

Madison County Board of Supervisors

Risk Assessment and Decision

of

Spectra's Proposed Natural Gas Pipeline

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INTRODUCTION:

Purpose:

The purpose of this report is to help the Madison County Board of Supervisors determine whether or not to allow their community's land to be developed with a natural gas pipeline. This report will take into account the following factors:

- Social, environmental, economic, and political cost/benefit analysis
 - Perspective of national energy security
 - Technology and science of natural gas including hydraulic fracturing, pipeline installation details
 - Perspective as to the viability of the local and state government policies to keep citizens safe as well as possible benefits

Scope:

The pipeline is planned to span from Pennsylvania to North Carolina, which runs through Madison County, Virginia. The scope of this report will mainly take into account the welfare of the Madison County residents. One specific case study is the account of the Culton's farm, which the pipeline would be built nearly a mile through their property. Risk factors will be unbiasedly assessed, as well as benefits to community.

History:

What spurred this report was the interest of Paul Culton, whose 102-year old father owns the farm in which Spectra Energy plans to build their natural gas pipeline through. His father has maintained the farm since he was 17 and inherited from his father. Through a love of nature, he has worked hard to see his farm flourish, and has not used herbicides or pesticides for decades. Thus, when asked if he would allow his property to be developed on, he was naturally perturbed by the thought. However, perhaps it would benefit not only him, and his community, but the needs of customers of natural gas: The American citizen. After all, nearly all vehicles run on some type of gasoline, and the electrical energy grid which is powered by coal burning could be replaced with natural gas. These two industries and products are the driving factor of the economy. Without it, our advanced society could no longer operate. However, there are renewable energy sources as well: solar, wind, hydroelectric. The current technological efficiencies of those will be taken into account.

Natural gas has long been known to geologists to be stored in deep underground shale rock. Not until recently, has there been technology able to affordably extract this natural gas. The new technology is hydraulic fracturing, dubbed "fracking". It is the center of a controversy due to the secrecy of the chemicals used in extracting the natural gas from the shale and the worry that it leaks into groundwater sources. Not only this, but earthquakes have been attributed to fracking due to its changing the pressure content of the earth.

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Like all pipelines, natural gas pipelines have the potential to leak, explode, damage the environment, and be harmful to humans. This report will analyze these risk factors in great detail.

In short, the decision is based on the well-being of citizens of Madison County.

ENVIRONMENTAL RISK FACTORS:

Pipeline Details:

Currently, the United States has a pipeline network of around 3 million miles that in 2016, delivered 25 trillion cubic feet of gas to 74 million customers. The pipeline is essential comprised of four stages:

1. **Extraction Point.** This is where the natural gas is extracted from the shale deep below the earth, and pumped to either a collection station or a larger mainline pipeline.
2. **Processing:** processing plants receive the natural gas in order to separate hydrocarbon gas liquids from the non-hydrocarbon gas and water. It is then transported to the main pipeline.
3. **Mainline Pipelines:** these pipelines are of a wide diameter (between 8 and 48 inches). These consist of 40 to 100-mile lengths interrupted by compressing stations (also called pumping stations) that regulate pressure. They are divided into intrastate and interstate categories.
4. **Local distribution:** pipelines are routed to companies that locally deliver the gas to consumers through lower pressure pipes.

In addition, there are storage facilities if supply temporarily exceeds demand.

Source: https://www.eia.gov/energyexplained/index.cfm?page=natural_gas_pipelines,
<http://naturalgas.org/naturalgas/transport/>

Construction Process:

How is the pipeline installed? How long does it take? These questions will be answered here.

1. First, a planned "right of way" is engineered. Right of way is simply corporate lingo for a final design of the pipeline. This is all assuming that federal and state level permits have been acquired, as well as agreements between land-owners or eminent domain condemnations.
2. Staging areas and storage yards are cleared along the path right of way is cleared with construction equipment. These include parking for employees, office trailers, and headquarters for construction vehicles and equipment.
3. Clear cutting the right of way. Right of way are often blocked by forested areas and must be cut and cleared for pipeline installation. Trees are sold by discretion of the landowner or by the company should they be permitted. Stumps are grinded down. The right of way is typically between 80 and 125 inches in width.
4. Excavating a trench. After the clear cutting a trench must be dug for the pipeline to lay in. Sandbags are added to restrict water flow in and out of the trench.
5. Pipe assembly. Pre-fabricated segments of pipe (usually 40ft in length) are transported to and installed in the trench. The pipes are bent to follow right of way, welded together, sandblasted and covered with epoxy to prevent corrosion or leakage. Finally, they are examined with x-rays for insurance of quality.

6. **Burial and Testing.** After pipe inspection, the trench is filled with dirt. Then the integrity of the pipeline must be tested using hydrostatic meters. Millions of gallons of water are permitted by the state to send through the pipes. The water sent through is increased above the maximum operational level. If the pipeline remains intact, then it is deemed operational and the project is complete.
7. **Seeding and fertilization.** After project completion, the ground is seeded, fertilized, and marked with flags. In time it will simply look like a patch of grass.

Source: <https://www.fractracker.org/resources/oil-and-gas-101/pipeline-construction/>

Safety Precautions:

The safety of the citizens and environment Madison County are of upmost importance. So what safety precautions are followed in pipeline installation?

As indicated above in the construction process, pipelines are covered with epoxy at welded segments. They are examined with x-rays to ensure quality work has been done. Then hydrostatic testing is conducted with sending water through pipes at above maximum operational pressure.

There are other precautions to ensure integrity of the pipeline. You cannot dig near the pipeline at all (digging is a major cause of accidental leakage). You cannot plant trees along the right of way. The right of way is demarcated with flags or signs. Pipelines are monitored 24/7 using sensors. Regular surveys and patrols are conducted. Maps of the pipeline right of way are given to the public.

Source: <https://www.consumersenergy.com/~media/CE/Documents/safety/emergency-officials-pipeline-safety.ashx>

Risk Factors of Pipelines:

Leakage of natural gas is a serious environmental and human health hazards. Leaks can cause explosions, fires, groundwater contamination, asphyxiation. Indicators of a leak include:

- Odor of rotten eggs or sulfur
- Hissing sounds
- Dust blowing from a hole in the ground
- Bubbling wet areas
- Dead or discolored vegetation
- Flames

Source: <https://www.newlook.dteenergy.com/wps/wcm/connect/d72626bc-de98-4899-b183-9d5b893c5116/Natural-gas-pipeline-safety.pdf?MOD=AJPERES>

Probability of Catastrophic Event:

The causes of pipeline damage include:

- Digging or development over right of way
- Extreme natural events
- Fire or explosion near pipeline
- Collapsed buildings
- Overpressure of pipeline
- Equipment failure

How often have these events occurred and how probable are they?

Using data from the National Transportation Safety Board, there have been 125 recorded accidents involving natural gas pipelines from 1969 to 2017 (although the actual number is possibly higher). These include rupturing of pipelines, fires, explosions, and leaks. These come at huge economic losses and often loss of human life. "The main causes of natural gas pipeline leakage occurrence are design defect of auxiliaries and interference for the third party, especially the parties ignore signage." (Shan et al., 2017) Although there are over 3 million miles of pipeline and only 125 recorded incidents, this cannot be ignored and is clearly a significant risk factor. Mitigation and preventative measures must be created and enacted.

Source: <https://www.nts.gov/investigations/AccidentReports/Pages/pipeline.aspx>,
<https://www.hindawi.com/journals/sp/2017/3639524/>

Spectra Energy Safety History:

Because the scope of this report deals with only the pipeline planned to go through Madison County and not the natural gas industry in general, Spectra's company safety history must be investigated.

The following is a lengthy report from a whistleblowing organization, dubbed Spectrabusters:

- 1989-10-21: Spectra Energy fined \$15 million for PCB spills at 89 pipeline sites – EPA
- 2013-06-19: Spectra pipeline property damage and safety record
- Spectra never bothered to check pipeline for corrosion –Spectra employee
- 2013-03-09: Spectra backtracks about pipeline incident
- 2013-12-21: Final Order from PHMSA to Spectra CEO Greg Ebel for five violations of federal regulations and Spectra's own company procedures.
- 2015-12-01: We were told to shut up or quit –Spectra Energy whistleblowers
- 2015-05-31: Natural gas pipeline ruptures east of I-30 bridge, closing two miles of Arkansas River, by Benjamin Hardy, Arkansas Blog, Tue, Jun 2, 2015 at 7:36 PM
Arkansas River pipeline blowout occurred on Sunday morning, cause still unknown, by Benjamin Hardy, Arkansas Blog, on Wed, Jun 3, 2015 at 2:12 PM
Spectra Energy working to recover 400 feet of lost pipeline after blast on Arkansas River, by Benjamin Hardy, Arkansas Blog, Mon, Jun 8, 2015 at 10:22 PM
- 2015-05-28: Spectra's Canadian negligence and Fort Nelson leak and flare

- 2015-04-15: Natural gas pipeline carried oil which leaked: owned by a Spectra company
- 2014-09-14: Spectra Energy and gas pipeline campaign contributions to GA Gov. Nathan Deal
- 2014-07-06: Farmers counter-sue Spectra over British Columbia pipeline
- 2013-12-31: "The most terrifying experience": Spectra blows another compressor station
- 1994-03-25: Spectra's Durham Woods apartment fire, Edison, NJ, 1994: thousands evacuated, hundreds made homeless, massive property damage.
- 1991-05-15: Spectra fined \$18.6 million + \$200 million cleanup for PCBs by Pennsylvania in 1991
- 1986-02-21: "natural gas under 987 psig ruptured the No. 15, 30-inch-diameter pipeline of the Texas Eastern Gas Pipeline Company 50 feet south of State highway 52 near Lancaster, Kentucky. The force of the escaping gas ripped 480 feet of pipe out of the ground, exposed 40 feet of an adjacent parallel pipeline, ignited and destroyed two houses, one house trailer, six automobiles, and damaged other buildings. Three persons were injured, 2 of them seriously, and 77 other persons were evacuated from the area."
- 1985-04-27: 700×500 feet incinerated, 5 dead, 3 burned: Texas Eastern Gas Pipeline 1985
- EPA and Spectra knew about PCBs as early as 1985

Source: <http://spectrabusters.org/hazards/spectra-safety-violations/>

Combined, those incidents caused over \$12 million in property damage and fined over \$600,000 by the United States. This is certainly of concern and will play a large part in the final decision. However, in the interest of fair and unbiased science --- here is what Spectra has to say about its safety.

According to Spectra, they have a "strong safety record" due to being about half the industry average for incidents --- this is based on percent of pipelines involved incidents per 1000 miles per year which is: .15 per 1000 miles of pipeline per year vs. .36 of all U.S. pipelines per 1000 miles of pipeline per year (this was over a 5-year period of 2011-2015). For further clarification, an incident is defined by Spectra Energy as having to involve:

1. An event that involves a release of gas from a pipeline, or of liquefied natural gas, liquefied petroleum gas, refrigerant gas, or gas from an LNG facility, and that results in one or more of the following consequences:
 - a. A death, or personal injury necessitating in-patient hospitalization;
 - b. Estimated property damage of \$50,000 or more, including loss to the operator and others, or both, but excluding cost of gas lost;
 - c. Unintentional estimated gas loss of three million cubic feet or more;

2. An event that results in an emergency shutdown of an LNG facility. Activation of an emergency shutdown system for reasons other than an actual emergency does not constitute an incident.
3. An event that is significant, in the judgment of the operator, even though it did not meet the criteria of paragraphs (1) or (2) of this definition.

Source: <http://www.spectraenergy.com/Safety/Asset-Safety-Record/>,
<http://www.spectraenergy.com/~media/Microsites/Spectra/Documents/Incident-and-Categories.pdf?la=en>

ECONOMIC FACTORS:

Individual Compensation:

Individuals are compensated for the use of their land for installing a pipeline. Ultimately, the compensation is up to the negotiation between the landowner and the company. Payment for the land used by a pipeline on your property is called a "pipeline easement". In fact, the University of Texas A&M has published a checklist regarding how an individual should prepare for a negotiation.

<http://agrifilecdn.tamu.edu/texasaglaw/files/2016/08/Texas-Pipeline-Easement-Negotiation-Checklist.pdf>

To summarize, it is best to consult legal advice.

Typical easement compensation rates are rarely publicly disclosed and vary wildly. Unfortunately, the best information regarding West Virginia seems to be that a former pipeline inspector for the U.S. Department of Environmental Protection recommends \$50 per foot, while the West Virginia Oil and Natural Gas Association recommends \$5 per foot.

Thus the Culton family could be compensated between \$26,400 and \$264,000 total for their land use. Using this as deciding factor truly depends on the need of the Culton family. For ease of argument purposes, the average of these compensation rates are \$27.50 per foot or 145,200 total, which is a fairly large sum of money for only a mile of your land. Another source, received reports from five homeowners in Lancaster County, Pennsylvania were offered between \$23,000 and \$65,000 (for the same pipeline going through Madison County, Virginia). The length of land of these homeowners was not disclosed.

Source: <https://marcellusdrilling.com/2015/06/how-much-should-landowners-get-for-a-pipeline-right-of-way/>, http://lancasteronline.com/news/local/pipeline-company-makes-offers-up-to-to-property-owners-along/article_45fd481c-4320-11e4-bb80-0017a43b2370.html

The proposed pipeline right of way will go through approximately 10 miles of Madison County, which could provide between \$246,000 and \$2.4 million total to landowners in the county.

Jobs:

It is difficult to correctly determine how many jobs will be provided and how much economic revenue precisely will be provided to Madison County or even the state of Virginia for the PennEast pipeline. However, the 112-mile pipeline will provide \$1.2 billion for the states of New Jersey and Pennsylvania, with an estimated \$23 million per year after construction. However, even a fraction of that would significantly boost Madison County and Virginia's economy as well as provide some jobs for locals. 30,000 jobs are expected to be created during construction, with 300-400 permanent jobs.

Source: <http://www.mcall.com/news/local/mc-penneast-pipeline-economic-impact-study-20150209-story.html>

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Energy Savings:

Using natural gas as opposed to coal for electricity will save the region over \$893 million per year. It is difficult to quantify that for just Madison County, Virginia.

<http://pennestpipeline.com/economic-impact/>

POLITICAL FACTORS:

National Energy Security:

In 2006, President Bush said the following about our reliance on foreign-imported oil:

"Keeping America competitive requires affordable energy. And here we have a serious problem: America is addicted to oil, which is often imported from unstable parts of the world. The best way to break this addiction is through technology... [The goal is] to replace more than 75 percent of our oil imports from the Middle East by 2025. By applying the talent and technology of America, this country can dramatically improve our environment, move beyond a petroleum-based economy, and make our dependence on Middle Eastern oil a thing of the past."

It is a valid point --- that the Middle East is largely an unstable region. Even the most innocent of cynics could glean that wars fought there are over their natural petroleum resources. A fact of our society is that oil is extremely important, or better stated: energy is of utmost importance. With the help of natural gas, this oil dependence can be at least alleviated somewhat. The new technology of fracking has also lowered natural gas prices significantly as supply has boomed. It is important to secure our energy supply. Furthermore, natural gas has much lower and less hazardous emissions than oil and even coal.

Source: <https://www.energy.gov/policy/articles/valuation-energy-security-united-states>

But what about renewable resources for energy?

Renewable Resource Energy:

Of course there are renewable and "essentially free" energy sources such as wind, solar, and hydroelectric. There are also new fuel sources under development such as algae-derived biofuel that operates just like traditional oil. Their cost is essentially free after infrastructure and energy transportation costs.

How efficient are renewable energy sources? Some places have weaker winds and weaker or intermittent solar radiation levels. But perhaps other areas could compensate.

According to various news articles, only 0.6% of the United States land area, or 18,000 square miles are needed to provide energy to the whole country (4,000,000 GWh). Somewhat ironically, this is about 6000 less square miles than the size of West Virginia. So, not exactly a small plot of land, but seemingly feasible. However, you cannot just dedicate one 18,000 square mile plot of land to just solar panels. They must be spread somewhat about the nation as there must be the transmission of energy through cables or stored in large batteries.

Source: <https://www.good.is/infographics/solar-power-all-of-america>

One downside to solar power distribution is the lithium mining necessary to create the lithium ion batteries that store solar energy. Mines release acid drainage into local waterways and impact the environment much in the way gas leaks due (albeit different in chemical structure). Perhaps that is a lesser evil.

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For the sake of comparison, an America powered solely by wind turbines would take approximately 583,000 onshore turbines (taking up an area around the size of Rhode Island in total). There would still be the issue of storing and transporting the energy, as well as infrastructure startup costs.

Source: <http://www.businessinsider.com/wind-turbines-to-power-earth-2016-9>

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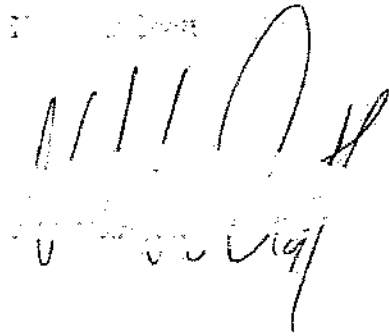
FINAL DECISION:

Upon careful reviewable of the above well-researched factors, the Madison County Board of Supervisors would personally vote "Nay" to the proposed pipeline right of way. To the individuals of the Culton family, we would also recommend declining the offer.

There is an unfortunate downside, as it appears to be somewhat of a "not in my backyard" situation. Natural gas is a viable energy source and less polluting than coal for energy production. However, weighing the aforementioned factors, the costs appear to greatly outweigh the benefits. Pipeline refusal will avoid danger to citizens and country, as well as peace of mind.

Best regards,

Dr. Delgado-Acevedo

A handwritten signature in black ink, appearing to read "Dr. Delgado-Acevedo", with a large, stylized flourish at the end.

Special Thanks To:

Dr. Johanna Delgado-Acevedo

