentation was shown and the respondents gained more knowledge of hydraulic fracturing, the 42.4% dropped to only 1.6% that still felt they did not know enough. The respondents whom answered "Yes" to a state tax composed an overall 85.7% in the post-survey and 12.7% answered no to a state tax.

DISAGREGATED DATA DISCUSSION - OPEN-ENDED COMMENT SECTION

PRE-PRESENTATION SURVEY RESPONSES

INDIVIDUALS WHO SELECTED "FRACK NOW" ON QUESTION 1

Out of sixty-five people, six individuals that took the pre survey answered question one by stating to "begin fracking now". Of these people, their main concern was water and land contamination, water use, trucking, noise, and damage to roads. Their opinions on benefits to come from drilling were job creation, economic growth, domestic energy, and tax revenue that could be used for schools and community needs.

INDIVIDUALS WHO SELECTED "WAIT UNTIL 2014, AND THEN FRACK" ON QUESTION 1

The first question on the pre-survey ballot asked "When should we begin fracking in Allegany County and Garrett County?" Out of sixty-five people, only two, a relatively small number, responded with the answer choice of waiting until 2014 for the EPA and MDE study results, and then begin fracking. One of the respondent's reasoning was "whether we do this now or in 2014, the revenue and amount of gas present will be the same." Both the responders also included their concerns about contamination to drinking water, and the impact on the local wildlife and environment. It can be concluded that both citizens are concerned about the risks of drilling and think it is best to wait until after studies have been completed and more information gathered to start fracking locally.

INDIVIDUALS WHO SELECTED "WAIT UNTIL 2014, AND THEN DECIDE…" ON QUESTION 1

Out of approximately sixty-five respondents, eighteen said that we should wait until 2014 for EPA and MDE Study results, and then decide whether or not to begin hydraulic fracturing in Garrett and Allegany County. All 18 of these participants stated groundwater contamination is their main concern. Other leading concerns were depletion of natural resources and wildlife habitats, as well as "tremors". The most prominent benefits that respondents were looking forward to seeing are a decreased dependency on other countries for energy sources and employment increases that will circulate money and boost the local economy.

INDIVIDUALS WHO SELECTED "NEVER FRACK" ON QUESTION 1

Five out of sixty-five people surveyed before the presentation were completely against fracking and chose "never frack" as their answer to Question 1. It was found that their reasons for this were all very similar. They did not understand how it would directly benefit the people of Allegany County. They believed that the companies extracting the gas would reap all of the benefits, the workers would come from out of state, and that the gas would be exported out of our local area. They were also extremely concerned about the detrimental effects fracking would have on the environment, water quality especially being a major issue. They were aware that the chemicals used were toxic, and believed that the methods used in fracking were rather new and could be improved. Lastly, the destruction of local land and infrastructure was recognized as a possible negative. In conclusion, this group of people saw no direct benefit to themselves and were more supportive of finding alternative sources of fuel.

INDIVIDUALS WHO SELECTED "I DO NOT KNOW ENOUGH…" ON QUESTION 1

While analyzing the pre-fracking survey, we found that thirty-three out of sixty-five people felt they did not know enough about hydraulic fracturing to accurately answer the opinion questions. When asked, "What other positives, negatives, interesting ideas, or questions do you want to share at this time?" Our most common question was, "What is fracking?" Another concerned respondent asked about the impact on jobs. This

question was echoed by one other poll-taker. "What is the affect on taxes?" was another question asked. One other poll-taker asked, "Is any other country fracking and what problems do they have?" Our last concern from one other citizen was, "I'm interested why the money is talked about first and not the health issues." Concerns about hazards included water pollution, air pollution, and disruption of land. The most frequent positive mentioned was the rise in local jobs. The second most common positive response was that it is a great resource to use and there is a great amount of it. While it seemed that some members of this group had some understanding of the issue, others stated that they had no knowledge of the topic at all. All members of this group selected that they "do not know enough to vote at this time."

POST-PRESENTATION SURVEY RESPONSES

INDIVIDUALS WHO SELECTED "FRACK NOW" ON QUESTION 1

In a group of three individuals who all favored Maryland fracking now, all three listed water quality as a concern about Marcellus Shale drilling. The issue of damage to roads came up twice, while chemicals in the ground and health were also listed. Two individuals said they believed the job creation was an important benefit. One simply listed three dollar signs as the most important benefit to them.

INDIVIDUALS WHO SELECTED "WAIT UNTIL 2014, AND THEN FRACK" ON QUESTION 1

In the post–presentation survey, seven individuals thought it was best to wait until 2014 for the EPA and MDE study results, and then begin fracking. These people had similar opinions on the benefits and disadvantages of fracking. The top concern of fracking with these individuals was water quality. Other concerns were land scarring, and road damage. Benefits that were agreed upon most included increased employment, decreased dependence on foreign oil, and increased school funding. All respondents in this group thought it was best to wait until 2014, then frack.

INDIVIDUALS WHO SELECTED "WAIT UNTIL 2014, AND THEN DECIDE…" ON QUESTION 1

Forty-five of approximately sixty-five participants in our hydraulic fracturing opinion post survey had decided we should wait until 2014 for EPA and MDE Study Results, then make a decision whether to frack or not. This is a vast majority of the respondents, compromising more than two-thirds of the participants. One participant supports the claim by saying, "We need to wait for better information, I'm glad there is a moratorium and I'm disappointed that some of our local officials are pushing to frack now." A second opinion states, "I was in favor of fracking (before the presentation) – now I feel there are many unanswered questions which need answered before it begins." Many feel we do not have enough immediate information to assure safety. A common concern among participants is the chemicals used with their potential harm to humans and the environment. However, if the EPA studies results show safety to the environment, it seems some participants would be in favor of fracturing. This is displayed by one person's opinion: "I did not know much about fracking before. I think I would favor fracking as long as it is environmentally safe."

INDIVIDUALS WHO SELECTED "NEVER FRACK" ON QUESTION 1

Seven out of approximately sixty-five respondents felt that we should never frack in Allegany and Garrett County. The overall opinion was that none of the benefits of hydraulic fracturing are worth the risks. One said, "Fracking is not a long term solution to a long time problem," and "I am definitely against it!" while another says, "No fracking!" stating that there are "No immediate benefits."

INDIVIDUALS WHO SELECTED "I DO NOT KNOW ENOUGH…" ON QUESTION 1

Two individuals from the post survey still said they did not know enough to vote. However, they both share concerns about water contamination. One person questioned what kind of compensation will be received by families if something goes wrong. The top benefit was agreed to be economic growth. Neither individuals' opinion was changed by the presentation, with one stating, "I learned much, but my opinions haven't changed because I need to study the issue more."

CONCLUSION

In conclusion, the presentation on hydraulic fracturing and the pre- and post-surveys given at Mountain Ridge was a very useful study. Of 65 respondents, 84.8% resided in Allegany County. The pre-presentation results showed that over half of the respondents (51.5%) did not feel they knew enough to make informed decisions on this topic. Of those who did come with enough prior knowledge, a large majority (81.8%) provided answers that indicate support for the Governor's current moratorium. In the post-presentation survey, a larger majority (92.1%) provided answers that indicate support for the Governor's current moratorium. In the post-presentation survey, 96.9% of respondents felt they had enough knowledge to make informed decisions. Another interesting piece of data was that in the post-presentation results, 90.5% answered with "yes" to imposing a county tax on retrieved gas to generated revenue to be put toward schools, hospitals, police and fire services, and infrastructure, etc. Results from post-presentation survey stated that 85.7% were in favor of state taxes on retrieved gas directed towards paying for proper oversight, research on impacts of fracking, and other frack-related expenses.

Suggestions for future research include expanding the sample group to a more diverse population and larger population.

The researchers recommend that increased efforts be made to properly inform the public on the positives, negatives, and areas of uncertainty regarding hydraulic fracturing. The researchers also recommend that elected officials encourage more polling of larger population sets so that they can ensure that their policy recommendations coincide with the will of the public they represent.

APPENDIX

TEXT OF SPEECH/POWERPOINT DELIVERED AFTER PRE-SURVEY BUT BEFORE POST SURVEY ON TUESDAY, FEBRUARY 21ST, 2011

INTRODUCTION

Good morning. My name is Meghan Coburn. I am speaking today on behalf of Mountain Ridge's 2010-2011 AP Environmental Science classes. Last year's class researched the issue of hydraulic fracturing for approximately four months. The current class has continued to track the issue since September and has spent the past month updating the research and presentation.

Hydraulic fracturing, also known as hydro-fracking or simply "fracking," is the process of using millions of gallons of water mixed with sand and thousands of gallons of varied chemicals to fracture shale rock thousands of feet below the ground. These chemicals and sand particles hold the fractures open, allowing gas to seep back through the drill-hole and to be extracted to the surface. The main issue with the process is the water and the chemicals used. They are essentially the source of most of the controversy. The main benefits are economic growth and cleaner fuel. This process is currently being used in West Virginia and Pennsylvania. However, it has not been permitted in the State of New York or Maryland. These are the primary places where the shale is found.

I will explain the methods used by last year's class to gather information. Then members of the current AP Environmental Science class will continue. Mark Manwani will explain the methods used by this year's class to gather the most recent statistics. Madison Offstein will explain the positive aspects of hydrofracking and how it may benefit our county. Sam Greenawalt and Kyle Harris will explain the negative aspects of hydrofracking. Kiya Wilhelm will cover areas of uncertainty. Georgia Grace Edwards will discuss plans for future research. Finally, Kristie Whiteman will provide an overview of current government positions on hydraulic fracturing.

Last year we collectively read all of the major scientific publications written by the United States Geological Survey, Maryland DNR, U.S Department of Energy, and the Environmental Protection Agency on the impacts of hydrofracturing in our region.

We collectively read all articles published in the Cumberland Times-News in the past four months on this topic. In addition we have read over 50 articles published in newspapers of Pennsylvania and West Virginia.

We attended speeches or presentations from representatives of the following organizations: The George's Creek Watershed Association, the USGS, the Department of Energy, the Western Maryland Resource Conservation and Development Council, Samson Resources, and Texas Keystone Incorporated.

We received and read direct personal correspondence from Commissioner William Valentine, Delegate Wendell Beitzel, Senator George Edwards, and Governor Martin O'Malley.

We visited the Waynesburg, Pennsylvania area. During this trip we viewed 12 hydrofracturing sites first-hand and interviewed 23 local citizens in the Waynesburg, Pennsylvania area.

This effort lead up to a public presentation given to the Allegany County Commissioners at a public meeting in May and a repeat performance at the Frostburg Museum given to the Frostburg Historical Society. The original

presentation was reviewed by environmentalists, members of the gas-drilling industry, independent scientists, politicians, and members of the general public. It was praised from all sides for its accuracy and fairness.

Early in January, five members of last year's AP Environmental Science class met with the members of this year's AP Environmental Science class to pass on our knowledge and help them to kick off their own research effort.

The members of this year's AP Environmental Science class have collectively read all the articles published in the Times-News over the past nine months. We have read the most recent documents published by the Maryland Safe Drilling Initiative, the Environmental Protection Agency, the Center for Rural Development in Pennsylvania, and the New York State Department of Environmental Conservation. We viewed an industry-produced film entitled, "Shale Gas and America's Future".

We have met directly with Dan Soeder, hydraulic fracturing expert from the U.S. Department of Energy. We spent an entire day with Johan Schjif of the University of Maryland Center for Environmental Studies, Chesapeake Lab, gathering baseline water quality data on local water supplies.

We directly visited all local sources of Mountain Ridge's drinking water, took water samples, and viewed the nearest potential fracking site, less than one mile northwest of the Piney Run Reservoir.

We have spent the past month discussing, revising, and updating the original presentation produced by last year's AP Environmental Science class.

All facts stated in today's presentation are supported by one or more of the above sources and can be verified by reading our full research paper which includes all citations and a works cited page. This will be available upon request.

Over the course of this research, our understanding of hydrofracturing and its potential positive and negative impacts upon our county has deepened and evolved. I feel that we are well-qualified to share data and our opinions with you on this topic.

POSITIVES

Marcellus shale is a domestic natural gas source which is cleaner burning than coal and oil. Hydraulic fracturing for Marcellus shale has many positive aspects. For example, if this gas is taxed and the money stays in the local economy, county infrastructure such as schools, hospitals and roads could be greatly improved. Jobs will be created to support the industry both directly and indirectly. Property and rental value will increase tremendously. Farmers will be paid for leases on their land and royalties if gas is extracted.

A notable and upfront positive effect of drilling for the Marcellus shale will be the job increase in our struggling economy. In the city of Clearfield, Pennsylvania, unemployment rate dropped from 10.1% in December 2010 to 9 % in February 2011 after shale drilling was started in the area. (Frank, 2011) This occurred during a time that unemployment was rising in most of the nation. Traveling drilling crews have already been established and most workers come from other states. Yet, over time, as local people receive training, more and more of them may be employed. In the immediate term, hundreds of local truckers are needed to transport the millions of gallons of water and chemicals, making up 10% of the jobs in the Marcellus shale industry. (The Tribune-Democrat, 2011) People will be needed to work at hotels and restaurants that the workers visit while they are drilling in the area. In addition, local businesses will gain

patrons from the hundreds employed on fracking sites. This may allow local businesses to expand or hire more employees.

If there is a tax on extracted gas, tax revenue can be used to fund school and hospital needs. It can also be used to hire more firemen, ambulance crews, and police officers to serve the community and handle the population and traffic increase. Revenue will additionally be used to repair the roads from the damages caused by tractor trailers.

A small percentage of the population will benefit from the gas if they own land that has the gas underneath it. One farmer mentioned in a Waynesburg interview received a $250,000 signing bonus and now makes $15,000/month in royalties on the gas produced. This is a little above average, but it represents the economic potential of this resource. Another financial benefit is that owners of rental properties will be able to increase rates, due to increased demand for housing.

Compared to traditional vertical drilling, modern hydraulic fracturing uses a horizontal drilling technique. This allows each drill site to have multiple gas extraction wells, each extending horizontally for 5,000 or more feet in several different directions. This minimizes habitat destruction and maximizes gas output for each site.

Beyond the economic boost, there is an important environmental benefit as well. Natural gas is more efficient and cleaner burning than coal. When burned, natural gas releases 58% less CO2 than coal and 33% less CO2 than oil. (Miller, 2004) We already have a large part of the infrastructure in place to distribute the industry-estimated 400 trillion cubic feet of gas throughout the country, minimizing the cost of an infrastructure conversion for only the Marcellus shale. If we converted all of our electricity production to natural gas, we would have enough to power the entire country for 33 years. Under a more reasonable usage estimate of 25% of the nation's energy, this supply will last 132 years. (Soeder, 2011) Using Marcellus gas in cars rather than gasoline could be cheaper than foreign oil. The Marcellus Shale contains enough gas to replace all oil imports for an estimated 54 years. Cars and buses can be cheaply converted to run on natural gas. Pennsylvania is already making an effort to convert public buses and fleet cars to natural gas, proposing that 25% of bus purchases by mass transit agencies be natural gas fueled by 2015 and 75% by 2026. (Mellot, 2011)

While popular distrust of this new industry exists, Dan Soeder a leading expert on Marcellus Shale, and geologist for the Department of Energy, states that only an estimated 0.5% of recorded drill sites result in newsworthy spills. This means that only 1 in 200 wells in Pennsylvania and West Virginia experience major contamination events. Seeing as Maryland plans to proceed with more caution than its predecessors, the likelihood of spills will only decline. (Soeder, 2012)

A final piece of supporting evidence in favor of hydraulic fracturing comes from the Center for Rural Pennsylvania. This group monitored water quality in 233 wells. All wells involved in the study were within 5,000 feet of a Marcellus Shale fracturing site. Comparative analysis of pre-fracturing and post-fracturing water wells shows no significant changes in levels of key indicator chemicals used in hydraulic fracturing, or in levels of methane. Only one of 233 wells showed an increase in bromide concentrations. However these levels declined and returned to normal levels within one month. (Center for Rural Pennsylvania, 2011)

Even more gas is held in the Utica Shale, a similar untapped natural gas deposit below the Marcellus. The combination of Utica and Marcellus both have the ability to supply large amounts of energy to our country for over a century, making it important to consider the positive effects these sources will have before we come to a decision.

NEGATIVES

Drilling for Marcellus Shale in Allegany County may seem like a great opportunity that many look forward to, but there are many flaws with this potentially great energy source. I will speak only of proven and documented problems.

First, there is the issue with water consumption. In the drilling process, there are approximately four million gallons of water used to retrieve the gas. This water comes from local streams and rivers and is used until the job is completed. While some say that this amount of water is relatively small compared to average municipal water use, (Beitzel, 2011) it should be noted that this is a consumptive water loss, meaning that unlike water from the shower or dishwasher, most of this water is not returned to the water cycle. Instead most of this water remains deep in the ground for many years. (Soeder, 2011) Proper regulations must be enforced to ensure that the demand is not so high as to debilitate local waterways.

Water is not the only ingredient in the drilling process. The second concern is the many chemicals that are needed to effectively retrieve the gas and to hold the cracks in the earth open. These "proppant" chemicals include kerosene, benzene, hydrochloric acid, other carcinogens, neurotoxins, and a host of other dangerous substances. For each drilling project, more than fifteen thousand gallons of these harmful chemicals are used. (DNR, 2010) Large trucks transport these concentrated chemicals to the drilling site and then mix the chemicals with water. This is a very risky procedure because if there should be a spill, even a small scale spill, the great concentration of the chemicals would have devastating effects on the environment and on human health. Small spills of 10-100 gallons are a common occurrence. While each spill may be "small", the cumulative impact of these spills from many sites is much larger and could have potential unknown consequences and effects. (Soeder, 2011)

Another problem with drilling deals with how wastewater is handled and treated. This "produced water", in many cases, sits in man-made ponds. This poses a risk to humans (due to potential leaks) and wildlife that may wander to these exposed chemical pools. When this wastewater returns to the earth's surface it contains uranium, radon, and the other fracking chemicals mentioned earlier. Current municipal wastewater treatment facilities are not designed to handle such chemicals and proper treatment is extremely expensive, not to mention that very few facilities exist for this process. Our state plans to require disposal at proper treatment facilities, but because of the high expense for proper treatment, violations will occur. Such infractions have already been witnessed in Pennsylvania. (Silver, 2011) Furthermore, injection of wastewater fluids into deep-injection wells 20,000 feet below Earth's surface has been linked with small earthquakes in Ohio and Arkansas. (Soeder, 2012)

For each Marcellus Shale drilling well, 250 tons of drill cuttings are collected. While drilling down to the shale, the drill bit grinds up bits of material that gets carried upwards to the surface. The biggest concern about the drill cuttings is the fact they contain harmful amounts of radioactivity. Thus far, drill cuttings have either been buried on the fracking site or transported to nearby municipal landfills. (Soeder, 2012) Neither of these disposal methods is acceptable or safe.

One of the concerns given the most media attention is methane seeping up from wells and into aquifers. While many of the claims regarding flammability of water have yet to be substantiated, a study published in April by the National Academies of the Sciences by Duke University indicates that drinking water wells within a one-kilometer radius of a drilling site have a 17 times higher concentration of methane than wells outside of a one-kilometer radius. (Osborne, 2011) However, a lack of baseline data makes this study difficult to interpret.

Accidents and miscalculations happen as well. All of the citizens in the town of Carmichael were ordered by the Pennsylvania Department of Environmental Protection to boil their water. This was a result of complications with fracking flowback fluid in their municipal water supply. Seven families in Bradford County were ordered to evacuate and drink bottled water after a blowout occurred on April 19th. (Tribune, 2011) Of 8000 total wells fracked in the Mid-

Eastern States, there have been over 40 newsworthy contamination events already between Pennsylvania and West Virginia. (Soeder, 2012) These 40 are only those that have gained media attention; it is possible that other lesser contamination events have gone unnoticed. Even where there are no proven cases of contamination, anxiety about the health of drinking water is widespread.

After drinking water, the most common concern mentioned by citizens of Waynesburg was the increase in truck traffic. In a count taken by environmental science students in the spring of 2011 while sitting along Main Street in Waynesburg, approximately 50 18-wheelers passed in a one hour period. This poses a safety risk to pedestrians and smaller vehicles. There is no pre-fracking data for comparison, but citizens indicate that few, if any, 18-wheelers passed through their town in the years before fracking. Large trucks cause significant wear on roads not designed for such traffic. While fracking companies do pay to replace roads that lead directly to their sites, they do not repair roads that are further away.

Another concern mentioned by several individuals interviewed was unwelcomed increases in their property taxes. Rates for rentals have increased on long-term renters, forcing some to move to other areas. These are some of the indirect and unfortunate financial consequences of hydrofracturing.

A social impact that was uncovered during the trip to Waynesburg was that fracking in the area led to an increase in crime. A police officer is quoted as saying, "Because so many of the workers are brought in from Texas and other Western states and many of them are in their 20's and 30's without families, there has been an increase in bar fights, alcohol abuse, and illegal drug trafficking." Data from the Greene County District Attorney's Office supports this claim by showing a 16% increase in overall crime from 2005 to 2010. This crime increase exceeds the rate which would be expected due to the coinciding population growth. Yet, it is acknowledged that more data from other fracking and non-fracking counties would be needed to solidly support a connection between fracking and crime.

Returing to environmental concerns, methane is actually 25 times more potent as a greenhouse gas compared to carbon dioxide. About 2 to 6% of methane gas leaks from pipelines when being transported, which only contributes to global climate change. (Living on Earth, 2011) The time period it resides in the atmosphere is about 12 years. So, it can be argued that even though burning natural gas emits less carbon dioxide than both oil and coal, the methane release could potentially have a more detrimental immediate effect on climate change. Furthermore, development of the U.S. infrastructure is not keeping up with the amount of gas produced. Therefore, the Marcellus output is not replacing oil or coal usage domestically, but excess is instead being shipped overseas. This provides no global climate change prevention benefit. To this point, drilling for Marcellus gas is only delaying the necessary and ultimate shift to clean renewable energy sources.

While drilling for gas in the Marcellus Shale may bring economic growth to our area, a host of other problems may accompany it.

UNCERTAINTY

There is a lot of uncertainty surrounding the specifics of Marcellus Shale fracking. Although the basics are known, many details have either been overlooked or have not yet been researched by any scientific organization.

What happens to the remaining three million gallons of frack fluid that is not retrieved? Does it stay underground? If it does stay underground, for how long? What new chemicals are produced when fracking chemicals react with deep rock? Will it resurface at a later date far into the future? Most prevalent on citizens' minds, does any of this seep into aquifers and other drinking water sources? The answer to all of these questions is, "no one is sure yet". While some studies are beginning to emerge, neither the EPA, DNR, USGS, nor any other scientific organization has conclusive answers yet .

It seems that the Maryland legislature is poised to require full-disclosure of all fracking chemicals used in order

to earn a permit and this is a step in the right direction. Yet, of the chemicals that are commonly used, what are the health impacts of continued low-level consumption over many years? What is the health impact when hundreds of wells, using millions of gallons of fracturing fluids, are all in one county for 20, 50, or 100 years? How long do the permanent drilling pipes last before corrosion, weathering, and other effects cause them to crack? Will they last 50, 100, 200 years, or more? If these pipes eventually do crack open, what will the consequences be? Similarly, what is the impact of hundreds of wells upon air quality and human health?

An EPA Draft Study, released three months ago, indicates that fracking caused significant contamination of drinking water wells in Pavillion, Wyoming. However, this study has fallen under much criticism and scrutiny. What can we learn from Pavillion, Wyoming? Are the results reliable? If not, what really did happen in Pavillion? What can we in Maryland learn from the confusion caused at this fracking and testing site? (EPA-Pavillion, 2011)

Somerset County currently has about 50 fracked sites. It is known that Garrett County will produce more gas than Allegany County. How many fracking sites will be developed in Allegany County? One source suggests that Garrett may have 1500 wells and Allegany will may eventually have 200 wells. (Soeder, 2012) Are these predictions accurate? When will we see the first fracking site in Allegany County? How much gas really is in our nation's Marcellus Shale? Some estimates are as high as 400 trillion cubic feet. Other estimates are as low as 200 trillion cubic feet. Which estimate is correct? Only time will tell.

Another method of hydrofracturing has been introduced: carbon dioxide fracking. It is cleaner, uses less toxic chemicals, and can be a good method for sequestering carbon dioxide from local power plants. In Canada it has been shown to produce four times more gas than traditional methods. To date, it has not been successfully used in this region. Can carbon dioxide fracking be effectively used in Maryland? If so, should we wait for this method to be perfected? (Michael, 2001)

Answers to many of the questions may be favorable for industry. If so, we should proceed. If not, we should improve the process. The fact is, we need answers before we can move forward.

With so many unknowns, it is clear why there is so much debate over proper legislation to protect the health of citizens and the environment. Are laws too strict or not strict enough? Nobody knows because the basic scientific questions have not yet been answered. Until answers to the above questions are found, the consequences of Marcellus Shale drilling will remain a mystery and legislation will be guesswork.

FUTURE RESEARCH

To resolve much of the uncertainty mentioned above, a major research effort has been initiated by the EPA. As the "Draft Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources" indicates, the EPA is working hard to resolve many of the questions raised earlier. The scope of the proposed research includes the full life cycle of water in hydraulic fracturing, from water acquisition through the mixing of chemicals and actual fracturing to the post-fracturing stage, including the management of flow back and produced water and its ultimate treatment and/or disposal. (EPA, 2011) They will include studies of areas that already have reports of contamination as well as before-and-after studies where fracking has not yet begun but will start soon. One such "before-and-after" site is near Washington, Pennsylvania where data will be collected on air quality, soil gas, avian populations, groundwater and stream health, and endangered species before and after fracking. Tracer studies are also being done to precisely follow the pathway of fracking fluids. Scientists from the USGS, US Fish and Wildlife Service, US Department of Energy, the Army Corps of Engineers, and many other research organizations will be participating. An interim progress report will be published in 2012. The complete EPA Report is slated for 2014. (EPA, 2011)

In addition, the Department of Energy is conducting a risk assessment study to determine the statistical likelihood of specific types of accidents, the probability of contamination events, the seriousness of the effects on nearby communities, and the estimated costs of mitigation and cleanup. This information will be released within the next few years. (Soeder, 2012)

There are also environmental studies to be completed in Maryland so that citizens and government officials can learn as much as possible and make informed decisions. Such studies include baseline analysis of water quality. This testing is necessary to determine whether hydraulic fracturing is harming water and soil in surrounding areas, or if the conditions were pre-existing. According to Maryland's Marcellus Shale Safe Drilling Initiative Study, which was released in December 2011, Garrett County will be the sole "focus of baseline studies in the immediate future." The DNR plans to "recruit, train, and equip teams of local volunteers to collect baseline conductivity, pH, water temperature, and possibly other data at additional stream locations." Gauges will also test trace metals, salts, methane, radioactivity, and invertebrates. (Maryland, 2011)

Additionally, the Governor's Executive Order tasks MDE and DNR, in consultation with an Advisory Commission, composed of a variety of citizens, with conducting a three-part study and reporting findings and recommendations. The first part was completed in December of 2011. It included a presentation of findings and related recommendations regarding the desirability of legislation to establish revenue sources and also standards of liability for damages caused by gas exploration and production. By August of 2012, recommendations will be made for the best practices for all aspects of natural gas exploration and production. By August of 2014, a final report will include findings and recommendations relating to the impact of drilling including possible contamination of ground water, handling and disposal of waste water, environmental and natural resources impacts to forests, greenhouse gas emissions, and economic impact. Maryland is taking a cautious approach to hydraulic fracturing and does not plan to begin fracking until after August of 2014. (Maryland, 2011)

Due to economic constraints baseline sampling sites in Allegany County will not be included in the State funded research set. In the mean time, Frostburg's municipal water supply currently has the potential to be affected by a proposed fracking site less than one mile northwest of its reservoir in Pennsylvania. To make up for the lack of baseline testing in our county, we, the AP Environmental Science students of Mountain Ridge High School, have decided to take the initiative and conduct baseline testing at five locations that could potentially be affected by this fracking site. We have already tested for total dissolved solids, water temperature, pH, turbity, barium, bromide, and strontium at the following locations: Piney Run Tributary, Piney Run Dam, Savage River Aquifer, and the Water Treatment Plant. We plan to continue to sample at these sites once each month for the next several years, establishing a range of natural variability, enabling us to determine if any abnormal values are detected after fracking begins. We are being assisted on this project by a scientist at the University of Maryland Center for Environmental Studies, Chesapeake Lab.

OUR ELECTED OFFICIALS

In both our local and state government, there is quite a lot of controversy over the topic of drilling in the Marcellus Shale. Some officials want to start drilling now, while others want to observe the experiences of other states and then take measures to improve drilling methods in Maryland.

The County Commissioners of Garrett and Allegany Counties want to see fracking start as soon as possible. They are quoted in a recent letter to the Governor encouraging "the Advisory Commission to expedite their review". (Commissioners, 2011) Senator Edwards and Delegate Beitzel share their pro-fracking perspective. They would like to boost the local economy as soon as possible.

Yet, Governor O'Malley has held firm on his moratorium and is not the only one with this opinion. U.S. Senator

Ben Cardin and U.S. Senator Barbara Mikulski support O'Malley's moratorium and encourage more research. This will improve safety of the fracking methods to avoid spills, leaks, and other damaging accidents.

President Barack Obama has taken a "middle-of-the-road" approach. He supports drilling in the Marcellus Shale, but "will take every possible action to safely develop this energy" (Obama, 2012).

The weighing of the pros and cons has divided many on the issue of Marcellus Shale drilling. Pennsylvania and West Virginia have been fracking for over two years, while New York and Maryland have each maintained a moratorium.

In a poll taken for the Maryland Petroleum Council, 74% of respondents "favored the development of natural gas resources in Western Maryland". (Maryland Petroleum, 2011) Yet, the question asked made no mention of hydraulic fracturing. A Cumberland Times-News poll taken in January concluded that 66% of their readers opposed hydraulic fracturing. (Goldsworthy, 2011) It appears that the wording of the questions, the level of information provided to participants, and the demographics of the population polled all play a part in the results. This has been a difficult issue for gauging public opinion.

CONCLUSION

Now that you have learned about the positives, negatives, and areas of uncertainty regarding hydraulic fracturing for the Marcellus shale gas, we would like to hear your opinion. The following survey will ask about issues such as: When should fracking begin in Allegany county? If a tax is put on extracted gas where should the money go? What are your major concerns about fracking? Which benefits of fracking excite you most?... along with other key issues.
Please answer these questions with your honest opinion.

A final survey item asks if you are willing to have your anonymous survey included in a compiled report that will be sent to Governor O'Malley, our County Commissioners, and others in the decision making process. We will not refer to "Mountain Ridge" in our data report, but will simply refer to this population as a "group of citizens". We hope that you will allow us to include your survey results so that our elected officials can have a more informed sense of public opinion.

Before distributing the surveys, we are willing to answer any questions that you may have on this topic and welcome any feedback.

We thank you for listening. We hope that this presentation has been informative. Thank you for enriching our learning experience.

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