

Blackout

CASE STUDY

in the Gas Patch



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ANGEL AND WAYNE SMITH

Clearville, Bedford County PA

Summary

Events in Angel and Wayne Smith's community of Clearville illustrate the trajectory of gas development in Pennsylvania. In 2007, Steckman Ridge, LP (a subsidiary of Spectra Energy) proposed to build a Marcellus Shale gas storage project by converting and expanding an older Oriskany Sandstone gas production field, parts of which would run under and near the Smith's home and cattle operations.

Our research on gas wells and facilities in the area revealed several pollution events, problems that persisted for long periods of time, and plausible reasons why the development would have compromised air and water quality. In addition, there were instances when the Pennsylvania Department of Environmental Protection (DEP) gave operators the benefit of the doubt about activities and incidents. Yet it was only because residents filed complaints that DEP conducted some inspections and investigations and discovered violations.

Over time, the Smiths and several neighbors have developed increasingly frequent headaches, bouts of fatigue, sinus problems, throat and eye irritation, muscle tremors, and shortness of breath. They wonder if groundwater conditions might have changed due to early drilling activities, the shutting in of production wells, or continual injection and withdrawal of gas at the storage field. They've tracked when blowdowns and venting occur at the station and possible links to their health problems. They've filed numerous complaints with DEP, the US Environmental Protection Agency (EPA), and the US National Response Center (NRC), written to public officials, and filed Right-to-Know requests to obtain documents on operations and emissions.

The Smiths trace the start of their problems to the summer of 2007, when the taste, odor, and appearance of water from their well and spring began to change. Over the course of several months, a horse and three cows died and 12 calves were either miscarried or stillborn—unprecedented losses in

For more about Angel and Wayne Smith, see:

Video Interview

www.youtube.com/watch?v=cF6lparxGwQ

Spectra Energy Watch property rights website

www.shalepropertyrights.com/blog/

PHOTOS

ABOVE: Angel and Wayne Smith at their farm. Photo by Nadia Steinzor/Earthworks

BELOW LEFT – RIGHT:

SR6 gas storage well with the Quarles Compressor station in the background. Photo by Nadia Steinzor/Earthworks

Foaming on Sideling Hill Creek. Photo by Seri Kern

Pipeline with cows. Photo by Frank Finan



decades of farming. When operations expanded at the Steckman Ridge Quarles Compressor station, the Smiths and other residents started experiencing frequent noise and odors and declining air quality.

In April 2008, the US Centers for Disease Control and Prevention (CDC) wrote to the Federal Energy Regulatory Commission (FERC) about the Steckman Ridge gas storage project, including concerns about the “proximity of area residents to the pipeline alignment,” that “excessive noise levels [from the compressor station] can harm human health and well-being,” and the need for a “comprehensive assessment and mitigation of issues that might negatively affect human health.”¹ Just two months later, FERC approved the project—relying in part on assurances by Steckman Ridge that “its proposed facilities strike an appropriate balance between landowner and environmental concerns and system requirements” and “any adverse impacts on landowners and communities will be minimal.”²

DEP has never made any connection between problems reported by residents and older drilling activities, the more recent gas storage project, or the compressor station. It isn’t clear whether this had to do with time and resource constraints, insufficient information and training provided to inspectors, inconsistent parameters in testing that made data comparison difficult, or other factors. In the meantime, the Smiths and their neighbors continue to ask questions about their health and environment—and are still waiting for answers.

Wells and Facilities Around the Smith Home

The Quarles compressor station is 0.72 miles away from the Smiths. Seven gas storage wells are within two miles, the closest being SR 6, 0.39 miles away, and Clark 1663, 0.75 miles away. In addition, there are three formerly active conventional gas wells within two and a half miles (Beegle 1558, 0.4 miles away; the SC Boor 4831, 1.71 miles away; and the Eckman 1862, 2.4 miles away). The status of these wells and their role as possibly pollution pathways is unclear. None are in the DEP database of plugged and abandoned wells, although Pennsylvania’s Environment Facility Application Compliance Tracking System (eFACTS) lists the Boor and Eckman wells as “plugged” and a handwritten note in the Beegle well file indicates that Pennsylvania General Energy Corp (PGE) told DEP in 2008 that it was plugged before being fully drilled.³

Inspections and Violations

The following table shows the number of inspections for facilities near the Smith’s from 2008 to 2013, including those that occurred in response to citizen complaints. DEP policy states that inspections will occur “At least twice a year if the well is located in a gas storage reservoir or in a gas storage reservoir protective area.”⁴

Inspection data from DEP’s Environment Facility Application Compliance Tracking System (eFACTS) show that on average, the two gas storage wells closest to the Smiths were inspected 1.4 times per year in the past six years. A closer look at the data show that both wells were inspected just once a year in 2011, 2012, and 2013 (except for SR6, which received two inspections in 2013). Similarly, the five wells located between 1 and 2 miles from the Smith home were inspected just once a year in 2011, 2012, and 2013. Prior to 2011, especially in the years when drilling or site restoration was underway, the wells were sometimes inspected two or more times.⁵

Table 1. Inspections at facilities in the vicinity of the Smith’s home (2008-2013 eFACTS data)

	Storage wells within 1 mile	Storage wells between 1 and 2 miles	Quarles compressor station
Number of drilled/active wells	2	5	N/A
Number of inspections	17	49	14
Average inspections per well, over all years	8.5	9.8	N/A
Average inspections per well, per year	1.4	1.6	N/A
Complaint inspections	1	0	4

No violations have been issued for the wells within a mile of the Smiths. In June 2009, violations were issued at two storage wells more than a mile and half away. One was for SR10; a DEP inspector found that while the well was shut in, there was “light bubbling by wellhead...There was evidence that berm failed in 2 spots and sediment was carried to the stream about 40 feet away.” Violations were issued for failure to minimize erosion and sedimentation and to stabilize the site until it was restored, and for discharge of polluting material to waters of the Commonwealth. At the STUP 1557, a DEP inspector noted that the “Site is waived to be built within 100 ft of an EV [Exceptional Value] stream and wetland. Field Drain discharges right above compost sock and water is beginning to pool and bypass sock.” DEP issued a notice of “de minimus” (minor) violations for these pollution risks.

Also in 2009, DEP issued violations related to the Quarles compressor station. Following two shutdowns that released lubricating oil and methane gas, Steckman Ridge received violations for fugitive emissions of oil and failure to notify DEP about the incident.

Smith Events Timeline

The following events related to natural gas development occurring within one mile of the Smith home have been compiled from DEP inspection reports and other information available through file reviews, included in eFACTS and DEP’s Oil and Gas Compliance Database, and provided by residents. Given that some inspection reports were missing from files and other documents are unavailable to the public, this timeline is not necessarily complete.

Events related to gas wells and water

Date	Summary
2002-2004	DEP approves waivers for Pennsylvania General Energy Corp (PGE) to disperse drill cuttings and tophole water onto the land at the Beegle 1558 and Clark 1663 wells. A well restoration report for Clark 1663 confirms that an 80x30x10 foot waste pit containing drill cuttings was buried onsite.
4/2/05	<p>A PGE incident report to DEP describes how drilling at the Quarles 1709 well resulted in foaming in Sideling Hill Creek. After first observing the problem, the operator resumes drilling and continues all week, noting intermittent foaming during drilling events and that they “assumed no drilling meant no foam.” Six days later, DEP conducts an inspection because a resident files a complaint. The next day, the operator finds several holes in a waste pit “due to liner being brittle and susceptible to cracking” and uses “water under edge of pit liner to flush residual soap through shale to stream and dilute.”</p> <p>PGE is later charged with violations of discharge of surfactants into Sideling Hill Creek (an Exceptional Value watershed) and failure to notify DEP and fined \$4,200. In July 2009, a DEP inspector notes in a report that trees at the Quarles 1709 site had lost “90% of their bark [sic] and limbs and appear to have been dead awhile.” She stated that the likely cause was the “pit failure” and possibly the land application of drill cuttings that occurred years earlier.</p>
5/20/06	Residents notice tall, thick plumes of foam on Sideling Hill Creek. They send photos and a letter to a regional DEP officer indicating the foaming may originate at the Quarles or Eckman wells, and that plastic pipes have been placed into the creek from a nearby road. There are no records in eFACTS of inspections at the Quarles or Eckman sites in 2006 and our research did not find any indication that DEP followed up on this event. (PGE filed a notice to plug the Eckman well one month after the incident.)
Late 2006	PGE shuts in gas production wells in the area in preparation for turning over the land and wells to Spectra Energy for development of the gas storage field.
8/27/07	The Smiths file a complaint with DEP about water quality concerns and multiple livestock deaths since the PGE wells were shut in. DEP conducts a water test and writes to the Smiths in October that, “While these secondary contaminants [iron and manganese] exceed the drinking water standards, they do not pose a health risk...we are unable to conclusively relate the quality concerns for your water supply to gas well drilling or production.”
3/20/08	The Smiths file a complaint with DEP about water quality concerns and possible arsenic contamination following a private water test. The DEP inspector notes in a complaints record that based on his Internet research, introduced arsenic is tied to “fertilizer and pesticides, and also from animal food” and that “some mention is given to oil/gas well production fluids but only in passing.” DEP writes to the Smiths in April recommending that they “consult a professional water treatment company.”
5/14/08	Steckman Ridge applies for a stream distance waiver related to conversion of the Quarles 1709 gas production well into a gas storage well. The original well was 40 feet from a tributary to Sideling Hill Creek, but the operator notes that new “construction activities will disturb ground within approximately 20 feet of the stream.” (Because the hard copy form wasn’t signed by DEP and stream distance waivers issued before 2013 are not listed in eFACTS, we can’t confirm whether this particular waiver was approved.)

9/19/08	The Smiths contact their state senator about ongoing water quality concerns in the area and the senator's aide contacts DEP. A regional DEP employee emails the Smiths in October explaining that that DEP's water test the previous April showed elevated arsenic and iron and reiterates the inspector's conclusion at the time that they should "consult a professional water treatment company."
12/2/08	The Smiths file a complaint with DEP about an oily scum on the water troughs for cattle, an oily feel to hot water in their house, and muddy spring water. Within a few days, DEP conducts a water test and inspects the SR6 well site, where drilling was underway. The inspector notes in the complaint record that because some parameters were undetected and others down from previous tests, "there is insufficient evidence to show that the gas well caused the problems."
4/23/09	DEP records indicate testing is done in Shaffer Creek following a complaint filed by the Smiths about "large amounts of foam running down stream." DEP detects MBAS (methylene blue active substances) at 0.41 mg/L; another test in May detected MBAS at under 0.20 mg/L. MBAS indicates the presence of surfactants such as a detergent or foaming agent.
7/1/09	The Smiths file a complaint with DEP about foam on Shaffer Creek. The complaint record notes that previous water tests detected MBAS. The complaint record does not indicate whether a site visit occurred, but one month later DEP closes the complaint on the basis that previous water tests "revealed that there has been no impact from gas well activities."
8/27/09	DEP approves a stream distance waiver application from Steckman Ridge, which seeks to place the "temporary construction workspace" of the SR9 well five feet from two wetlands. The operator notes that the wetlands are located in the Shaffer Creek watershed, a special protection warm water fishery.
11/24/09	The Smiths file a complaint with DEP about foam on Shaffer Creek and email photos to DEP. In a related email to colleagues, a DEP employee states, "If water samples are collected, make sure to add MBAS." The complaint record indicates that a DEP inspector visited the site eight days later, but only saw "small amounts" of foam and told Angel Smith that foam is "normal for this time of year and agricultural areas." The inspector also noted that she was "on time constraints" and "there are no guarantees" she would make it out if the problem occurred again. The inspector did not take stream samples and closed the complaint that day.
5/12/10	The Smiths email photos of foaming on Shaffer Creek to DEP, noting that the problem seems to occur when the Quarles compressor starts running again after being down for a few days. An employee emails the inspector who had handled the case before that, "looks like foam to me" and asking how it compares to previous foaming events at the site.
8/3/10	Following an inspection at the SR6 well, a DEP inspector notes in his report that, "There are 2 plugged wells located within the Storage Reservoir... The SC Boor 4831 well has never been located... The Eckman 1862 well was not accessible due to the inability to make contact with the land owner." (As noted above, the status of these wells is unclear.)
3/23/11	The Smiths file a complaint with DEP about foam on Shaffer Creek. According to the complaint record, a DEP inspector visits the area the same day and takes photos, noting that "nothing out of the ordinary was observed... the only foam I saw was in the riffle areas... But one thing to keep in mind is that the last time we got these complaints, the pictures were taken in the early morning... and by the time I responded, the foam had already dissipated." The complaint is recorded as "resolved" the same day.
11/18/11	The Smiths file a complaint with DEP about high levels of foam on Shaffer Creek and email photos. According to the complaint record, a DEP inspector visits the area the same day and concludes that the foam is "naturally-occurring" and there was "no evident impact to water quality of aquatic environment."
10/30/13	The Smiths file a complaint with DEP about an "oily/sticky/fatty" white substance on the surface of their pond. Available records don't indicate whether DEP investigated or resolved the complaint.



Events related to the Quarles Compressor Station

Date	Summary
8/23/09	<p>An emergency shutdown (ESD) occurs at the station due to a compressor failure, resulting in the release of a mist containing methane and lubrication oil. According to the 2010 Consent Assessment of Civil Penalty reached between DEP and Steckman Ridge, DEP first learns about the incident on 8/25 after receiving several complaints from residents about an oily residue on their properties. A DEP complaint record states, "natural gas formed a plume about a mile in diameter around the compressor station...Spectra Energy doing remediation. Alarm and release heard by residents."</p> <p>A DEP memo indicates that on 8/26, DEP visits a complainant's home and notes, "significant blotching of some sort (looked like oil) on the property." On 8/27, Angel Smith files a report with the National Response Center (NRC), which states that a compressor station "suffered a failure and blew a mist of oil into the environment." Later that day, Spectra Energy reports the incident to NRC. A consultant's report on the incident concluded that, "Oil associated with the release was...observed to have been deposited on certain surfaces...at distances of up to approximately one mile away."</p>
9/13/09	<p>A local resident emails EPA Region 3 about the August release from the compressor station, asking for information on the emissions "so we know the facts of what was released, exactly how far the oily substance traveled and in what direction." The email was forwarded to DEP, but we did not find documents indicating how or when DEP responded.</p>
10/26/09	<p>During a planned shutdown at the compressor station, mist containing both methane and lubrication oil is released. According to a subsequent letter from Steckman Ridge to DEP, personnel at the site determined that oil emissions dispersed off the property and observed oily residue across the road—but that a "canvass including water ponds, cattle drinking holes and ditches in the area" did not show any evidence of impacts.</p> <p>According to a DEP memo, two days before the shutdown, DEP received an online complaint from a resident noting "loud hissing noises from the station and subsequent eye burning and a headache." When asked about this earlier incident, Steckman Ridge's manager told DEP they were conducting routine start up and that nothing unusual had occurred that day.</p>
1/20/10	<p>A blowdown at the compressor station occurs following a problem with the backup power system. In a letter to DEP, Steckman Ridge indicates that the blowdown lasted about five minutes and released 130,000 cubic feet of gas in the air, but that "No evidence of oil was found on station property or around the perimeter of the facility."</p>
3/9/10	<p>The Smiths file a report with NRC about ongoing pollution and health concerns related to the Steckman Ridge gas storage project. NRC forwards the report to DEP. Employee emails indicate that EPA received several calls from the area the next day but that, "This was not an emergency response issue. This allegedly has been an ongoing problem for several months."</p>
3/23/10	<p>A DEP employee emails a colleague saying that he forgot he received a complaint about oil on a pond and asking for it to be entered into the Complaint Tracking System (CTS). The complaint is registered "resolved" the same day it is entered into the CTS. But the DEP employee later emails the Smiths saying that their complaint about oil on a pond has been entered into the system "for investigation."</p>
3/24/10	<p>DEP and Steckman Ridge enter into a Consent Assessment of Civil Penalty for the two shutdown incidents at the compressor station in 2009. DEP states that both were the result of malfunctions "which posed an imminent danger to public health, safety, welfare and the environment." Violations are issued for fugitive emissions of oil and failure to notify DEP and Steckman Ridge is fined \$22,000.</p>

3/24/10	A DEP employee emails Angel Smith that Steckman Ridge's reported emissions "are well within the limits allowed." Angel emails back the next day requesting information on annual reported emissions, the 2009 releases of lubricating oil, and all blowdowns, and asking "How are you as a department suppose to know if they (Steckman) reported to you right? Example, if they tell you they have only 4 and...we have 30 [blowdowns], whose word are you going to take?"
4/8-10/10	According to call reports from DEP's Air Quality division, Steckman Ridge shuts down and restarts the compressor station at least five times over the course of three days because of an "engine crankcase high pressure indicator." On April 8, Angel Smith emails DEP that the compressor station has gone off "at least six times this week, very loud," she detected odors, and her horses were sneezing a lot.
4/28/10	According to a call report from DEP's Air Quality division, Steckman Ridge conducts a required emergency shutdown safety check, which "involves venting natural gas from a 2" line about 8-10 times during the day. Each venting episode will last about 10-15 minutes." The report notes that local residents and County emergency services will be notified.
5/8/10	DEP receives a call about an emergency shutdown and gas release at the compressor station. During a site investigation, Steckman Ridge confirms that a crew member opened a valve out of sequence and "created a gas blow-off that lasted approximately 4 minutes" but that employees searched the surrounding area for petroleum deposits and didn't find any. The investigation record indicates that DEP advised the company to include the blow-off emissions in its annual emissions report.
7/12/10	Angel Smith emails DEP that the compressor station "keeps blowing off...even 2:00 am..." and asks whether such incidents are being reported. A DEP employee responds that, "Not all blow-offs need to be reported...but the company will need to account for those emissions in their annual report to DEP." According to a call report from DEP's Air Quality division, Steckman Ridge shut down the compressor station at 2:15 am "due to a high temp cylinder indicator," which resulted in noise and a natural gas release for several minutes, but that employees did not find any indication of an oil release in subsequent canvasses of the area.
10/8/10	In an email to DEP, Steckman Ridge reports that while packing a line with natural gas, a valve leaked, but the company wasn't sure how long the gas release lasted. The company emphasized they wanted to "keep DEP in the loop" because a resident had called 911 and the County Emergency Management office.
3/16/11	The Smiths file complaints with DEP and NRC about sulfur odors coming from the direction of the compressor station, as well as an oily sheen and foam on Shaffer Creek. The DEP complaint record indicates that an inspector had been at the station that day and it wasn't operating. About a week later, he noted, "I do not know anything at the Station that could emit sulfur odors" and closed the complaint.
4/25/11	Angel Smith calls the district DEP air quality office about gas odors; a DEP employee email indicates he told her to call the County Emergency Management office. Two weeks later, Angel emails DEP that County emergency personnel had detected carbon monoxide, propane, and another chemical that day. She also writes that on May 5, a steer died and a cow almost miscarried and wasn't producing milk, and on May 9 she heard "the compressor station roaring" and a siren going off. On May 20, a DEP employee responds that, "We have not seen evidence of any environmental violations related to the May 9 siren" and that in the future, Angel should instead contact Steckman Ridge about noise issues and County Emergency Management about safety concerns.

6/28/12	<p>According to trip report, an agency coordinator with the EPA visits a neighbor of the Smith's following numerous complaints filed with NRC about odors, arsenic in a water well, and frequent shaking of the house. The neighbor associates these problems with the Steckman Ridge and nearby Artemas (Columbia Gas) gas storage facilities.</p> <p>The coordinator concludes there was no "credible evidence of a potential public health threat" and that EPA did not have the authority to address vibrations "or the funding to conduct monitoring for vibrations associated with underground gas storage." But he also states, "I do believe that you have felt and smelled what you have reported" and "as a continuous sensation from an external industrial or commercial source it [shaking] may present a physical and/or psychological health threat."</p>
8/13/12	<p>A neighbor of the Smith's emails DEP about a "boom" at the compressor station, followed by a siren and smoke coming out one of the stacks. Three days later, a DEP inspector visits the station and notes in a report that a Steckman Ridge employee indicated routine maintenance/inspections were underway that released natural gas at such a high pressure (2200 pounds per square inch) as to be visible.</p>
2/9/13	<p>Angel emails DEP about a very loud boom that she and several other neighbors heard coming from the vicinity of the compressor station. A few days later, a DEP employee responds that DEP Air Quality staff had contacted Steckman Ridge personnel at the station, who told DEP that "there were no noted unusual occurrences at the station that weekend" and that the station wasn't running because they were withdrawing gas from the storage field.</p>
3/10/13	<p>Angel emails DEP that the day before, loud snapping and popping noises, smoke, and odors had been coming from the compressor station and the fire company came out. She asks whether the incident was reported to DEP and what occurred. DEP responds that an Air Quality Division employee contacted Spectra Energy, and the company stated that a relief valve had popped off.</p> <p>On 3/15, the Bedford Gazette reports that a Spectra Energy spokesperson initially told the newspaper that only air was released during the incident—but later changed its assessment and verified that natural gas had been vented. A 3/18 email from Spectra Energy to DEP confirms that due to a faulty switch, about 430,000 cubic feet of natural gas and Volatile Organic Compounds (VOCs) was vented. The email also indicates that the station is now shut down "for routine annual maintenance" that could involve venting of gas.</p>

Water Quality

Between 2007 and 2010, the Smiths had their water tested numerous times by independent laboratories and DEP conducted testing in response to complaints. In addition, Steckman Ridge had the Smith’s water tested in July 2008 prior to drilling activities in the area and again in November 2008 following a complaint. Because the tests were ordered by different entities, the parameters included in the sampling varied, making a clear “apples to apples” comparison difficult. In addition, we did not find any water quality data from before 2007, even though gas development was already underway for several years.

After reviewing the data found in DEP files and provided by the Smiths, we identified two the following two key concerns.

Elevated parameters

As summarized in the table below, some of the water samples taken of the Smith’s well water had contaminants at levels many times above both the federal Maximum Contaminant Level (MCL) for drinking water and median concentrations typically found in Pennsylvania groundwater.⁶

Table 2. Water testing at Angel & Wayne Smith (selected parameters)

Date and lab	Iron (mg/l)			Manganese (mg/l)			Arsenic (mg/l)		
	Result	Level above MCL (0.3 mg/l)	Level above PA median (0.05 mg/l)	Result	Level above MCL (0.05 mg/l)	Level above PA median (0.01 mg/l)	Result	Level above MCL (0.010 mg/l)	Level above PA median (0.0025 mg/l)
8/2007, DEP (well)	10.3	34x	206x	3.228	65x	323x	--	--	--
4/2008, DEP (kitchen tap)	0.076	0.25x	1.5x	0.137	3x	14x	00.012	1.2x	5x
7/2008, Fairway Labs (for Steckman Ridge) (well)	4.39	15x	88x	0.43	9x	43x	0.0526	5.3x	21x
12/2008, DEP (kitchen tap)	0.439	1.5x	9x	0.06	1.2x	6x	--	--	--
3/2009, Mountain Research (Smiths) (well)	0.0781	0.26x	1.6x	0.138	3x	14x	0.0127	1.3x	5x

-- parameter not included in test

Even though EPA assigns secondary standards to iron and manganese (i.e., contaminants that have aesthetic but not direct health effects), the agency emphasizes that continuously high levels can change the taste and color of water to the point of being unusable without extensive treatment.⁷ While arsenic is a naturally occurring element in rock and soil, the serious short- and long-term health effects of exposure have led EPA to set a goal level for the protection of health and safety that goes far beyond the enforceable regulatory MCL: zero.⁸

The precise cause of the fluctuating levels of arsenic in the Smiths water has never been established. In 2013, University of Texas researchers confirmed that private water wells closest to Barnett Shale gas drilling sites had higher levels of heavy metals such as arsenic (as well as barium, strontium, and selenium), possibly due to faulty casings, vibrations from drilling, or the lowering of water tables.⁹ In 2010, the Smiths paid to install a comprehensive water filtration and purification system for their home, from which their livestock and pets also drink.

A neighborhood problem

Water quality changes have occurred at other locations in the area than the Smith's farm. As detailed in the events timeline, in 2009 DEP tested water from Shaffer Creek in response to complaints of large amounts of foam and found methylene blue active substances (MBAS),¹⁰ which indicate the presence of surfactants such as a detergent or a foaming agent; this parameter is often recommended as part of water sampling near oil and gas operations.¹¹ The Smiths filed several more complaints about foaming in Shaffer Creek through 2011, but we didn't find any records indicating that DEP conducted further tests or investigated the source of the MBAS.

In April 2013, DEP collected samples from the water supply of one of the Smith's neighbors in response to a complaint filed the month before. In a letter to the homeowner, DEP stated that manganese was present above the secondary MCL, but "At this time, the Department's investigation does not indicate that gas well drilling has impacted your water supply."

However, the DEP letter did not mention that methane was detected at 23.2 micrograms per liter ($\mu\text{g}/\text{l}$). When Steckman Ridge conducted pre-drill baseline water tests at several locations in the area, methane was at barely detectable levels.¹² Two private water tests conducted on the Smith's water well (in March 2009 and September 2010) detected methane, but none of the tests by DEP or for Spectra Energy did. Although DEP may consider such levels too low to require action, Penn State Extension advises that, "...any water well with a detectable concentration of methane should be routinely tested to ensure that the methane concentration is not increasing to a dangerous level."¹³

According to a 2012 EPA report, water sampling at the home of a neighbor of the Smith's who lives near both the Steckman Ridge and Artemas gas storage facilities detected arsenic levels at 0.027 mg/l, nearly three times the federal MCL.¹⁴

UNDERGROUND BUT NOT HIDDEN: THE RISKS OF GAS STORAGE

According to the US Energy Information Administration (EIA), in 2011 there were more than 400 underground natural gas storage areas nationwide, 80 percent of which have been created from former oil and gas production fields.¹⁵ The Steckman Ridge storage field proposal comprised nearly 100 acres of land 23 gas storage wells, 7 miles of pipeline, 23 well laterals, and a compressor station.¹⁶

Back in 1973, the EPA stated that “Underground gas storage fields present a potential for contamination of usable ground water by leakage of gas through the confining beds, through abandoned improperly plugged wells, or through inadequately constructed gas injection or withdrawal wells. Gas could also escape from an overpressured field...”¹⁷ In 2004-2005, researchers confirmed the potential for water contamination from gas storage fields in a study confirming that water wells clustered close to a storage field in Tioga County, Pennsylvania had higher concentrations of methane than others nearby.¹⁸

Steckman Ridge’s proposal to DEP for the gas storage project indicated that hydrostatic (pressure) testing on the system would result in discharges of industrial wastewater at 33 locations, all located within the special protection watersheds of Sideling Hill Creek, classified as Exceptional Value (EV), and Shaffer Creek, classified as a Warm Water Fishery (WWF).¹⁹

In the 2007 proposal for the gas storage project, Spectra Energy confirmed the locations of four private groundwater supply wells, four springs, and one pond within 150 feet of the proposed construction area, as well as 21 private wells, six springs, and six ponds within 1,000 feet of the storage wells. The company confirmed that pre- and post-construction testing for all of these water supplies would be conducted and that at the time of construction, no other “potential or actual threats to groundwater” existed within the proposed project area.²⁰

Air Quality

The Quarles compressor station is not included in the DEP Natural Gas Emissions Inventory—most likely because it is classified under natural gas transmission rather than gas production—but it is part of the general emissions inventory in eFACTS. As seen in the table below, the station is among the top emitters in Bedford County of seven key air pollutants. Since 2010, the volume of emissions released has increased for all of the pollutants except for volatile organic compounds (VOCs), which were higher in 2009, the year that two accidental releases of methane and oil occurred.



Table 3. Emissions from Quarles 1709 Compressor Station in tons and (rank), compared to emissions from other facilities in Bedford county (eFACTs data)

	2009	2010	2011	2012
VOC	25.3 (4)	13.7 (4)	14.8 (4)	16.0 (4)
Benzene	0.08 (3)	0.08 (3)	0.08 (3)	0.09 (3)
Carbon Monoxide	1.55 (4)	5.59 (3)	4.45 (3)	8.73 (2)
NOx	5.14 (3)	4.61 (3)	5.44 (3)	6.90 (3)
PM10	0.50 (3)	0.48 (3)	0.55 (3)	0.75 (3)
SOx	0.03 (3)	0.03 (4)	0.04 (2)	0.05 (2)
Toluene	0.23 (5)	0.23 (3)	0.23 (3)	0.24 (2)

In 2013, Earthworks conducted several air canister tests on the Smith’s property and near a neighbor’s home. The canisters were placed approximately 0.4 miles west and 0.25 miles east of the compressor station. As seen in Table 4, this testing detected a few VOCs known to be associated with gas development, including acetone, methane, and toluene, as well as hazardous air pollutants, or HAPs (i.e., all other contaminants except for the chlorofluorocarbons, or CFCs). Also known as toxic air pollutants or air toxics, HAPs cause or may cause cancer or other serious health effects, such as reproductive problems or birth defects, or adverse environmental and ecological effects, and are regulated by the EPA.²¹

According to DEP, some of the VOCs found near the Smith home are present in ambient air because they were once widely used and persist in the atmosphere, but methane, acetone, and toluene may very well be related to Marcellus shale activities.²²

Table 4. VOCs (including methane) detected in ambient air near the Smith’s home (Sample 1) and a neighbor’s home (Sample 2)

Concentrations are in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$)	Sample 1 June 9, 2013	Sample 2 June 9, 2013	Sample 1 July 14, 2013	Sample 2 July 18, 2013	Sample 1 August 16, 2013	Sample 2 August 16, 2013
Methane	--	--	--	--	2.7	2.3
2-Butanone	--	0.96	--	--	--	--
Acetone	--	--	10	11	--	--
Carbon tetrachloride	0.89	0.56	0.60	0.63	0.61	0.58
Chloromethane	1.4	0.91	0.92	1	0.64	--
Methylene Chloride	1.2	--	--	--	--	--
Trichloroethylene (TCE)	0.14	--	--	--	--	--
Toluene	1.7	--	--	--	--	--
CFC-11	2.2	1.5	1.5	1.6	1.4	1.3
CFC-113	0.9	0.57	0.59	0.61	0.57	0.55
Total number of VOCs detected (including methane)	7	5	5	5	5	4

-- not detected



Because most VOCs do not have associated air quality standards, it is difficult to assess the potential for each individual, or the combination of several chemicals together, to cause health effects—underscoring the importance of the health symptoms and changes that residents report.

In addition, the Earthworks canister samples were taken at times when we assumed that the Quarles compressor station was operating normally.²³ Compressor stations occasionally undergo maintenance or emergency situations where they are “blown down,” which means they vent gas directly to the atmosphere. During these relatively short periods of time, nearby residents may be exposed to much higher concentrations of chemicals than are typical. Unfortunately, there is no requirement for operators of compressor stations to monitor concentrations of chemicals at nearby residences during blowdowns. Without this information, it is not possible to fully assess the potential health effects related to emissions from compressor stations.

Endnotes

¹ Letter from Sarah Heaton, MPH, Public Health Analyst, National Center for Environmental Health, Centers for Disease Control and Prevention, to Kimberly D. Bose, Secretary, FERC. April 1, 2008.

² Federal Energy Regulatory Commission Order Issuing Certificates. Docket No. CP08-15-000, June 5, 2008.

³ Both wells are in DEP’s database of spud wells (www.depreportingservices.state.pa.us/ReportServer/Pages/ReportViewer.aspx?/Oil_Gas/Spud_External_Data); neither is in the DEP Orphan and Abandoned well database (www.depreportingservices.state.pa.us/ReportServer/Pages/ReportViewer.aspx?/Oil_Gas/Abandoned_Orphan_Web). eFACTS indicates that DEP conducted inspections at the Boor well in 2013 and at the Eckman well in 2012 and 2013.

⁴ Pa. Code §78.903, “Frequency of Inspections.”

⁵ Data on inspections for the wells SR6, Clark 1663, SR 10, SR 14, SR 15, SR 17 and STUP 1557 from eFACTS Facility search: http://www.ahs.dep.pa.gov/eFACTSWeb/criteria_facility.aspx

⁶ Boyer, E., Swistock, B., Clark, J., Madden, M. and Rizzo, D. 2012. “The Impact of Marcellus Gas Drilling on Rural Drinking Water Supplies.” Center for Rural Pennsylvania.

⁷ Penn State Extension. “Iron and Manganese in Private Water Systems.”

⁸ U.S. Environmental Protection Agency. “Basic Information about Arsenic in Drinking Water.”

⁹ Brian E. Fontenot, Laura R. Hunt, Zacariah L. Hildenbrand, et al. “An Evaluation of Water Quality in Private Drinking Water Wells Near Natural Gas Extraction Sites in the Barnett Shale Formation.” *Environmental Science and Technology*, July 2013.

¹⁰ Steckman Ridge Response to Smiths’ Comments. Received August 11, 2009. FERC Docket No. CP08-15-000. Attachment A - PADEP Results.

¹¹ For example, Penn State Extension “Common Water Test Parameters Related to Natural Gas Drilling” and ALS Global Labs, “Marcellus and Utica Shale Support.”

¹² Groundwater monitoring data in Steckman Ridge, “FERC Pre-Filing Process Project Update for Stakeholders.” July 2007.

¹³ Brian A. Swistock and Dana Rizzo, Penn State Extension. “Methane Gas and Its Removal from Wells in Pennsylvania.”

¹⁴ Report by Stephen Jarvela, Federal On-Site Coordinator, US EPA Region 3. September 28, 2012.

¹⁵ See map of facilities at www.eia.gov/cfapps/ngqs/images/storage_2011.png and “Underground Natural Gas Storage” pages at www.eia.gov/pub/oil_gas/natural_gas/analysis_publications/ngpipeline/undrgrnd_storage.html#overview.

¹⁶ Federal Energy Regulatory Commission Order Issuing Certificates. Docket No. CP08-15-000, June 5, 2008.

¹⁷ US EPA, *Ground Water Pollution from Subsurface Excavations.* 1973.

¹⁸ Kevin J. Breen, Kinga Revesz, Fred J. Baldassare, and Steven D McAuley. “Natural Gases in Ground Water near Tioga Junction, Tioga County, North-Central Pennsylvania - Occurrence and Use of Isotopes to Determine Origins.” US Geological Survey, 2007.

¹⁹ “Steckman Ridge Storage Project, Monroe Township, Bedford County, Pennsylvania.” Project proposal submitted by Steckman Ridge to PADEP, December 17, 2007.



²⁰ Ibid.

²¹ EPA Air Toxics website: "Pollutants and Sources." www.epa.gov/ttn/atw/pollsour.html

²² PA DEP. *Southwest Pa. Marcellus Short-Term Air Sampling Report*. 2010.

²³ Nearby residents did not alert us to any strong odors or events during our sampling periods. There is no easy way for the public to determine if operators reported problems to DEP, and no way to determine if operators experienced problems that led to excessive emissions at any given time.

