



Hydraulic Fracturing Well Preliminary Air Monitoring Assessment



Muskingum County

Division of Air Pollution Control
February 2014

Baseline Air Monitoring Hydraulic Fracturing

Ohio EPA DAPC is conducting a preliminary air monitoring assessment of an operating hydraulic fracturing well in Muskingum County. For this monitoring we have two locations, a fixed monitoring station and a remote sampling site.

Sampling Parameters/Methods

Intermittent Sampling

Volatile Organic Compounds

Initially the sampling method will be via timed evacuated canister samplers. Compounds to be determined from the canister samples will include the list of TO-14a analysis. The analysis includes the compounds benzene, toluene, ethyl benzene and xylene or BTEX compounds. Those compounds are associated with certain gas and oil formations. VOC canister collection will initially be at a 1-in-6 day collection period. The sample period will be targeted to collect a 24-hour midnight to midnight sample. More frequent 1-in-3 day sampling could be performed during actual drilling and fracturing activities.

Analysis of canister samples will be by the Ohio EPA Division of Environmental Services Laboratory. Those samples will be analyzed against 69 target compounds.

Methane

Methane concentrations can be analyzed from the gas canister samples, but those samples are not done as frequently since they are sent to an EPA contract laboratory.

Fine Particulates

DAPC will sample for fine particulates as PM_{2.5} using a portable battery- powered PM_{2.5} sampler. Filter sample preparation and analysis of the filters for fine particle concentrations will be by the Groveport gravimetric laboratory.

The canister sampling and the Fine Particulate monitoring are being conducted at the remote satellite site.



Particulate and VOC sampling with a portable meteorological station.

Continuous Monitors

Hydrogen Sulfide

A hydrogen sulfide monitor will be installed in the sampling shelter/trailer to continuously monitor for H₂S. DAPC has portable H₂S survey instruments to manually survey for H₂S around the well site at other locations than at the sampling shelter.

Carbon Monoxide

A carbon monoxide monitor will be installed in the sampling shelter to provide continuous CO measurements.

Continuous Gas Chromatograph (GC) Monitor

Due to the limitations of conducting intermittent sampling once every few days with the 24 hour canister sampling, DAPC decided to incorporate a near real time gas chromatograph (GC) system for collecting VOC sampling at the sampling trailer where the other continuously operating instruments are located. The GC will also operate continuously, taking and analyzing a five minute sample every hour.

After the GC monitoring was added the canister sampling frequency was reduced to 1-in-12 day sampling.

Meteorological

A meteorological station will collect wind speed/wind direction, temperature and barometric pressure data. The meteorological data will be collected continuously with periodic data downloads.

Data Collection

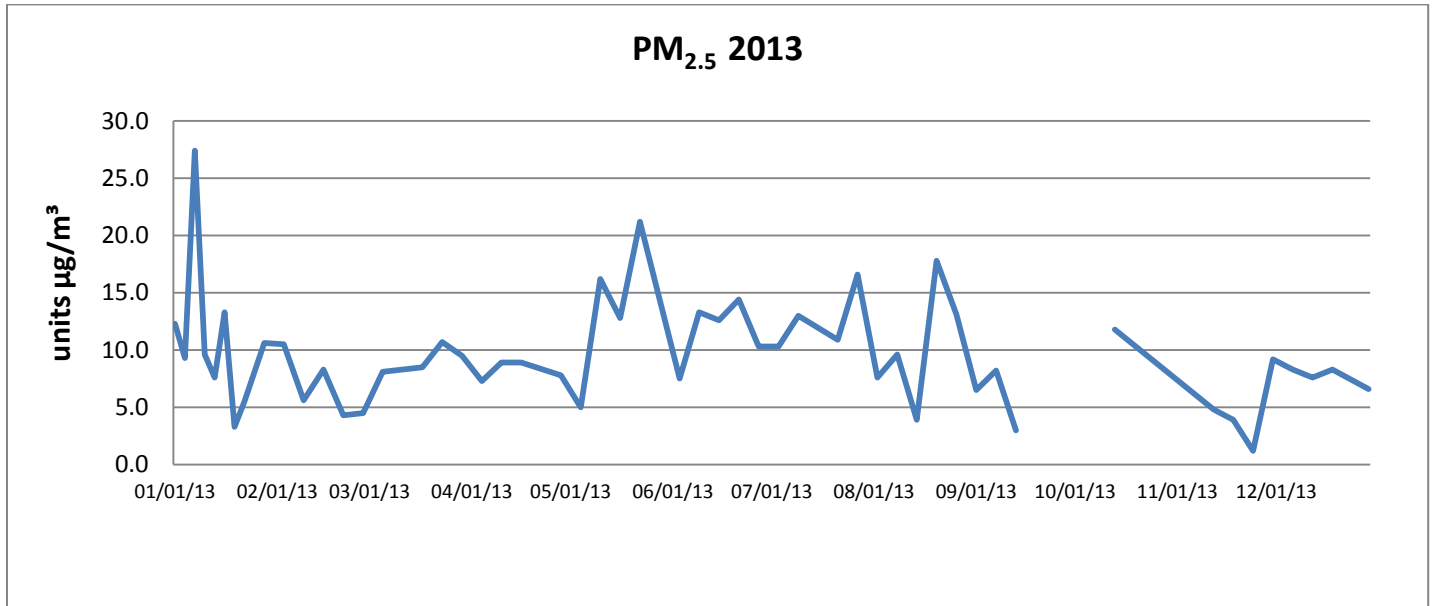
All of the data generated by continuous monitors include the GC is sent via cellular modem telemetry to the Remote Ambient Data System (RADS) maintained by DAPC. All of the continuous monitoring instruments are located in a fixed monitoring location. DAPC has an environmentally controlled monitoring trailer located within half a mile of the well site.



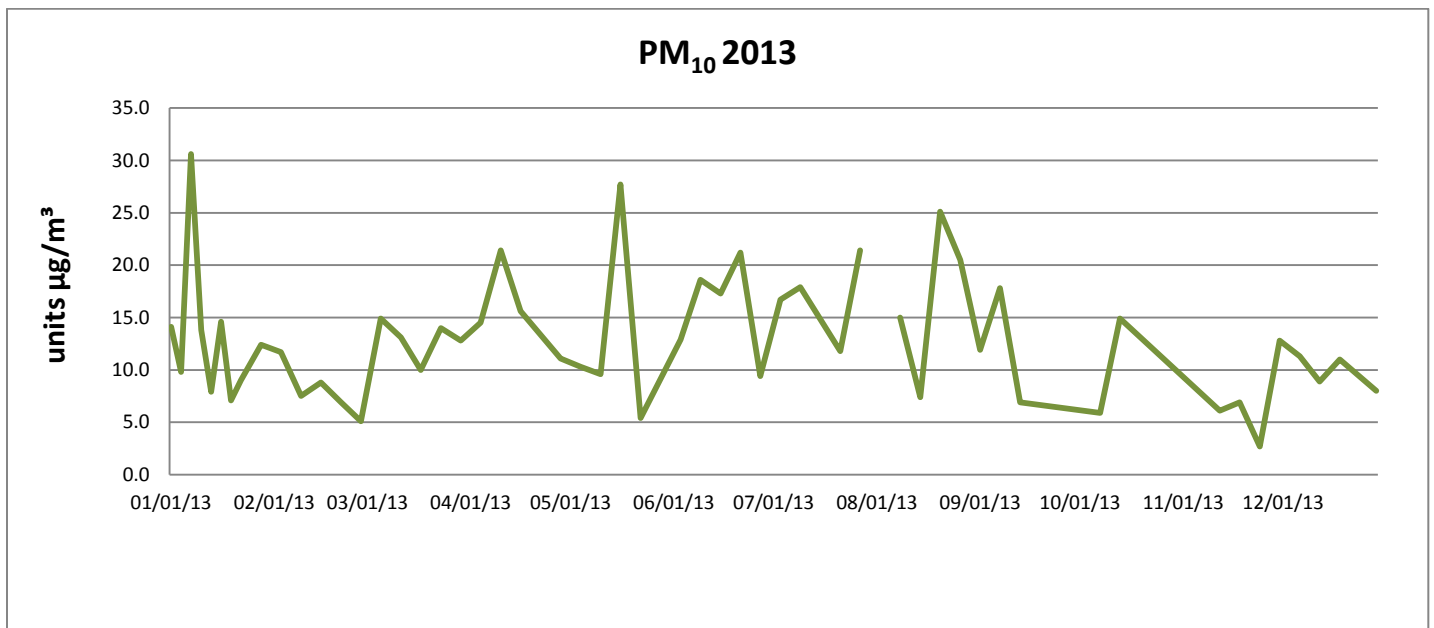
Air Monitoring Instruments.

Summary of the Intermittent Data

Summary of the PM_{2.5} data

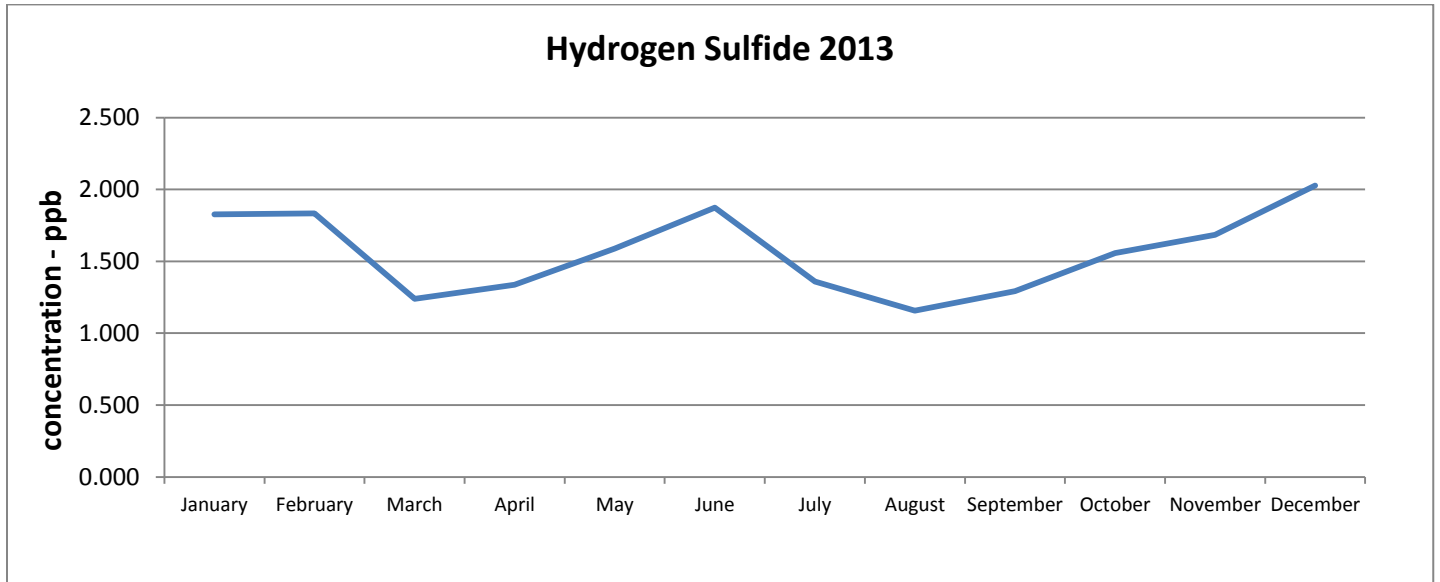


Summary of the PM₁₀ data

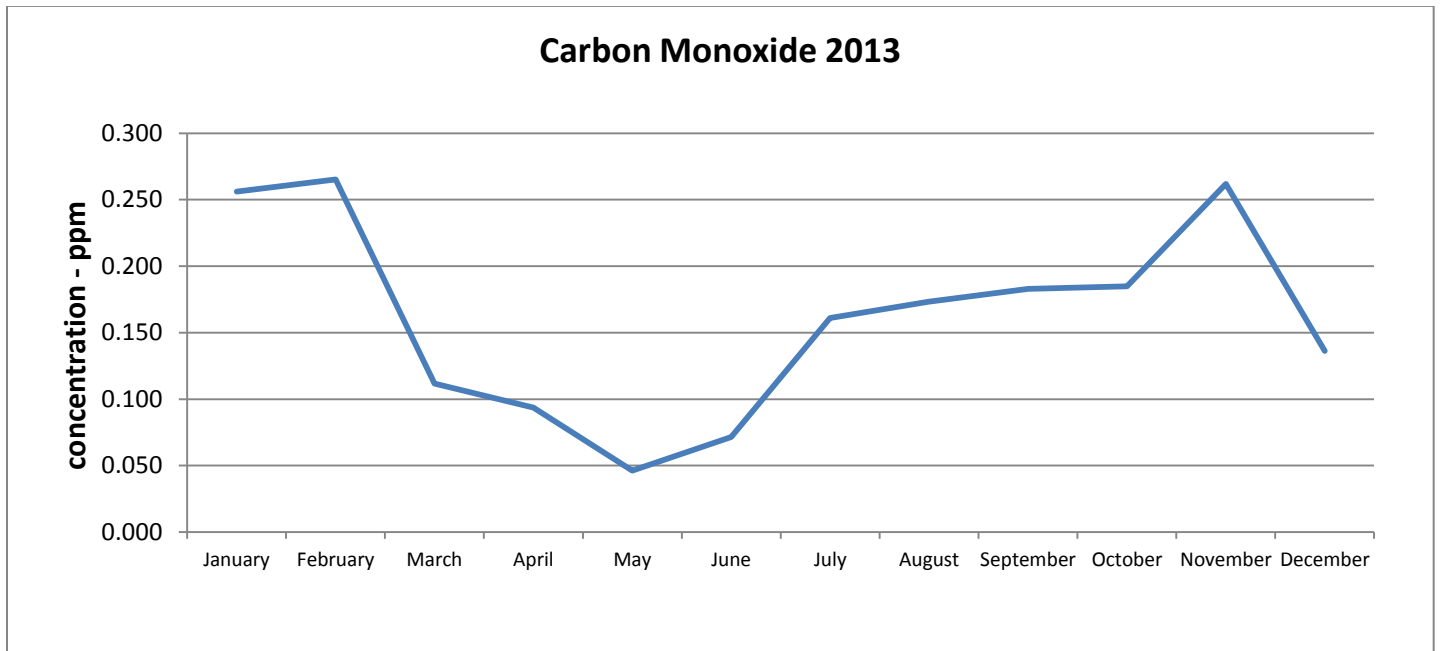


Summary of the Continuous Monitor Data

Summary of the Hydrogen Sulfide data



Summary of the Carbon Monoxide data



Summary of Canister Sampling VOC data, only detected compounds reported.

*Volatile Organic Compounds Detected in 2013
Wilds Location VOC canister sampling Muskingum County*

Summary of Canister Data	Concentration ppbv			Frequency
Compound list	Minimum	Average	Maximum	Detected
Acetonitrile	0.20	0.30	0.44	9
Benzene	0.20	0.32	0.54	14
n-Butane	0.54	2.49	8.30	27
2-Butanone	0.60	1.65	7.00	21
Chlorodifluoromethane	0.23	0.37	0.79	27
Chloroform	0.24	0.24	0.24	1
Chloromethane	0.40	0.62	1.20	27
Cyclohexane	0.25	0.25	0.25	1
Decane	0.43	0.43	0.43	1
Dichlorodifluoromethane	0.40	0.63	0.91	27
n-Heptane	0.29	0.94	1.80	8
Hexane	0.20	0.92	2.40	13
Methylene chloride	0.33	0.33	0.33	1
Naphthalene	0.60	0.60	0.60	1
n-Nonane	0.24	0.27	0.30	2
n-Octane	0.23	0.48	0.67	5
n-Pentane	0.26	1.06	3.20	27
Propylene	1.60	2.80	4.10	3
Toluene	0.20	0.54	2.30	10
Trichlorofluoromethane	0.21	0.31	0.45	27
Vinyl acetate	0.33	1.02	2.20	17
Total m&p-xylenes	0.51	0.52	0.52	2

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Summary data collected from the portable GC is not quality assured, due to the low levels being detected, and is made available only to illustrate the baseline levels for the 10 target compounds.

May 2013

Monthly Summary					Observed			
Component	Average	Maximum	Units	Count	Average	Maximum	Units	
1 Ethane	0.097	0.151	ppm	723	96.66	151.30	ppb	
2 Propane	0.007	0.012	ppm	33	6.90	12.10	ppb	
3 Butane	0.005	0.026	ppm	333	4.88	26.20	ppb	
4 Pentane	0.004	0.020	ppm	404	4.20	20.40	ppb	
5 Hexane	0.004	0.005	ppm	5	3.60	4.90	ppb	
6 Benzene	0.127	0.274	ppb	720				
7 Toluene	0.063	0.507	ppb	434				
8 Ethyl Benzene	0.119	0.193	ppb	21				
9 m_p-Xylene	0.056	0.270	ppb	711				
10 o-Xylene	0.039	0.291	ppb	391				

June 2013

Monthly Summary					Observed			
Component	Average	Maximum	Units	Count	Average	Maximum	Units	
1 Ethane	0.111	0.149	ppm	674	96.66	151.30	ppb	
2 Propane	0.008	0.018	ppm	43	6.90	12.10	ppb	
3 Butane	0.006	0.084	ppm	468	4.88	26.20	ppb	
4 Pentane	0.004	0.089	ppm	276	4.20	20.40	ppb	
5 Hexane	0.003	0.004	ppm	7	3.60	4.90	ppb	
6 Benzene	0.103	0.185	ppb	667				
7 Toluene	0.063	0.140	ppb	234				
8 Ethyl Benzene	#DIV/0!	0.000	ppb	0				
9 m_p-Xylene	0.039	0.066	ppb	655				
10 o-Xylene	0.055	0.110	ppb	163				

July 2013

Monthly Summary					Observed			
Component	Average	Maximum	Units	Count	Average	Maximum	Units	
1 Ethane	0.110	0.139	ppm	710	109.67	138.50	ppb	
2 Propane	0.008	0.022	ppm	62	8.04	21.90	ppb	
3 Butane	0.006	0.149	ppm	503	5.83	148.90	ppb	
4 Pentane	0.005	0.106	ppm	51	4.75	105.80	ppb	
5 Hexane	0.024	0.024	ppm	1	23.90	23.90	ppb	
6 Benzene	0.099	3.620	ppb	707				
7 Toluene	0.044	0.080	ppb	17				
8 Ethyl Benzene	#DIV/0!	0.000	ppb	0				
9 m_p-Xylene	0.029	0.053	ppb	468				
10 o-Xylene	0.054	0.080	ppb	152				

August 2013

Monthly Summary					Observed			
Component	Average	Maximum	Units	Count	Average	Maximum	Units	
1 Ethane	0.113	0.142	ppm	744	113.33	142.40	ppb	
2 Propane	0.010	0.070	ppm	178	9.97	69.70	ppb	
3 Butane	0.005	0.083	ppm	457	5.34	83.20	ppb	
4 Pentane	0.003	0.012	ppm	106	2.93	11.90	ppb	
5 Hexane	0.006	0.013	ppm	3	6.13	12.80	ppb	
6 Benzene	0.081	0.204	ppb	735				
7 Toluene	0.085	0.663	ppb	24				
8 Ethyl Benzene	#DIV/0!	0.000	ppb	0				
9 m_p-Xylene	0.024	0.091	ppb	179				
10 o-Xylene	0.045	0.071	ppb	119				

September 2013

Monthly Summary					Observed			
Component	Average	Maximum	Units	Count	Average	Maximum	Units	
1 Ethane	0.112	0.231	ppm	677	111.56	231.00	ppb	
2 Propane	0.010	0.103	ppm	181	10.48	102.50	ppb	
3 Butane	0.004	0.092	ppm	455	4.34	91.80	ppb	
4 Pentane	0.006	0.256	ppm	158	6.37	255.80	ppb	
5 Hexane	0.016	0.053	ppm	4	16.10	52.70	ppb	
6 Benzene	0.065	0.184	ppb	625				
7 Toluene	0.089	0.141	ppb	4				
8 Ethylbenzene	0.084	0.148	ppb	2				
9 m_p-Xylenes	0.084	0.148	ppb	2				
10 o-Xylene	0.084	0.148	ppb	2				

October 2013

Monthly Summary					Observed			
Component	Average	Maximum	Units	Count	Average	Maximum	Units	
1 Ethane	0.118	0.372	ppm	687	118.47	372.40	ppb	
2 Propane	0.017	0.200	ppm	313	17.42	199.80	ppb	
3 Butane	0.005	0.090	ppm	320	5.37	89.90	ppb	
4 Pentane	0.004	0.010	ppm	100	3.81	10.40	ppb	
5 Hexane	0.004	0.006	ppm	27	3.61	5.90	ppb	
6 Benzene	0.246	3.920	ppb	524				
7 Toluene	0.328	2.473	ppb	218				
8 Ethylbenzene	0.165	1.082	ppb	219				
9 m_p-Xylenes	0.165	1.082	ppb	219				
10 o-Xylene	0.165	1.082	ppb	219				

November 2013

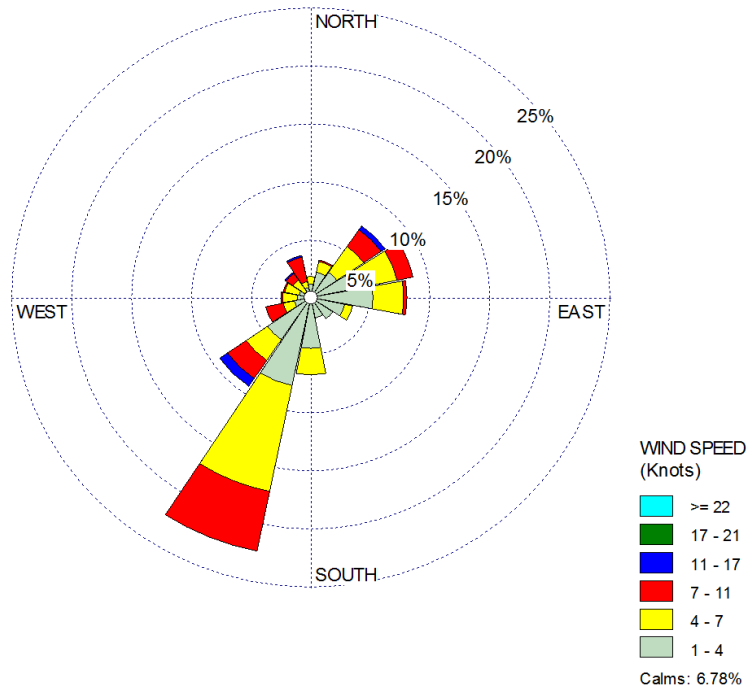
Monthly Summary					Observed			
Component	Average	Maximum	Units	Count	Average	Maximum	Units	
1 Ethane	0.115	0.148	ppm	720	115.38	148.40	ppb	
2 Propane	0.008	0.031	ppm	167	8.10	30.90	ppb	
3 Butane	0.003	0.007	ppm	347	2.63	6.70	ppb	
4 Pentane	0.002	0.002	ppm	8	1.89	2.10	ppb	
5 Hexane	ND	ND	ppm	0	ND	ND	ppb	
6 Benzene	0.526	0.852	ppb	720				
7 Toluene	0.335	0.554	ppb	720				
8 Ethylbenzene	0.254	0.520	ppb	718				
9 m_p-Xylenes	0.195	0.342	ppb	697				
10 o-Xylene	0.175	0.304	ppb	719				

December 2013

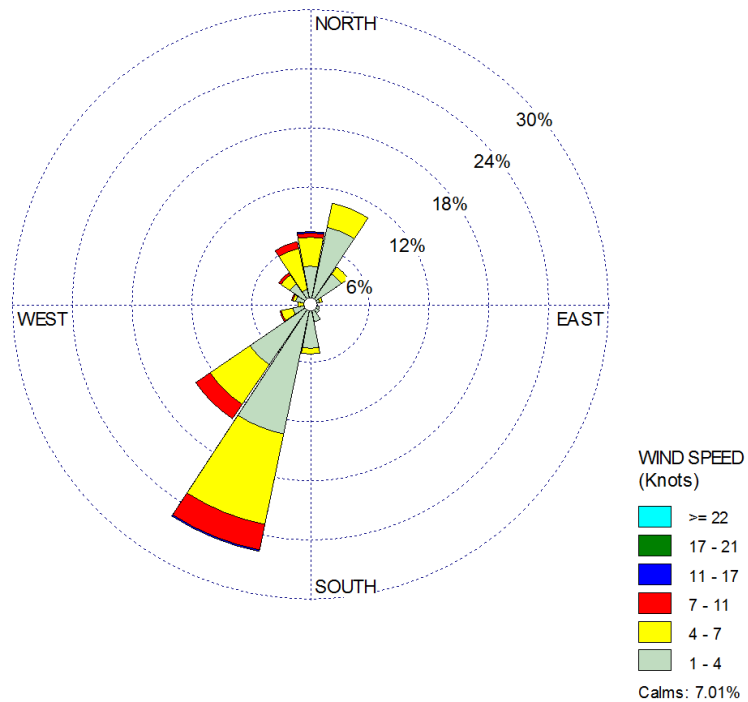
Monthly Summary					Observed			
Component	Average	Maximum	Units	Count	Average	Maximum	Units	
1 Ethane	0.123	2.298	ppm	679	123.41	2298.20	ppb	
2 Propane	0.009	0.036	ppm	218	8.86	35.90	ppb	
3 Butane	0.003	0.012	ppm	151	2.72	11.50	ppb	
4 Pentane	0.003	0.004	ppm	15	2.53	4.00	ppb	
5 Hexane	ND	ND	ppm	0	ND	ND	ppb	
6 Benzene	0.613	2.233	ppb	674				
7 Toluene	0.375	0.825	ppb	651				
8 Ethylbenzene	0.257	0.559	ppb	496				
9 m_p-Xylenes	0.211	0.288	ppb	672				
10 o-Xylene	0.226	0.380	ppb	569				

Wind rose data as indicated shows the direction the wind is blowing from in meters per second.

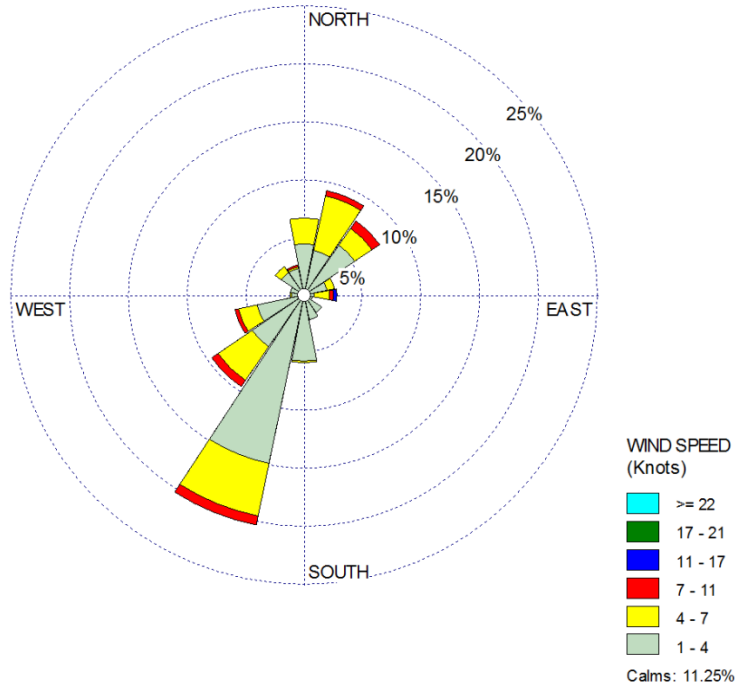
Wind Rose Generated for May 2013



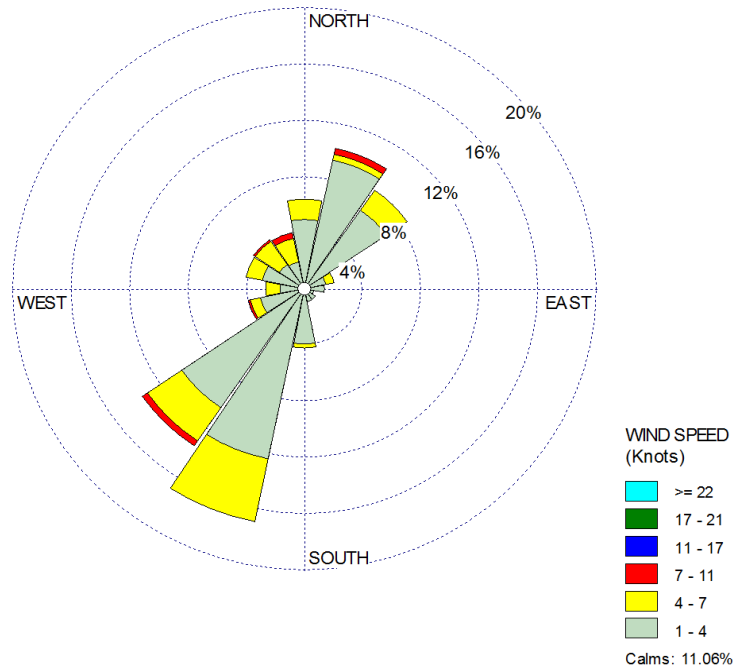
Wind Rose Generated for June 2013



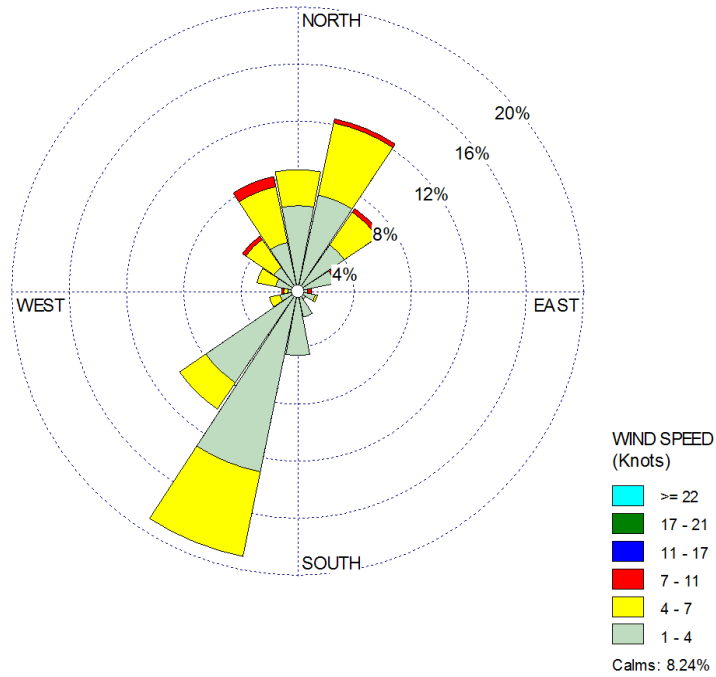
Wind Rose Generated for July 2013



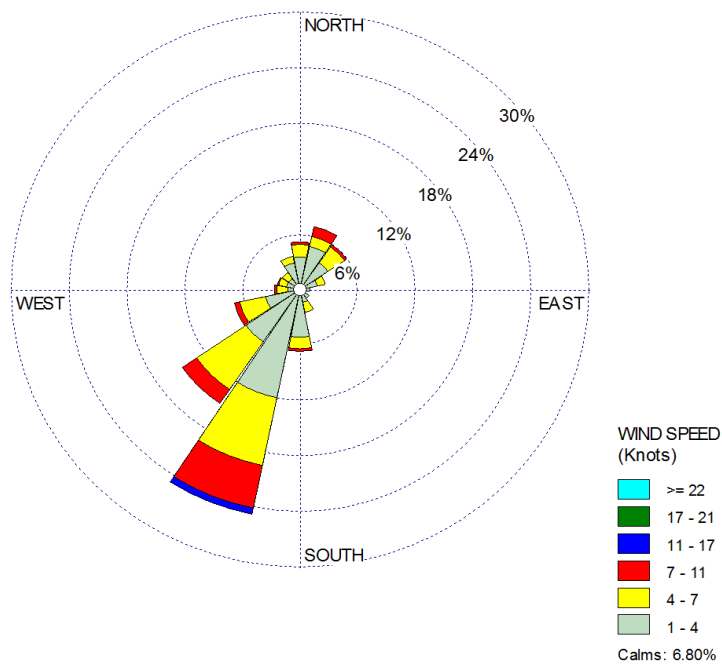
Wind Rose Generated for August 2013



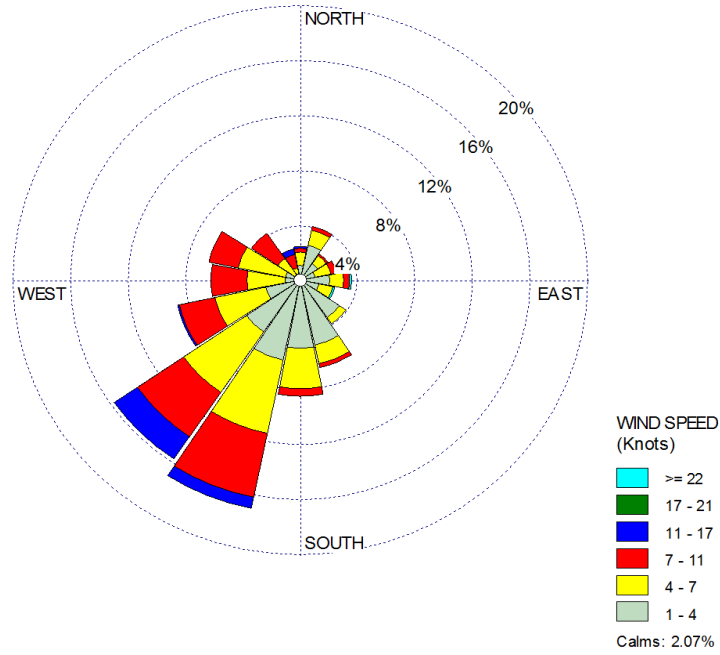
Wind Rose Generated for September 2013



Wind Rose Generated for October 2013



Wind Rose Generated for November 2013



Wind Rose Generated for December 2013

