

Blackout

in the Gas Patch CASE STUDY



JANET AND FRED MCINTYRE

Connoquenessing Township, Butler County, PA

→ Read the full report at
<http://blackout.earthworksaction.org>

Summary

Events in Janet and Fred McIntyre's neighborhood in Butler County, known as the Woodlands, show just how fast the shale gas boom can change a place. According to Pennsylvania's Environment Facility Application Compliance Tracking System (eFACTS), between 2004-2008, only 10 new oil and gas permits were issued in Connoquenessing Township; that number jumped to 51 in 2009-2013. DEP ranks Butler County sixth among Pennsylvania counties in the number of unconventional wells drilled.¹

The McIntyres had been bothered by noise, smells, and traffic for a long time. But the turning point came in January 2011, when the entire family got sick after a meal that included several glasses of tap water. Then the water in the kitchen and bathroom turned soapy and foamy and a dog suddenly died. A month later, they started noticing a strong smell and foaming of the water from their household well.² Over time, Janet, Fred, and their daughter developed rashes, breathing problems, fatigue, eye and throat irritation, and headaches. Several neighbors have reported odors and similar problems with their water and health.

Our research indicates plausible reasons for the water and air quality and health symptoms experienced by the McIntyres and other residents of the Woodlands since shale gas drilling began.

In the months preceding the McIntyre's water problems, at least six wells were being drilled and hydraulically fractured within approximately one mile of their home. As detailed in the events timeline below, Department of Environmental Protection (DEP) inspectors have identified casing problems, methane leaks, soil contamination, and observable emissions at nearby wells. DEP inspection reports indicate that a defective casing at one of the wells closest to the Woodlands (Voll 1H) was leaking gas.

For more about the McIntyre family and the Woodlands neighborhood:

2012 Pittsburgh Post-Gazette

<http://www.post-gazette.com/stories/business/news/fouled-waters-woodlands-residents-search-for-answers-ways-to-survive-without-clean-water-649566/>

2013 Associated Press story on DEP and US EPA water testing

<http://bigstory.ap.org/article/cause-color-fetid-water-eludes-pa-town>

PHOTOS

Top: Janet and Fred McIntyre with their water buffalo for clean water deliveries. Photo by Nadia Steinzor/Earthworks

Below, L-R: Infrared video showing emissions from the Sarsen gas processing plant, Butler County. Photo by Frank Finan

Janet McIntyre and Diane Sipe help with water bank deliveries for the Woodlands. Photo by Jason Bell

Well head bubbling from possible casing failure. Photo by Nadia Steinzor/Earthworks

Well site development close to home. Photo by Frank Finan



DEP samples of the McIntyre's water detected contaminants and iron and manganese many times higher than pre-drilling levels, as well as elevated levels of other parameters. In addition, DEP data show that the wells and facilities near the Woodlands emit considerable amounts of volatile organic compounds (VOCs), including chemicals known to be associated with the health symptoms reported by residents (e.g., benzene, toluene, and formaldehyde).

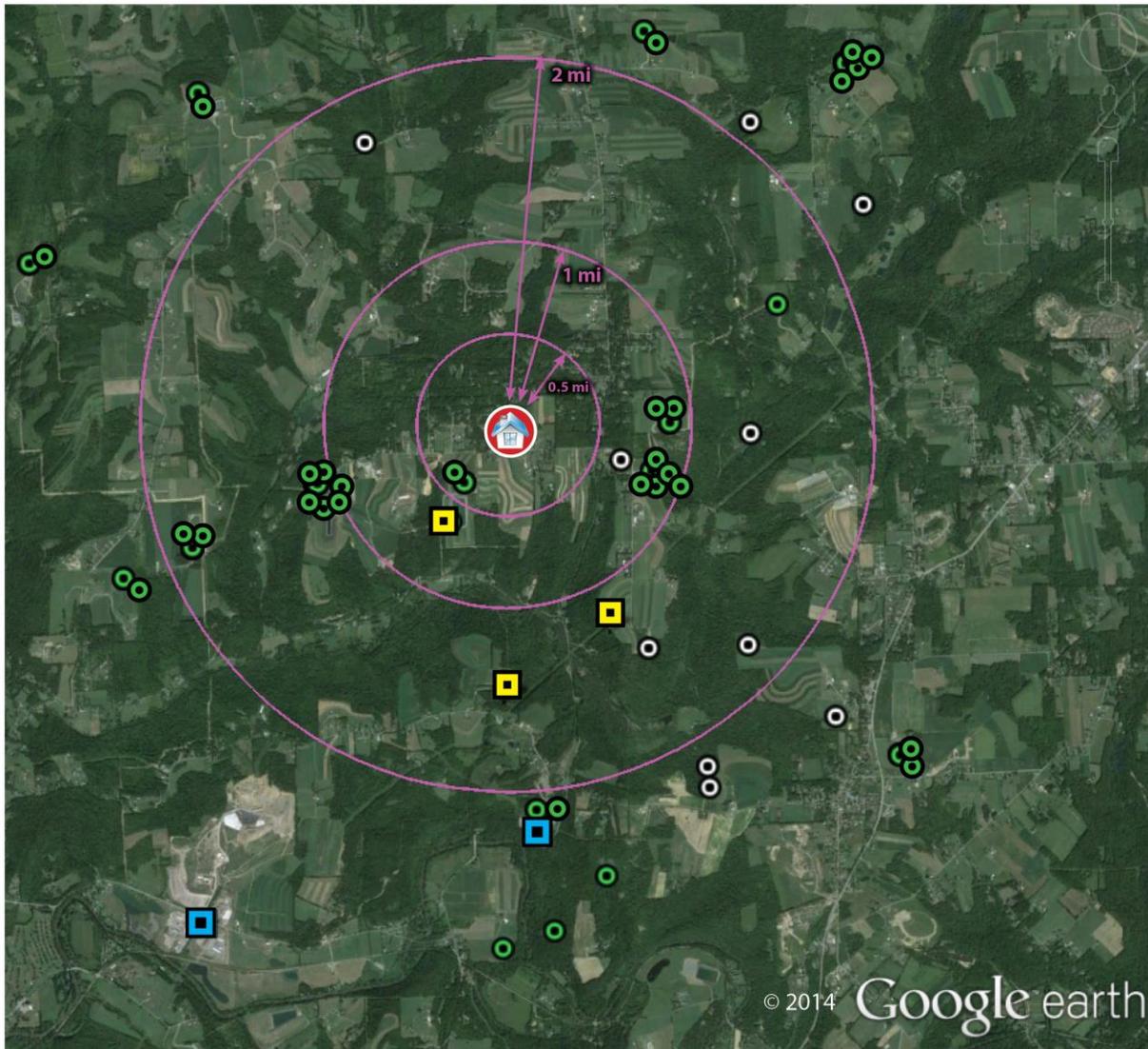
Yet DEP has never made a connection between the rapid expansion of gas wells and facilities in the area and the ongoing, consistent problems reported by the McIntyres and their neighbors. It isn't clear whether this had to do with time and resource constraints, insufficient information and training provided to inspectors, inconsistent parameters in testing that made data comparison difficult, or other factors.

For residents of the Woodlands, the quest for answers and help has been long, hard, and frustrating—and is far from over. Thanks to community groups, volunteers, private donations, and coordination by a local church, the "Water for Woodlands" program makes weekly deliveries of drinking water to more than 30 families.³ Several have also received donated water "buffalo" tanks so they can have clean water for bathing and household uses. In light of problems at nearby gas sites and emerging science, Earthworks and its partners have asked DEP to conduct a new investigation of the Woodlands.



Wells and Facilities Around the McIntyre Home

Between 2008 and 2011, 30 unconventional wells were drilled within two miles of the McIntyre home, 16 of which are within one mile and five within a half mile. Three of five wells drilled closest to the McIntyres were later plugged (Voll 5H, 6H, and 7H). In addition, two conventional wells within two miles were drilled decades ago; one is plugged.⁴



KEY

- Unconventional gas well
- Conventional gas well
- Compressor station
- Gas processing plant
- 🏠 House

New Problems from Old Wells?

Abandoned, unplugged wells can deteriorate and provide pathways for oil, gas, brine, and other contaminants to travel to the surface or into groundwater. In addition, there is some indication that hydraulic fracturing of a new well that intersects with an abandoned well could result in methane leakage.⁵

In the course of investigating problems with the McIntyre's water supply, DEP seems to have considered whether there might be a link to abandoned oil and gas wells in the area. According to an April 2011 memo from a DEP water quality specialist to a DEP compliance manager, an abandoned oil well was approximately 1,200 feet north of the McIntyre home, but DEP concluded that it wasn't leaking any gas or fluids. DEP also noted that "some old maps" showed another old oil well approximately 600 feet northwest of the McIntyre home, but "it could not be located in the field."

The Edward Gilliland 0, about 1.4 miles from the McIntyres, was first spud in 1984 but DEP production reports indicate that it never produced gas for sale.⁶ In September 2010, a DEP inspector noted in a report that it was an "abandoned combo well" that was overgrown with vegetation and clearly not in use. DEP issued a violation to the original operator for failure to plug the well upon abandonment. Then a July 2011 DEP inspection report called the well a "producing combo" well and noted it was now properly maintained and venting—which in turn led DEP to close the violation.

To prevent gas pressure from building up and causing explosive conditions or movement into other formations, abandoned wells are sometimes vented to the atmosphere to allow the gas to escape. It appears that this is what was done at the Edward Gilliland 0 well. The well is currently listed in eFACTS as an active well owned by Valley Energy Corp, although the permit date is still listed as 1984. It is unknown whether this or any of the other abandoned wells in Connoquenessing Township may have caused groundwater or types of pollution, particularly with the recent surge in drilling and hydraulic fracturing in the area.

Inspections and Violations

As seen in the table below, unconventional wells in the vicinity of the McIntyre home received an average of 7 to 8 inspections; a few had many more, likely due to ongoing casing and gas leakage problems. These included 20 inspections at the Voll 1H, 0.38 miles away; and 22 at the Shannon 1H and 16 at the Shannon 2H, both 1.37 miles away. Only one inspection was registered as the result of a citizen complaint; occurring at the Grosick Unit 1H well, it led to DEP issuing a violation. DEP has cited four wells within about one mile of the McIntyre home for violations related to pollution, well casing problems, and improper handling and storage of waste. (See events timeline below for details.)

Table 1. Inspections at wells in the vicinity of the McIntyre’s home (as of March 25, 2014)

	Unconventional wells within 1 mile	Conventional wells within 1 mile	Unconventional wells between 1 and 2 miles	Conventional wells between 1 and 2 miles
Number of drilled wells	16	0	14	2
Number of Inspections	115	N/A	121	8
Average inspections per well	7.2	N/A	8.6	4.0
Wells with zero inspections	0	0	0	0
% of wells with zero inspections	0	0	0	0
Complaint inspections	0	0	1	0

McIntyre Events Timeline

The following events related to natural gas development occurring within one mile of the McIntyre home have been compiled from DEP inspection reports and other documents available through file reviews, records in DEP’s Oil and Gas Compliance Database, and information 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 natural gas development within approximately one mile of the McIntyre home

Date	Event
7/7/10	Voll 1H: A DEP inspection reports notes possible problems with the cementing of the well, since upon setting the casing “Gel returns but did not get cement to surface.” The return of cement to the surface indicates that the space between the well casing and rock has been completely filled, which in turn reduces the chance that oil, gas, and contaminated fluids will move through that space and contaminate groundwater. ⁷
9/14/10	Voll 1H: A DEP inspection finds that the well is leaking gas and fluids and the impoundment did not have two feet of freeboard (required to prevent overflow of an impoundment). The inspector notes that Rex Energy was going to call for a “vac truck to suck out fluids from pit and well cellar.” DEP issues two notices of violation to Rex Energy at the Voll site for failure to maintain the freeboard and failure to report “defective, insufficient, or improperly cemented casing” to DEP within 24 hours or to correct the problem within 30 days (required under §78.86 of the Pa. Code).
9/15/10	Voll 1H: A DEP inspector visits the well site and confirms in an inspection report that there’s “gas bubbling through water that filled well cellar,” and that while he couldn’t determine the exact point of gas leakage, it was clear that gas was escaping from a valve. The inspector indicates that Rex intends to investigate the issue and to comply with §78.86 of the Pa. Code on reporting and resolving defective casing or cementing.
9/16/10	Voll Unit: Rex Energy sends a letter to a DEP inspector in response to his call about having observed emissions at the site the day before. Rex agrees that emissions were released and says the company installed risers at the Voll 1H and 2H wells “in order to disperse any potential emissions above ground level” and will monitor the situation.

10/7/10	Shannon 2H: A DEP inspector notes that fracturing of this well blew a hole in the well casing and that Rex Energy would investigate and repair it. A letter from Rex to DEP noted that the hole was about 400 feet below the surface. An inspection report from one month later indicates that the well was currently being repaired.
10/13/10	Voll 1H: A DEP inspection report indicates that a pressure test at the well revealed a hole in the casing, and that Rex Energy is trying to isolate the defect. We did not find any documentation about whether this hole was a new problem or related to the gas leak reported one month earlier at the same well, nor any indication of when the casing problem was fully repaired. Inspection reports from January 2011 indicate that hydraulic fracturing was underway at the well.
11/16/10	Voll 3H: According to DEP's compliance database, a violation is issued for this well after Rex Energy spills 40 pounds of bentonite gel while boring under Little Connoquenessing Creek. The inspector notes that he didn't see "visible impact on aquatic life" and drilling soon resumes. (The inspection report with information on this incident was missing from the file we reviewed.)
11/20/10	Gilliland 4H: A DEP inspector at the well site finds that an air compressor is leaking lubricating oil, which was "spraying into the air and being carried downwind." The compressor was shut down for repair and clean up of oil and oil-soaked gravel and the waste contained for removal. DEP issues a violation to Rex Energy for "failure to properly store, transport, process or dispose of a residual waste."
12/1/10	Gilliland 11HB: Rex Energy writes a letter to Butler County Commissioners about construction of this well, stating that, "flow back water from the fracturing of the well will be transported to a permitted brine water treatment facility for disposal." However, less than one year later (9/7/11), DEP approves a waste management waiver that Rex requested in order to treat flowback from the Gilliland well in tanks, prior to placement in an onsite impoundment "until the time of reuse for future fracking operations."
2/8/11	The McIntyres file a complaint with DEP after their well water starts foaming and smelling. A DEP complaint investigation form that, "...family became extremely ill last week. Every time they drank their water, it caused severe vomiting. Their water was foamy and had a strong odor. Due to several Marcellus wells being drilled near their residence they notified Rex Energy. On 2/1/11 a representative from Rex Energy came to their residence to sample their water. Complainant was instructed not to use their water (to include bathing). On 2/3/11, Rex Energy supplied Complainant with a water buffalo and they pulled their well."
2/10/11	According to complaint records, DEP samples the McIntyre's water but can't do extensive sampling because "the submersible well pump had been pulled." (Rex Energy had done this a week earlier.) DEP instead used a bailer to take grab samples and indicated they'd sample again at another time. The DEP inspector noted that, "the closest well is more than 1,000 feet away and is the Rex Voll 1H and 2H wells."
2/14/11	DEP inspectors conduct a second water test, noting in the complaint records that, "We helped [McIntyres] put the submersible pump back down the well so that we could collect samples. Water was 'rowled-up' a bit...but did seem to clear up a bit after 4 to 5 minutes. We didn't notice any smell or visible sheen...They pointed out some foaming in the yard when we were pumping it out. I told them it wasn't bad and nothing out of the ordinary." Lab results from this test indicate that iron was almost 250 times and manganese almost 150 times pre-drill levels
2/18/11	Emails between DEP staff and the lab analyzing the McIntyre's water samples indicate that two samples contained ethylbenzaldehyde and one contained toluene. When asked about a potential source of ethylbenzaldehyde, the lab said it might have been related to the acid used to preserve the water sample, since it was also in the field/trip blank (i.e., clean water used for quality control). DEP notes in a complaint report that the lab said on the phone that the toluene detection "was probably due to the preservative." However, neither the emails from the lab nor the actual water sample results indicated that toluene (detected at 0.372 ug/L) was also found in the field/trip blank. ⁸

3/3/11	DEP informs Rex Energy that the water samples did not show anything and thanks the Rex employee for his “professional courtesy.” Rex tells DEP that they will now remove the water buffalo and no longer supply the McIntyres with drinking water.
3/15/11	Almost two weeks after talking to Rex, DEP calls the McIntyres about their water test results. According to DEP notes in a complaint record, DEP told the McIntyres “that there was nothing showing in any samples” and that levels of inorganics were high “probably due to the placing of the pump back in the well.”
3/25/11	Complaint records indicate that a DEP employee told the McIntyres on the phone that, “our lab found nothing except toluene but that was way below any MCL’s.” (Maximum Contaminant Levels, or safety standards.)
4/4/11	DEP inspectors sampled the McIntyre's water again. On the same day that the sample was taken, a DEP inspector noted in the complaint record that the agency has “nothing to go on” and while they were going to re-test for iron and manganese, those “aren’t really health related parameters...so we are probably not going to be able to say anything affected the well. I said we just want to make sure these parameters are headed in the right direction.” DEP also visited a neighbor with a water complaint but concluded that, “the slimy feeling they had was iron bacteria.”
4/26/11	DEP sends an investigation determination letter to the McIntyres, informing them that there’s no evidence of a connection with drilling and that, “your iron and manganese results are back to pre-drill levels after the disturbance caused by the removal and replacement of the submersible pump.” On this basis, DEP closes the investigation.
8/9/11	DEP samples the McIntyre’s water again, as well as three weeks later to follow up. Lab records indicate this round of testing was done in response to a complaint, and Janet McIntyre confirmed she called DEP around this time because of concerns about her water. This time, test results indicate the presence of VOCs (acetone, ter-butyl alcohol, chloromethane, and 1,3,5-trimethylbenzene), as well as the highest strontium concentration of all the samples DEP took at the McIntyres. We did not find any indication of action by DEP in response to this contamination. Nor could we determine DEP’s perspective on the problem, since the complaint record related to the August testing was not included in documents that the McIntyres received through a 2014 Right-to-Know Law (RTKL) request. The McIntyres submitted a RTKL request for all DEP records of problems related to their own water supply; however, DEP denied at least 10 pages of records on the basis of protecting an informant—which would have been the McIntyres.
9/2/11	Grosick 1H: According to a DEP incident report for this well, the operator spills 500-1000 gallons of flowback fluid while transferring it to a tank. In response to a citizen complaint, DEP conducts an inspection four days later (9/6/11), which confirms that the spill had occurred. Soil was contained and sampled and the water supply of a resident was sampled and temporarily replaced. DEP issues a violation to Rex Energy for “failure to properly store, transport, process or dispose of a residual waste.” The DEP incident report notes that the spilled flowback water contained 11 metals and nearly 100 volatile and semi-volatile compounds. About 92 tons of impacted soil was removed by a remediation company, which submitted a report indicating that the soil was contaminated with dozens of chemicals and substances, including volatile organic compounds, aluminum, arsenic, barium, cadmium, chromium, iron, lead, manganese, selenium, mercury, acetone, and benzene. Water sampling data in Rex’s incident report suggest that in a nearby water well, concentrations of iron were about 300 times higher and manganese 200 times higher one month after the spill than on the day of the spill. Nonetheless, Rex concluded that, “Results of potable water well analyses did not indicate any detectable concentrations of the contaminants of concern.”



10/11/11	Grosick 1H-7H: DEP approves alternative waste management waiver applications submitted by Rex Energy for the wells at the Grosick site in order to treat flowback in tanks using a biocide and other chemicals prior to it being transferred to the onsite impoundment for use in future fracking operations. However, the erosion and sedimentation control permit application that DEP approved in July 2010 for the Gilliland, Grosick, and Voll well pads stated that the Grosick site would not have an impoundment.
12/1/11	Rex sends a letter to the McIntyres explaining that a third-party consultant (AMEC) report determined that drilling did not affect their water supply, and Rex would therefore remove the alternative water system that it had installed at their home. ⁹ However, the AMEC report clarifies limitations to its analysis, in particular that it relied only on data provided by Rex Energy and the well pad elevations and groundwater flow information were “inferred” rather than based on actual topographical data. ¹⁰ The consultant stated that, “Assessment of additional or future data could result in different interpretations than those presented in this report.”
2/29/12	Rex Energy removes clean water “buffalo” storage tanks and ends the clean water deliveries the company has been providing to several families in the Woodlands.
3/1/12	According to a meeting summary document, DEP employees meet with a US Environmental Protection Agency site coordinator following EPA’s receipt of numerous questions about gas development and water quality in the area on its public tipline. The notes clarify that the EPA coordinator is only talking with DEP and Rex Energy and not visiting residents, but also that EPA is following the situation in the Woodlands and the Agency for Toxic Substances Disease Registry is reviewing sampling data from the area. The notes state that ShaleTest had conducted indoor air quality tests but this was irrelevant to DEP because the agency doesn’t address deal such problems. This is erroneous, as Earthworks and ShaleTest conducted only <i>outdoor</i> air sampling in 2011.
3/20/12	Carson 1H-3H: DEP approves alternative waste management waivers submitted by Rex Energy for the wells at this site in order to treat flowback in tanks using a biocide and sediment bags so it can be used for future fracking operations.

Water Quality

According to data provided to the Scranton Times-Tribune by DEP and mapped by the FracTracker Alliance, the closest water complaints to the McIntyres were for the same site located 1.55 miles away.¹¹ However, the latitude and longitude data appears to be incorrect, as a related letter from DEP matches one that the McIntyres provided to Earthworks.

The FracTracker map indicates that eight complaints for water pollution were filed between April 2011 and April 2012 in the area around the McIntyres. Information we obtained from DEP indicates that between February 2011 and November 2013, 15 complaints were filed in Connoquenessing Township for water supply problems.

As seen in Table 2, the parameters included in DEP water sampling varied widely, making it difficult to compare results from one time period to the next. However, almost all of DEP’s resulting testing indicated high levels of iron and manganese, as well as other parameters in some tests (e.g., calcium and sodium). DEP did not establish causality with gas drilling activities in any of the cases.

In December 2012, Earthworks tested the McIntyre’s well water. Results indicated that most parameters had returned to pre-drill levels, although iron, manganese, and sodium remained elevated. The sample we took contained methane, but because neither DEP nor Rex Energy ever tested for methane, it is

impossible to know if our sample represented a one-time occurrence or an elevation over pre-drill levels.

In a multi-year study of water quality in the Woodlands, Dr. John Stolz and his colleagues at Duquesne University have identified a complex set of reasons for the changes experienced by many households and the elevated levels of manganese, iron, barium, strontium, methane, ethane, and propane detected in samples from water wells. These include faulty casing, spills, and leaks at nearby gas wells and the large volumes of fluids injected underground for fracking—which may in turn have shifted the water table and facilitated the flow of contaminants into water wells from both active and abandoned gas and oil sites and old coal mines.¹² The research shows that 65 gas well laterals have been drilled within a 2.5-mile radius of the Woodlands, and that there are possible correlations between the location of households in the area experiencing water quality changes and the depth and direction of drilling and resulting rock fractures.¹³

Table 2: McIntyre water test results and drinking water (DW) standards

Parameter (in mg/l unless otherwise indicated)	McIntyre Pre-Drill (1/29/10)	Complaint Rex Data (2/3/11)	Complaint DEP data (2/10/11)	Complaint DEP data (2/14/11)	Followup DEP data (4/4/11)	Complaint DEP data (8/9/11)	Followup DEP data (8/30/11)	Followup DEP data (8/30/11)	Earthworks Sample (5/7/12)	Approx. median concn. in typical PA grdwater*	Federal MCL	Federal/ DEP secondary DW standard
Barium	0.155	0.162	0.142	0.495	0.143	0.161			0.178	0.070	2.0 mg/L	
Calcium	48.9	43.204	54.6	56.2	40.6	43			48.2	No data	None	None
Iron	0.149	0.143	1.175	36.6	0.113	0.107			0.269	0.20	None	FED: 0.3
Magnesium	9.441	8.518	8.649	9.96	7.811	8.421			9.16	No data	None	None
Manganese	0.049	0.053	0.194	5.617	0.081	0.056			0.116	0.01	None	FED: 0.05
Potassium	1.366	1.179	1.208	1.955	1.187	1.223			1.38	No data	None	None
Sodium	8.193	7.6	7.928	8.141	7.125	7.469			9.2	6.87	None	None
Strontium			0.163	0.224	0.189	1.223			0.237	0.26	None	FED HA: 4
Chloride	2.4	6.6	3.9	2.2	2.5				2.98	5.3	None	FED: 250
Alkalinity	162	148	181.2	184.6	141.4					No data	None	DEP: min of 20
TDS	183	155	244	172	164	226			185	No data	None	DEP: <500 mg/L mo. av.
pH	6.74	7.47	7.9	7.4	7.3				7.3	7.5	None	FED: 6.5 - 8.5
Methane									1.35	No data	None	None. **
Acetone	ND	ND	ND	ND		5.44	2.63	2.91				
Chloromethane	ND	ND	ND	ND		0.752	0.546	0.486				
ter-Butyl Alcohol	ND	ND	ND	ND		ND	8.27	7.41				
1,3,5-trimethylbenzene	ND	ND	ND	ND		ND	0.318	ND				
Toluene	ND	ND	ND	0.372		ND	ND	ND				

ND: not detected; Blank Cell: not tested, or data not found. Copies of DEP data were provided to Earthworks by the McIntyres. It is possible that DEP did analyze for these chemicals, but if so, did not provide the data to the McIntyres.

* Pennsylvania State University.

Air Quality

Using data in both DEP's annual emissions inventories and DEP's Environment Facility Application Compliance Tracking System (eFACTS), we found that the gas wells near the McIntyre home release considerable amounts of toxic and hazardous air pollutants. As seen in Table 3, in 2012, the wells within 1 mile released more than 75 tons of VOCs; the Voll compressor (0.63 miles away) alone emitted over 6 tons of VOCs.

Table 3. Emissions from wells and facilities within 1 mile of the McIntyre home.¹⁴

Facilities		CO	NOx	PM10	PM2.5	SOx	VOC	Benzene	Ethyl-benzene	Formaldehyde	n-Hexane	Toluene	Xylene	2,2,4-TMB*
16 Wells	2011	25.6	94.9	3.35	3.25	0.12	23.3	0.12	0.01	0.01	3.57	0.21	0.24	0.55
12 Wells	2012	5.8	24.3	0.91	0.89	0.04	76.7	0.08	0.02	0.00	2.24	0.32	0.56	0.04
Voll compressor	2011	-	-	-	-	-	-	-	-	-	-	-	-	-
Voll compressor	2012	2.5	1.3	0.97	0.97	0.03	6.4	0.06	0.00	0.34	0.10	0.06	0.05	0.00
TOTAL	2011	25.6	94.9	3.35	3.25	0.12	23.3	0.12	0.01	0.01	3.57	0.21	0.24	0.55
	2012	8.3	25.6	1.88	1.86	0.07	83.1	0.14	0.02	0.35	2.35	0.38	0.61	0.04

* TMB - trimethylbenzene

Butler County accounted for more VOC emissions from well pumps than any other county statewide in 2012.¹⁵ Pumps are one of the top sources of emissions from the wells closest to the McIntyres, with VOCs from pumps at the 12 closest wells ranging from half a ton to almost 9 tons in 2012.¹⁶ As seen in Table 4, if taken together, these 12 wells would be among the top five emitters of VOCs and several hazardous air pollutants (HAPs), including benzene, n-Hexane, and toluene in Butler County. In addition, the Sarsen and Bluestone gas processing plants (about 2 and 3 miles away, respectively) were major contributors of benzene, formaldehyde, and toluene in the county.

Table 4. Natural gas facilities near McIntyre as compared to top emitters in Butler County listed in eFACTS (2012)

Rank	VOC	Benzene	Formaldehyde	n-Hexane	Toluene
1	Petrolia Chemical Plant	Petrolia Chemical Plant	Sarsen Gas Processing Plant	Butler Steel Works	Alcoa Window Manufac.
2	12 wells near McIntyre	Winfield Cement	Petrolia Chemical Plant	12 wells near McIntyre	Sarsen Gas Processing Plant
3	Calumet Penreco Chemical Manufac.	Sarsen Gas Processing Plant	Bluestone Gas Processing Plant	Petrolia Chemical Plant	12 wells near McIntyre
4	Const Carbide Machine Manufac.	Bluestone Gas Processing Plant	Voll Compressor	Calumet Penreco Chemical Manufac.	Bluestone Gas Processing Plant
5	Petrolia Chemical Manufac.	12 wells near McIntyre	Zelienople Asphalt Plant	Slippery Rock Univ.	Wiest Asphalt

In 2011, Earthworks conducted air canister testing outside the McIntyre home. That year, 16 wells were being drilled and/or completed within one mile.¹⁷ As seen in Table 5, both our sampling that year and in 2013 detected several VOCs known to be associated with gas development (such as acetone, benzene, and toluene).¹⁸ The sampling results also included HAPs such as carbon tetrachloride; trichlorofluoromethane (CFC 11); 1,1,2-trichloro-1,2,2-trifluoroethane (CFC 113); trichloroethene /trichloroethylene (TCE); dichlorodifluoromethane (Freon 12); tetrachloroethylene/tetrachloroethene (PCE).

Our 2011 air sampling outside homes in the Woodlands detected certain chemicals at equally high or higher concentrations than DEP found at oil and gas facilities in other locations, including the BTEX chemicals (benzene, toluene, ethylbenzene, and m&p-xylenes).¹⁹ In addition, some of the concentrations detected at these homes—all in a rural, residential area—were higher than DEP detected in sampling at the Marcus Hook industrial site.²⁰

In our 2012 health survey and environmental testing study, all of the participants from the Woodlands who reported having sinus and respiratory symptoms also had chemicals detected in air sampling at their homes known to be associated with those symptoms.²¹ The link between BTEX chemicals and other VOCs and respiratory problems is well-established.²² According to DEP, some of the VOCs detected in both the agency’s and Earthworks’ sampling are often present in ambient air because they have been widely use and persist in the environment—but the BTEX chemicals may be attributed to gas development.²³

Concentrations of benzene and toluene detected were considerably higher in our 2013 canister tests than in 2011. This was somewhat surprising because most of the drilling and well stimulation at the wells closest to the McIntyres occurred in 2010 and 2011. However, neither the Voll compressor nor the

Bluestone Gas Processing plant were active in 2011, but both were by 2013. In 2012, the Bluestone plant emitted more toluene and benzene than other major facilities in Butler county, except for the Sarsen processing plant and two others. The Voll compressor also emitted relatively large volumes of benzene (0.059 tons) and toluene (0.064 tons) in 2012.

Table 5. VOCs (including methane) detected by Earthworks in ambient air testing outside the McIntyre home

Concentrations are in micrograms per cubic meter (µg/m ³)	Oct. 12, 2011	July 3, 2013	August 15, 2013
1,1,2-Trichloro-1,2,2-trifluoroethane	0.71	0.59	0.58
2-Butanone		1.1	--
Acetone		16	8.1
Benzene	0.31	--	0.56
Carbon tetrachloride	0.48	0.56	0.64
Chloromethane	1.1	1.2	0.93
Dichlorodifluoromethane	1.9		
Methylene Chloride	3.8	--	--
Toluene	0.75	1.6	2.7
Trichlorofluoromethane	1.5	1.5	1.5
Total number of VOCs detected	8	7	7

blank cell: not analyzed

-- not detected

→ For the full report and other case studies go to <http://blackout.earthworksaction.org>

Endnotes

¹ PA DEP Secretary Christopher Abruzzo and Deputy Secretary Scott Perry, "2013 Oil and Gas Annual Report."

² PA DEP Memo from J. Scott Lux re: Act 223, Section 208 Determination, Connoquenessing Township, Butler County.

³ Natasha Khan, "A Day in the Life of a Water Bank." PublicSource, May 13, 2014; and Water for Woodlands donation site, <https://sites.google.com/site/waterforwoodlands/>

⁴ The two wells are Kwalwasser 1 and Edward Gilliland 0. In addition, according to DEP records there are seven wells within two miles of the McIntyre home that were spud (drilled) but do not appear to have ever produced gas.

⁵ Kusnetz, N. "Deteriorating oil and gas wells threaten drinking water, homes across the country." ProPublica, April 4, 2011.

⁶ PA DEP Oil and Gas Reporting Web Site - Well Details. Search Permit 019-21150 (Edward Gilliland 0 well). www.paoilandgasreporting.state.pa.us/publicreports/Modules/WellDetails/WellDetails.aspx

⁷ FracFocus web site. "Well Construction & Groundwater Protection." <http://fracfocus.org/hydraulic-fracturing-how-it-works/casing>

⁸ Lab reports include Qualifiers; U indicates analysis was performed for the compound but it was not detected and B is used when the analyte is found in the associated blank as well as in the sample. There was no Qualifier included in this lab report for the toluene value.



⁹ December 1, 2011 letter from Rex Energy to Fred McIntyre.

¹⁰ AMEC. *Evaluation of Alleged Groundwater Impacts in Four Domestic Wells. Western Connoquenessing Twp, Butler County, Pennsylvania.* Prepared for Rex Energy Corporation, October 10, 2011.

¹¹ See map and explanation of data at <http://thetimes-tribune.com/news/gas-drilling-complaints-map-1.1490926>.

¹² Alawattegama, S.K., Kondratyuk, T., Krynock, R., Bricker, M., Rutter, J.K., Bain, D.J., and Stolz, J.F. 2014. Well Water Contamination in a Rural Community in Southwestern PA with Unconventional Shale Gas Extraction. *Environmental Science and Health, Part A* (in press). 2014.

¹³ Ibid.

¹⁴ According to DEP data, three Voll Unit wells (4H, 5H and 6H) were plugged and one Carson Unit well (2H) was granted regulatory inactive status in 2012.

¹⁵ In 2012, there were 30 wells in Butler County that each accounted for more than 5 tons of VOC emissions from pumps. There were 13 other wells in Pennsylvania that had this level of VOC emissions from pumps, located in Fayette, McKean, Somerset, Washington, and Westmoreland counties. Of the 43 wells in the state with pumps that emitted more than 5 tons of VOCs, Rex Energy was the operator of all but six of those wells. Source: 2012 Natural Gas Inventory data by Emissions Source Type. Reports received in January 2013 from M. Rudawski, Environmental Group Manager, PA DEP.

¹⁶ Voll 1H and 2H had 0.5 tons, while Voll 3H and 4H had 8.9 tons. The other eight wells within a mile of the McIntyres each released between 5 and 6 tons of VOCs from pumps in 2012.

¹⁷ Data from PA DEP's Permitted Well Inventory and Frac Focus.

¹⁸ PA DEP. 2010. *Southwest Pa. Marcellus Short-Term Air Sampling Report.*

¹⁹ See data and findings on air quality in *Gas Patch Roulette: How Shale Gas Development Risks Public Health in Pennsylvania.* Earthworks 2012. <http://health.earthworksaction.org>.

²⁰ Ibid.

²¹ Ibid.

²² Earthworks, "Air Contaminants." www.earthworksaction.org/issues/detail/air_contaminants.

²³ PA DEP. 2010. *Southwest Pa. Marcellus Short-Term Air Sampling Report.*