Responding to Community Concerns Surrounding Hydraulic Fracturing Activities Near a School

ChemRisk LLC, Pittsburgh, PA

Hitchcock, K.M., J.M. Panko, P.K. Scott, K.M. Unice, E.C. Shay

ABSTRACT

The number of active hydraulic fracturing sites continues to grow in Western Pennsylvania, and along with them, community concerns. Often monitoring data are not always available to answer the questions that community members have. When a new well was drilled approximately 900 yards from the Fort Cherry school campus (McDonald, Pennsylvania), local parents expressed concerns over the students' potential for exposure to chemicals related to hydraulic fracturing. To answer their concerns, we developed an air monitoring program. Meteorological conditions (wind direction, wind speed, temperature, humidity, precipitation, and barometric pressure) were measured using a weather station. Continuous air monitoring to sample for volatile organic compounds (VOCs), hydrogen sulfide (H_2S), and explosive gases [measured in terms of the percent of the lower explosive limit (LEL)] was conducted using a MultiRae Plus gas monitor, a ppbRAE 3000 VOC monitor, and a RAELink3 system. In addition, summa canisters were deployed to sample for individual VOCs. Data were collected at baseline (between November 14 and 29, 2011), during fracking activities (November 30 through December 27, 2011), and during flaring activities (December 28, 2011 through January 6, 2012). The wind was predominantly from the southwest during all sampling periods, placing the school upwind of the well pad. All explosive gas measurements were 0% LEL during each sampling period. Daily average H_2S ranged from non-detect (ND) to 0.14 ppm (baseline), 0.00035 to 0.15 ppm (fracking), ND to 0.15 ppm (flaring). Daily average total VOCs ranged from ND to 0.48 ppm (as measured by the MultiRae) and ND to 0.385 ppm (as measured by the ppbRae) during baseline; from ND to 0.36 ppm (MultiRae) and ND to 0.031 ppm (ppbRae) during fracking; and from 0.055 to 0.52 (MultiRae) and ND to 0.022 ppm (ppbRae) during flaring. In general, we found no remarkable results as compared to background levels, and a basic screening level assessment showed that the measured VOCs were below health based screening levels. All results were communicated to the school board. Our example shows how very basic risk assessment techniques can be used to fill inherent data gaps and address community concerns related to hydraulic fracturing.

INTRODUCTION

Located in Washington County, Pennsylvania, the Ft. Cherry school campus (110 Fort Cherry Road, McDonald, PA 15057) educates students in grades pre-K through 12. A well pad, housing Chiarelli Units 3H and 8H, was constructed approximately 900 yards from the campus (Figure 1). Approximately in the late summer/early fall of 2011, members of the school's Wellness Committee expressed concerns that the activities at the well could expose the children to harmful chemicals. Subsequently, an ambient air monitoring program was established to understand the potential for children's exposures to chemicals in the outdoor air during hydraulic fracturing, flaring and gas production of the units; and to determine if there was a potential health risk associated with the exposures. Air-sampling and real-time air monitoring for VOCs and explosive gases were conducted during baseline (November 14-29, 2011), hydraulic fracturing (November 30-December 27, 2011) and flaring (December 28, 2011-January 6, 2012) phases of well development.

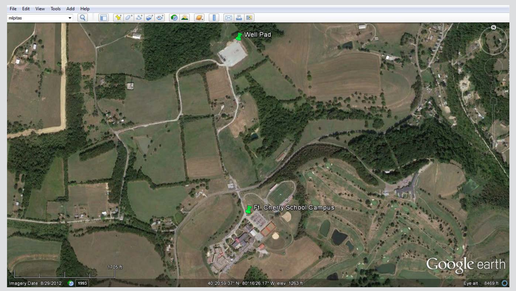

Figure 1. Map showing the locations of the well pad and the school.

METHODS

- Continuous air monitoring was conducted at the school using equipment manufactured by RAE Systems. The monitors were housed in locked plastic housing to ensure that they remained dry and secure (Figure 2).
  - MultiRae Plus gas monitor (MultiRAE) sampled for total VOCs, H_2S, and LEL.
  - ppbRAE 3000 also sampled for total VOCs, but with a lower resolution than the MultiRAE.
  - RAELink3 system (RAELink), a portable networking modem that provides wireless communication between the MultiRAE and ppbRAE and a host computer, was used to datalog the continuous monitoring results.
  - The equipment was calibrated periodically during sampling.
- Summa canisters with 24-hour flow regulators were deployed periodically and analyzed by Air Toxics, LTD in Folsum, CA, in accordance with modified EPA Method TO-15.
- Weather data (wind direction, wind speed, temperature, humidity, precipitation and barometric pressure) were measured using a Davis Vantage Pro2 wireless weather station (Figure 3). The results were datalogged in the host computer.
- Data were collected during three phases: baseline (November 14-29, 2011), hydraulic fracturing (November 30-December 27, 2011) and flaring (December 28, 2011-January 6, 2012).
- Upon completion of data collection, all results were analyzed and reported to the school district.

Figure 2. General setup of the Multi-RAE and ppbRAE.

Figure 3. Davis Vantage Pro2 wireless weather stations, as set up on the roof of the school.

RESULTS & DISCUSSION

Wind Direction

Winds predominated from the southwest, placing the school generally upwind of the well pad (Figure 4).

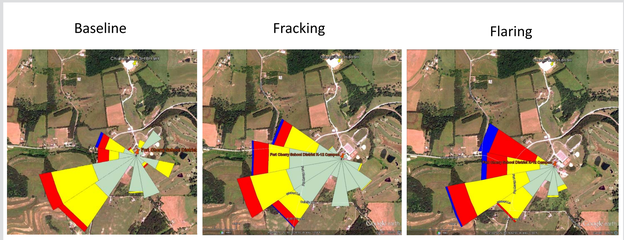

Figure 4. Wind rose.

Explosive Gases

Explosive gases were measured by the MultiRAE Plus in terms of the percent of the lower explosive limit (LEL). The analytical range was 0-100% LEL, with a resolution of 1% LEL. All LEL measurements recorded during the baseline, fracking and flaring sampling periods were 0% of the LEL.

H_2S

H_2S levels were measured by the MultiRAE in units of ppm. The analytical range was 0-100 ppm, with a resolution of 1.0 ppm. Measurements were often less than the multiRAE resolution (1 ppm); therefore values below 0.5 ppm may be overestimates and could be zero. Daily average H_2S ranged from non-detect (ND) to 0.14 ppm (baseline), 0.00035 to 0.15 ppm (fracking), ND to 0.15 ppm (flaring) (Figure 5).

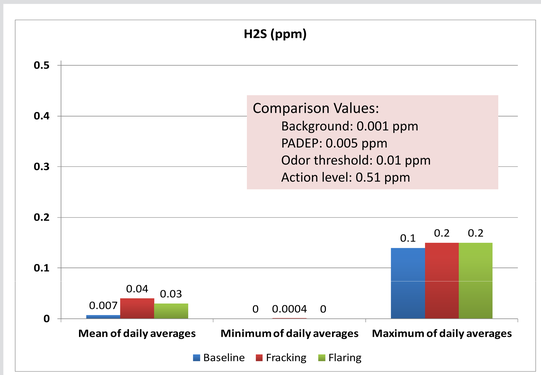

Figure 5. H_2S values, as measured by the MultiRae

Total VOCs

Total VOC levels were measured by the MultiRAE Plus in units of ppm and by the ppbRAE in units of ppb. The analytical range for the MultiRAE was 0-2000 ppm with a resolution of 0.1 ppm. The analytical range for the ppbRAE was 0-9999 ppb with a resolution of 1 ppb and 10-9999 ppm with a resolution of 0.01, 0.1 and 1 ppm at various concentration ranges. It was decided that the ppbRAE provided the more accurate measurements of total VOC levels due to its increased sensitivity. VOC monitoring data are presented in Table 1 and Figure 6.

Table 1. Total VOCs daily average measurements.

		MultiRae (ppm) Sampling Period			ppbRAE (ppm) Sampling Period		
		Baseline	Fracking	Flaring	Baseline	Fracking	Flaring
Daily average measurements [ppm]	Min	ND	ND	0.055	ND	ND	ND
	Max.	0.48	0.36	0.52	0.385	0.031	0.022

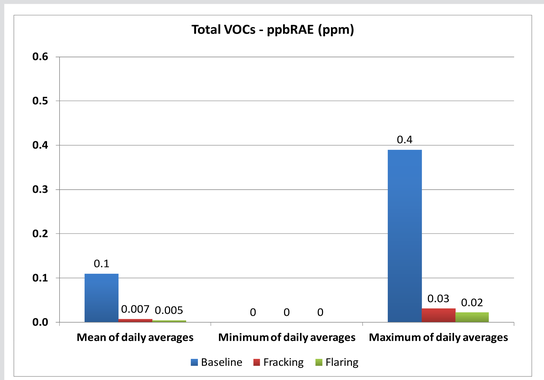

Figure 6. Total VOCs, as measured by the ppbRAE.

Individual VOCs

A total of 62 VOCs were included in this analysis with reporting limits for individual VOCs ranging from 0.00013 to 0.0008 ppm. Only 14 of the 62 compounds were detected (Table 2). The compounds that were detected are ubiquitous in the environment and are greater in urban settings. We found similar concentrations among the sampling periods, and all levels of detected VOCs, except benzene, were below the risk based screening levels. It should be noted that most urban and many rural benzene concentrations also exceed the screening level.

Table 2. 14 VOCs detected by summa canisters at the school.

	Ft. Cherry School Campus Data (ppm)					
	Baseline		Fracking		Flaring	USEPA ambient air risk screening levels (ppm)
Compound	11/17/2011	11/18/2011	11/30/2011	12/9/2011	12/28/2011	
1,4-Dioxane	--	--	0.00017	--	--	0.0001
2-Butanone	--	--	--	0.00090	--	1.7162
Acetone	0.0074	0.0028	0.0020	0.0010	0.0008	13.4454
Benzene	0.00016	--	0.00019	--	0.0002	0.0001
Chloromethane	0.00036	0.00035	0.00050	0.00034	0.00045	0.0454
Cyclohexane	--	--	--	0.00022	--	1.8314
Ethanol	0.0076	0.00066	0.0016	0.00079	--	not available
Freon 11	0.00032	0.00022	0.00022	0.00018	0.00021	0.1281
Freon 12	0.0004	0.00044	0.00046	0.00038	0.00047	0.0202
Heptane	--	--	--	--	--	not available
Hexane	0.00013	--	0.00028	--	0.00025	0.2088
Toluene	0.00023	--	--	0.0018	--	1.3793
2-Propanol	0.0054	--	--	--	--	2.9675
m,p-Xylene	0.00014	--	--	--	--	0.0230

CONCLUSIONS

- Our exercise was one example of how community members can work with local school boards and businesses to address environmental or public health concerns.
- Our analysis uncovered no remarkable results for any of the chemicals sampled.
- Our basic, but conservative, screening level evaluation determined that all VOCs detected were below health-protective levels.
- There continues to be a gap in the literature concerning long term monitoring term monitoring in residential/community areas near producing wells.
- Currently, there is a need for a common repository where such data can be shared.

REFERENCES - Available upon request.

ACKNOWLEDGEMENTS - The authors acknowledge the Ft. Cherry school board, teachers and staff for their assistance with this project. We also thank TRS-Environmental, our air monitoring equipment vendor, and Air Toxics, LTD, our analytical laboratory, for their cooperation.