

# PM2.5 and Air Toxics Fenceline Monitoring at Unconventional Natural Gas Development Sites in the Appalachian Basin

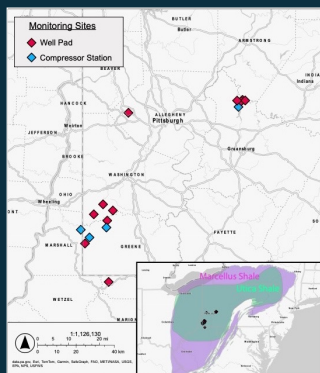


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## Background

- The Appalachian Basin contains the Marcellus and Utica shale plays
- Monitoring partnership with **CNX Resources Radical Transparency<sup>1</sup>** program
- Monitoring motivated by **recent health studies<sup>2</sup>** and public interest in region
- EPA monitoring methods<sup>3,4</sup>** used at fenceline of natural gas facilities to understand the level of contribution to the local air quality
- < 1 year of continuous monitoring at 15 unconventional natural gas development sites in Southwestern PA
- Monitoring is on-going as of August 2024



## Fenceline Setup

### BTEX



**Modified EPA Method 325 A/B<sup>5</sup> Sorbent Traps**  
4 sampling locations  
14-day average data

### PM2.5



**Met One BAM-1022 Beta Attenuation Monitor**  
Federal Equivalent Method  
2 sampling locations  
1-hour average data

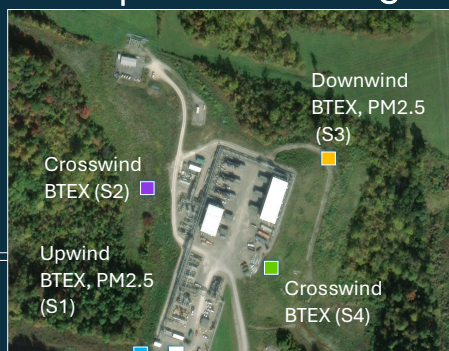
### Meteorology



**Met One 30.5 or AIO2**  
1 sampling location  
Mounted on 30-ft. tower  
5-minute average data

- Upwind/downwind siting of monitoring at each site based on 3-5 years of prevailing wind direction from nearby met station
- Siting at facility fenceline or as close to **500/750 ft setback distance established in PA Act 13<sup>6</sup>**
- Monitoring locations and probe heights meet EPA guidelines<sup>3</sup>** for an ambient air quality monitoring program
- QA/QC procedures follow **measurement quality objectives established in a Quality Assurance Project Plan per EPA guidelines<sup>7</sup>**

## Experimental Design

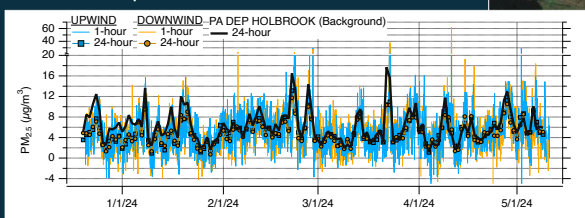


## Data Presented

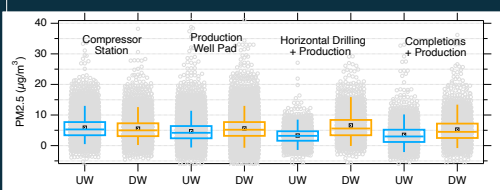
	Site	Sampling Dates	Details
Production	NV110	Oct. 23 – Apr. 24	7 x Marcellus Wells
	RHL37	Jan. 24 – Jul. 24	7 x Marcellus Wells
	MOR09	Apr. 24 – Jul. 24	9 x Marcellus Wells 2 x Burkett Wells
Compressor Station	Morris	Dec. 23- Jul. 24	8x NG Compressors 2x Dehydrators
Horizontal Drilling	MOR09	Nov. 24 – Jan. 24	4 x Marcellus Wells
Completion	MOR09	Jan. 24 – Apr. 24	4x Marcellus Wells

## PM2.5 Results

### Compressor Station Time Series

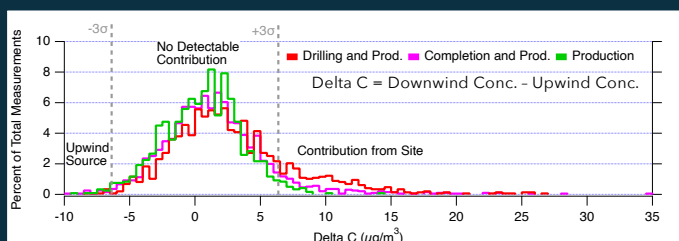


### 1-Hour Concentration Summary



- No 24-hour NAAQS exceedance** ( $35 \mu\text{g}/\text{m}^3$ )
- Daily concentrations similar to nearby background PA DEP air quality station
- During drilling and completions, the downwind station (S3) shows minor PM2.5 enhancements compared to the upwind (S1)

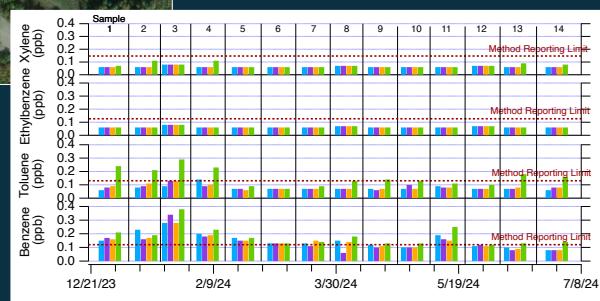
### Contribution Estimate – MOR09 Site



- Average wind direction for each well pad development phase is used to identify hourly upwind and downwind locations.
- Likely contribution during short-lived completion and drilling phase.

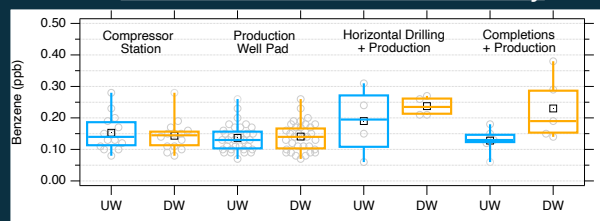
## BTEX Results

### Compressor Station Time Series



- BTEX concentrations at or below method reporting limits and close to regional background at compressor station
- Highest concentrations observed near site entry (S4) suggesting contribution from vehicle traffic
- Toluene-to-Benzene Ratios > 1** confirm vehicle emissions<sup>8</sup> observed at S4

### Benzene Concentration Summary



- All benzene observations were near regional background levels and **well below the inhalation minimum risk levels (Acute MRL: 9 ppb)<sup>9</sup>**
- Downwind stations do not show enhancement in benzene concentrations at compressor station or well pads in the production phase
- During short-lived well pad drilling and completions: <0.1 ppb average enhancement above background

## References

- www.cnxradicaltransparency.com/radical-transparency
- www.health.pa.gov/topics/environmental/Pages/OilGas.aspx
- US EPA, Quality Assurance Handbook for Air Pollution Measurement Systems, Volume 2, 2017
- US EPA, Quality Assurance Handbook for Air Pollution Measurement Systems, Volume 4, 2008
- www.epa.gov/emc/method-325a-volatile-organic-compounds-fugitive-and-area-sources-sampler-deployment-and-voc
- www.legis.state.pa.us/cfdocs/legis/li/uconsCheck.cfm?yr=2012&sessInd=0&act=13
- US EPA, 40 CFR Part 58 Appendix A - Ambient Air Monitoring Quality Assurance Requirements, 2006
- Zhang et al. 2016, JGR Atmospheres
- ATSDR, Toxicological Profile for Benzene, 2007