Air Quality Monitoring in the Vicinity of the December 2016 MCRRF Fire

Montgomery County, Maryland Solid Waste Resource Recovery Facility
Dickerson, Maryland

Final Report
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EXECUTIVE SUMMARY

Air monitoring data were collected in the vicinity of the MCRRF facility over a two week period in December 2016 during and immediately following a fire event. Samples were collected at four locations in the vicinity of the MCRRF and the fire. Target compounds included in the monitoring program were as follows: metals, volatile organics, polynuclear aromatic hydrocarbons (PAHs), polychlorinated dioxins and polychlorinated dibenzo furans (PCDDs/PCDFs), Total Suspended Particulate (TSP), PM_{10} and $PM_{2.5}$. Some of these target compounds have been monitored previously by the county as part of ambient air monitoring programs performed in the vicinity of the MCRRF. In addition to these target compounds wind speed and wind direction data monitored at the MCRRF by the county were used to establish the location of each station in relation to the MCRRF and fire (upwind or downwind on a % basis during each 24-hour sampling event).

Results for the volatile organics analyzed in the set of six samples collected indicated that only thirteen of sixty-two target compounds were detected. Concentrations measured were comparable across the sampling sites and represent background concentrations in ambient air. These data do not indicate influences attributable to the fire. In a similar manner PAHs concentrations in the five sample set were comparable for those compounds detected. These data, as well, represent background concentrations in ambient air and do not indicate influences attributable to the fire. This included results for the Day 1 sample collected at the Gothic Barn site which was found to be downwind of the fire (77.6% during a 24-hour sampling event).

PCDDs/PCDFs concentrations (expressed as a total of $Cl_4 - Cl_8$ homologues and not as a TEQ sum) in the Gothic Barn Day 1 sample were found to be above expected background concentrations in ambient air and most likely attributable to the fire (77.6% downwind of the fire during 24-hour sampling event). Particulate data collected at the Gothic Barn site indicated influences attributable to the fire. This includes results for TSP, PM_{10} and $PM_{2.5}$. TSP concentrations for all other sampling events were found to be consistent with background for the region. PM_{10} and $PM_{2.5}$ data also indicated contributions from other sources in the region and not attributable to the fire.

Measured concentrations for metals were comparable to levels measured in prior MCRRF air monitoring programs and represent atmospheric background for the region. The highest concentrations for three metals were measured in the Gothic Barn Day 1 sample and may reflect contributions from the fire. The highest lead concentrations of 7.69 ng/m^3 was found in this sample and yet well below the National Ambient Air Quality Standard for lead of 150 ng/m^3. (Expressed as a 24-hour time weighted average). Lastly, no exceedance of any Acute Inhalation Exposure Criteria was observed in any of the data, regardless of wind direction relative to the fire.

1.0 BACKGROUND PURPOSE AND OBJECTIVES

The air monitoring program reported upon here was designed to measure air quality in the area of the Montgomery County, Maryland Resource Recovery Facility (MCRRF) during a ten-day fire event at the MCRRF that was first reported at 6:20PM on the evening of December 8, 2017. The monitoring program was derived in response to a request to TRC from the Montgomery County Department of Environment (DEP) on Saturday, December 10, 2017 and a conference call held with DEP staff on Monday morning December 12, 2017. Working together with TRC, the County was able to install monitoring in the field commencing with particulate monitors on December 13 and additional monitors requiring preparation of specialized media for a wide range of parameters were installed December 15. Air quality monitoring results enabled comparison of samples collected downwind of the fire site with those collected during times when monitors were located upwind as well as comparisons with historical data collected in the vicinity of the MCRRF. Data were also evaluated in terms of comparison to National Ambient Air Quality Standards and to available health effects guideline values.

2.0 MONITORING NETWORK DESIGN AND SELECTION OF SAMPLING LOCATIONS:

Samples were collected at four locations in the vicinity of the MCRRF. The sampling locations, were as follows:

- Gothic Barn located at 20900 Martinsburg Road.
- Chiswell Farm located at 1230 Wasche Road.
- Poolesville Town Hall.
- Beallsville Fire Department located at 1901 Beallsville Road.
  (The Beallsville location has been used in all prior ambient air monitoring programs performed by the County).

Each of the four locations are shown relative to the MCRRF in Figure 1. Distances in miles and the compass direction relative to MCRRF are also provided.

Please refer to Section 5.5 (Results) for more detailed schematics showing the location of each monitoring station relative to the location of the fire event together with wind roses.

3.0 TARGET PARAMETERS AND MONITORING METHODOLOGY

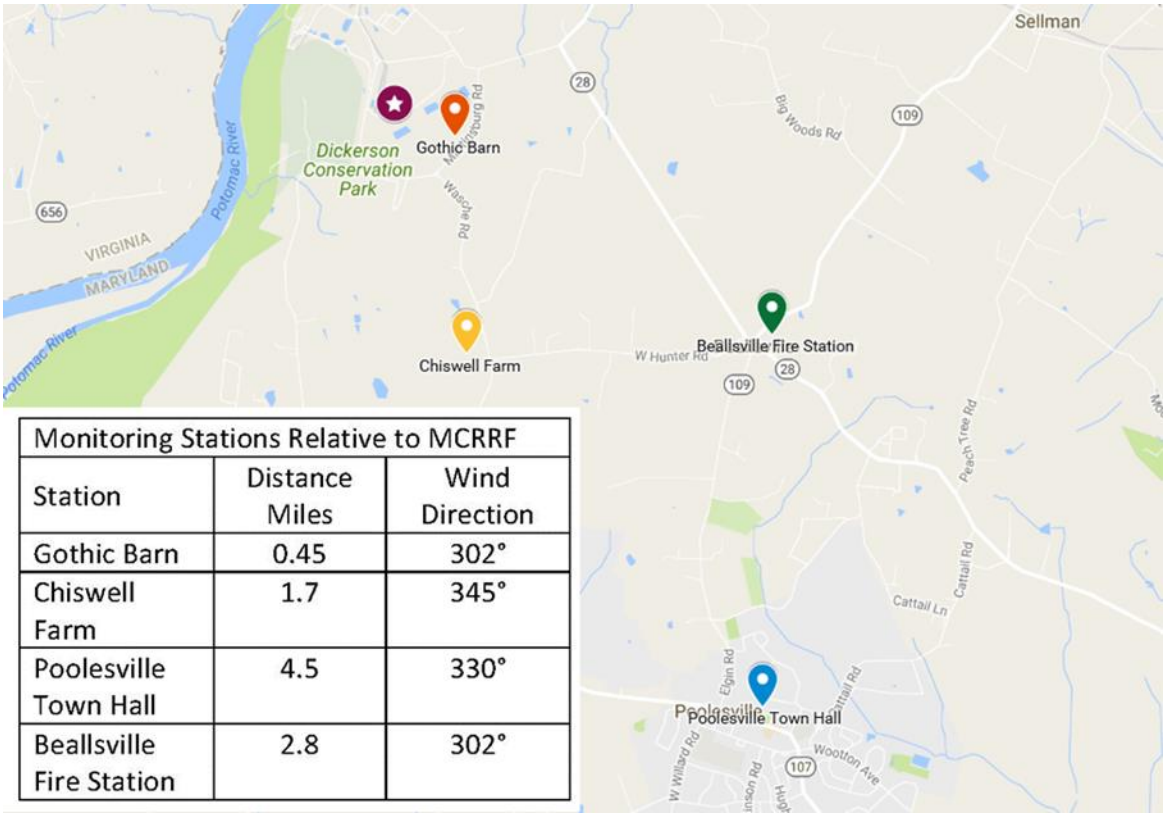
The compounds selected for monitoring, referred to as target compounds, includes those that can be associated with emissions from a municipal solid waste (MSW) fire. These include compounds both present in MSW and combustion by products potentially formed during the fire event. Some of the target compounds have been monitored previously by the County as part of ambient air monitoring programs performed in the vicinity of the MCRRF. These include metals, total suspended particulate (TSP) and chlorinated dioxins and chlorinated furans.

A listing of target compounds included in the monitoring program and their corresponding monitoring methods are as follows:

- PM_{10} and $PM_{2.5}$ – monitored on a continuous basis employing Dust Trak II monitors (Model 8530) at the Chiswell and Poolesville sites and Dust Trak DRX monitors (Model 8533) at the Gothic Barn and Beallsville sites.
- Metals - sample collection according to USEPA SRM 40 CFR Part 50 Appendix B and analyses by Inductively Coupled Plasma (ICP).
- Polynuclear Aromatic Hydrocarbons (PAHs) – monitoring and analysis according to EPA Method – TO 13 A.
- Volatile organics-sample collection and analyses using EPA-Method TO-15.
- Total Suspended Particulate (TSP) – sample collection and gravimetric analyses according to USEPA SRM 40 CFR Part 50 Appendix B.
- Chlorinated dioxins and chlorinated furans – monitoring according to EPA Method TO 9A and analyses by HRGC/HRMS.

In addition to the target compounds, meteorological data (wind speed and direction) were provided to TRC by Montgomery County. These data were used to determine whether each station was located upwind or downwind of the RRF facility during each sampling event.

Figure 1: Monitoring Stations Relative to MCRRF



Monitoring Stations Relative to MCRRF		
Station	Distance Miles	Wind Direction
Gothic Barn	0.45	302°
Chiswell Farm	1.7	345°
Poolesville Town Hall	4.5	330°
Beallsville Fire Station	2.8	302°

4.0 FIELD SAMPLING SCHEDULE

Figure 2 indicates the parameters monitored at each of the four sites, the numbers of sampling events conducted, dates, and start and stop times associated with each sampling event

PM_{10} and $PM_{2.5}$ were continuously monitored at the Gothic Barn and Beallsville Fire Department sites beginning on December 13, 2016. PM_{10} and $PM_{2.5}$ continuous monitoring commenced at the Poolesville and Chiswell sites on December 15, 2016. These monitors measured and recorded PM_{10} and $PM_{2.5}$ every five minutes.

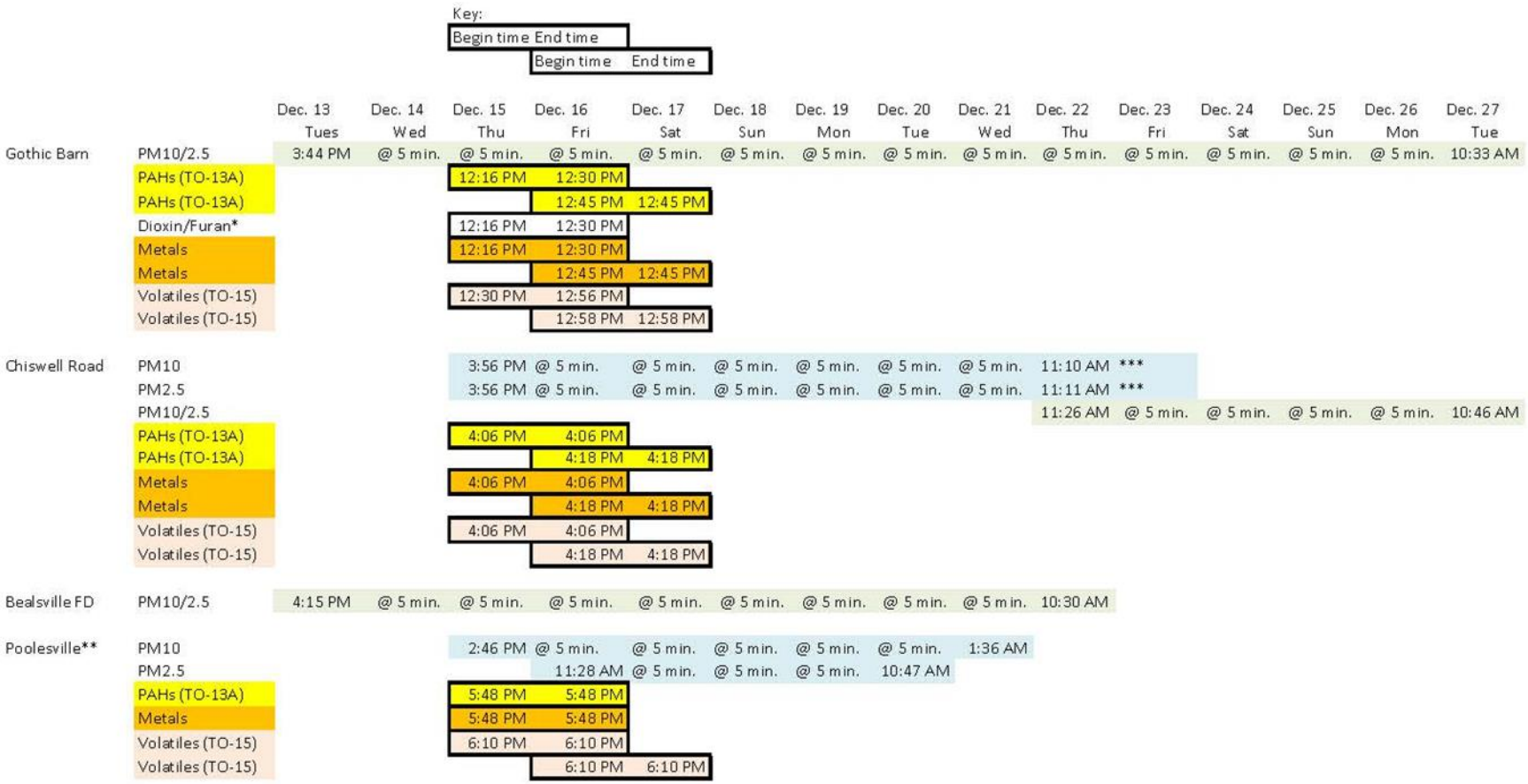
Sampling for the other target parameters took place during the calendar period December 15-17, 2016. These sampling events were each approximately 24 hours in duration. A total of six samples were collected for volatile organics and five samples each for metals, TSP and polynuclear aromatic hydrocarbons. One 24-hour sample was collected for chlorinated dioxins and chlorinated furans, and this was at the Gothic Barn site during the calendar period December 15-16, 2016.

5.0 RESULTS

5.1 Volatile Organics

As shown in Table 1 a total of six samples were collected and analyzed for a comprehensive list of volatile organic compounds. The target compound list prescribed by EPA Method TO-15 consists of 62 volatile organic compounds. The majority of these compounds were not detected in the six samples. Table 1 provides a summary of results for the six samples collected from December 15-17. Results are reported in units of both ppb and ug/m^3.

Figure 2: Field Sampling Schedule



*Added dioxin/furan for the 1st 24-hr sample
**Added in the field, using available resources

Table 1: Volatile Organic Compounds
Montgomery County RRF Ambient Air Sampling Program

SAMPLE ID	Goth-1		Goth-2		Chiswell-1		Chiswell-2		Poolesville-1		Poolesville-2	
SAMPLE LOCATION	Goth		Goth		Chiswell		Chiswell		Poolesville		Poolesville	
SAMPLE DATE	December 16, 2016		December 17, 2016		December 16, 2016		December 17, 2016		December 16, 2016		December 17, 2016	
% Downwind of RRF	78		0		43		1		42		6	
ANALYTE	ppbV	ug/m^3	ppbV	ug/m^3	ppbV	ug/m^3	ppbV	ug/m^3	ppbV	ug/m^3	ppbV	ug/m^3
Acetone	**3.1**	**7.4**	**6.7**	**16**	**3.1**	**7.3**	**8.8**	**21**	**4.6**	**11**	**6.9**	**16**
Benzene	**0.16**	**0.52**	**0.21**	**0.68**	**0.13**	**0.41**	**0.15**	**0.47**	**0.18**	**0.58**	**0.18**	**0.57**
Benzyl chloride	<0.035	<0.18	<0.035	<0.18	<0.035	<0.18	<0.035	<0.18	<0.035	<0.18	<0.035	<0.18
Bromodichloromethane	<0.035	<0.24	<0.035	<0.24	<0.035	<0.24	<0.035	<0.24	<0.035	<0.24	<0.035	<0.24
Bromoform	<0.035	<0.36	<0.035	<0.36	<0.035	<0.36	<0.035	<0.36	<0.035	<0.36	<0.035	<0.36
Bromomethane	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14
1,3-Butadiene	<0.035	<0.078	<0.035	<0.078	<0.035	<0.078	<0.035	<0.078	<0.035	<0.078	<0.035	<0.078
2-Butanone (MEK)	<1.4	<4.1	<1.4	<4.1	<1.4	<4.1	<1.4	<4.1	<1.4	<4.1	<1.4	<4.1
Carbon Disulfide	<0.35	<1.1	<0.35	<1.1	<0.35	<1.1	<0.35	<1.1	<0.35	<1.1	<0.35	<1.1
Carbon Tetrachloride	**0.071**	**0.45**	**0.071**	**0.45**	**0.064**	**0.4**	**0.076**	**0.48**	**0.073**	**0.46**	**0.074**	**0.47**
Chlorobenzene	<0.035	<0.16	<0.035	<0.16	<0.035	<0.16	<0.035	<0.16	<0.035	<0.16	<0.035	<0.16
Chloroethane	<0.035	<0.093	<0.035	<0.093	<0.035	<0.093	<0.035	<0.093	<0.035	<0.093	<0.035	<0.093
Chloroform	<0.035	<0.17	<0.035	<0.17	<0.035	<0.17	<0.035	<0.17	<0.035	<0.17	<0.035	<0.17
Chloromethane	**0.51**	**0.07**	**0.52**	**1.1**	**0.47**	**0.98**	**0.56**	**1.2**	**0.52**	**1.1**	**0.48**	**0.99**
Cyclohexane	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14
Dibromochloromethane	<0.035	<0.30	<0.035	<0.30	<0.035	<0.30	<0.035	<0.30	<0.035	<0.30	<0.035	<0.30
1,2-Dibromoethane (EDB)	<0.035	<0.27	<0.035	<0.27	<0.035	<0.27	<0.035	<0.27	<0.035	<0.27	<0.035	<0.27
1,2-Dichlorobenzene	<0.035	<0.21	<0.035	<0.21	<0.035	<0.21	<0.035	<0.21	<0.035	<0.21	<0.035	<0.21
1,3-Dichlorobenzene	<0.035	<0.21	<0.035	<0.21	<0.035	<0.21	<0.035	<0.21	<0.035	<0.21	<0.035	<0.21
1,4-Dichlorobenzene	<0.035	<0.21	<0.035	<0.21	<0.035	<0.21	<0.035	<0.21	<0.035	<0.21	<0.035	<0.21
Dichlorodifluoromethane (Freon 12)	**0.37**	**1.8**	**0.37**	**1.8**	**0.38**	**1.9**	**0.38**	**1.9**	**0.37**	**1.8**	**0.35**	**1.7**
1,1-Dichloroethane	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14
1,2-Dichloroethane	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14
1,1-Dichloroethylene	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14
cis-1,2-Dichloroethylene	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14
trans-1,2-Dichloroethylene	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14
1,2-Dichloropropane	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14
cis-1,3-Dichloropropene	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14
trans-1,3-Dichloropropene	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14
1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon 114)	<0.035	<0.16	<0.035	<0.16	<0.035	<0.16	<0.035	<0.16	<0.035	<0.16	<0.035	<0.16
1,4-Dioxane	<0.35	<0.16	<0.35	<0.16	<0.35	<0.16	<0.35	<0.16	<0.35	<0.16	<0.35	<0.16
Ethanol	**2.1**	**4**	**4.9**	**9.3**	<1.4	<2.6	**3.5**	**6.7**	<1.4	<2.6	**3**	**5.6**
Ethyl Acetate	<0.035	<0.13	**0.61**	**2.2**	<0.035	<0.13	**0.12**	0.43	<0.035	<0.13	<0.035	<0.13
Ethylbenzene	<0.035	<0.15	<0.035	<0.15	<0.035	<0.15	<0.035	<0.15	<0.035	<0.15	<0.035	<0.15
4-Ethyltoluene	<0.035	<0.17	<0.035	<0.17	<0.035	<0.17	<0.035	<0.17	<0.035	<0.17	<0.035	<0.17
Heptane	<0.035	<0.14	**0.044**	**0.18**	<0.035	<0.14	<0.035	<0.14	**0.039**	**0.16**	**0.038**	**0.16**
Hexachlorobutadiene	<0.035	<0.37	<0.035	<0.37	<0.035	<0.37	<0.035	<0.37	<0.035	<0.37	<0.035	<0.37
Hexane	<1.4	<4.9	<1.4	<4.9	<1.4	<4.9	<1.4	<4.9	<1.4	<4.9	<1.4	<4.9
2-Hexanone (MBK)	**0.053**	**0.22**	**0.089**	**0.37**	**0.056**	**0.23**	**0.091**	**0.37**	**0.051**	**0.21**	**0.11**	**0.45**
Isopropanol	<1.4	<3.4	<1.4	<3.4	<1.4	<3.4	<1.4	<3.4	<1.4	<3.4	<1.4	<3.4
Methyl tert-Butyl Ether (MTBE)	<0.035	<0.13	<0.035	<0.13	<0.035	<0.13	<0.035	<0.13	<0.035	<0.13	<0.035	<0.13
Methylene Chloride	**2.3**	**7.9**	**1.4**	**4.8**	**2**	**6.9**	**0.93**	**3.2**	**1.3**	**4.7**	**6.2**	**22**
4-Methyl-2-pentanone (MIBK)	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14	<0.035	<0.14	**0.05**	**0.2**
Naphthalene	**0.052**	**0.27**	**0.053**	**0.28**	<0.035	<0.18	<0.035	<0.18	<0.035	<0.18	<0.035	<0.18
Propene	<1.4	<2.4	<1.4	<2.4	<1.4	<2.4	<1.4	<2.4	<1.4	<2.4	<1.4	<2.4
Styrene	<0.035	<0.15	<0.035	<0.15	<0.035	<0.15	<0.035	<0.15	<0.035	<0.15	<0.035	<0.15
1,1,2,2-Tetrachloroethane	<0.035	<0.24	<0.035	<0.24	<0.035	<0.24	<0.035	<0.24	<0.035	<0.24	<0.035	<0.24
Tetrachloroethylene	**0.13**	**0.89**	<0.035	<0.24	<0.035	<0.24	<0.035	<0.24	<0.035	<0.24	<0.035	<0.24
Tetrahydrofuran	<0.035	<0.10	<0.035	<0.10	<0.035	<0.10	<0.035	<0.10	<0.035	<0.10	<0.035	<0.10
Toluene	**0.1**	**0.38**	**0.17**	**0.66**	**0.062**	**0.24**	**0.11**	**0.41**	**0.13**	**0.5**	**0.17**	**0.65**
1,2,4-Trichlorobenzene	<0.035	<0.26	<0.035	<0.26	<0.035	<0.26	<0.035	<0.26	<0.035	<0.26	<0.035	<0.26
1,1,1-Trichloroethane	<0.035	<0.19	<0.035	<0.19	<0.035	<0.19	<0.035	<0.19	<0.035	<0.19	<0.035	<0.19
1,1,2-Trichloroethane	<0.035	<0.19	<0.035	<0.19	<0.035	<0.19	<0.035	<0.19	<0.035	<0.19	<0.035	<0.19
Trichloroethylene	<0.035	<0.19	<0.035	<0.19	<0.035	<0.19	<0.035	<0.19	<0.035	<0.19	<0.035	<0.19
Trichlorofluoromethane (Freon 11)	**0.23**	**1.3**	**0.32**	**1.8**	**0.24**	**1.3**	**0.25**	**1.4**	**0.3**	**1.7**	**0.25**	**1.4**
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	<0.14	<1.1	**0.19**	**1.4**	<0.14	<1.1	<0.14	<1.1	**0.16**	**1.2**	<0.14	<01.1
1,2,4-Trimethylbenzene	<0.035	<0.17	<0.035	<0.17	<0.035	<0.17	<0.035	<0.17	<0.035	<0.17	<0.035	<0.17
1,3,5-Trimethylbenzene	<0.035	<0.17	<0.035	<0.17	<0.035	<0.17	<0.035	<0.17	<0.035	<0.17	<0.035	<0.17
Vinyl Acetate	<0.70	<2.5	<0.70	<2.5	<0.70	<2.5	<0.70	<2.5	<0.70	<2.5	<0.70	<2.5
Vinyl Chloride	<0.035	<0.090	<0.035	<0.090	<0.035	<0.090	<0.035	<0.090	<0.035	<0.090	<0.035	<0.090
m&p-Xylene	<0.070	<0.30	<0.070	<0.30	<0.070	<0.30	<0.070	<0.30	<0.070	<0.30	<0.070	<0.30
o-Xylene	<0.035	<0.15	<0.035	<0.15	<0.035	<0.15	<0.035	<0.15	<0.035	<0.15	<0.035	<0.15

Note: Results for acetone, ethanol, methylene chloride, and isopropanol were influenced by laboratory derived contamination and as a result do not represent actual concentrations present in ambient air at the site

Volumes are provided in cubic meters at actual temperature and pressure conditions

Values in bold indicate detected concentrations.

5.2 Polynuclear Aromatic Hydrocarbons (PAHs)

Five samples were collected and analyzed for polynuclear aromatic hydrocarbons. All samples were collected using high-volume air samplers employing EPA Method TO 13A. Four of these samples were submitted to CONTEST laboratory for analyses and a single sample collected on Day 1 at the Gothic Barn site was submitted to SGS for analyses. All analyses were performed using gas chromatography/mass spectrometry. The target compound list consisted of twenty (20) PAHs for analyses conducted by CONTEST. Results for the set of four samples analyzed by CONTESR are summarized in Table 2. All results are reported in units of ng/m^3. Results for the Gothic Barn sample (Day 1) analyzed by SGS labs are summarized in Table 3. Again results for the single sample are reported in units of ng/m^3. In both Table 2 and in Table 3, the percentage of time during each 24-hour composite sample period was located downwind of the RRF is indicated.

Table 2: Polynuclear Aromatic Hydrocarbons (PAHs)
Montgomery County RRF Ambient Air Sampling Program

SAMPLE ID	Goth	Chiswell	Chiswell	Poolesville
SAMPLE LOCATION	Goth-PUF-2	Chiswell-PUF-1	Chiswell-PUF-2	Poolesville-PUF-1
SAMPLE VOLUME (m^3)	282.0	281.2	280.6	273.5
% Downwind of RRF	0.0	43.3	1.0	42.3
SAMPLE DATE	December 17, 2016	December 16, 2016	December 17, 2016	December 16, 2016
ANALYTE	ng/m^3	ng/m^3	ng/m^3	ng/m^3
Acenaphthene	<0.71	<0.71	<0.71	<0.73
Acenaphthylene	<0.71	<0.71	<0.71	<0.73
Anthracene	<0.71	<0.71	<0.71	<0.73
Benzo(a)anthracene	<0.71	<0.71	<0.71	<0.73
Benzo(a)pyrene	<0.71	<0.71	<0.71	<0.73
Benzo(b)fluoranthene	<0.71	<0.71	<0.71	<0.73
Benzo(e)pyrene	<0.71	<0.71	<0.71	<0.73
Benzo(g,h,i)perylene	<0.71	<0.71	<0.71	<0.73
Benzo(k)fluoranthene	<0.71	<0.71	<0.71	<0.73
Chrysene	<0.71	<0.71	<0.71	<0.73
Dibenz(a,h)anthracene	<0.71	<0.71	<0.71	<0.73
Fluoranthene	**0.81**	<0.71	**0.77**	<0.73
Fluorene	**0.77**	<0.71	**0.97**	<0.73
Indeno(1,2,3-cd)pyrene	<0.71	<0.71	<0.71	<0.73
1-Methylnaphthalene	**3.0**	**2.1**	**3.1**	**2.3**
2-Methylnaphthalene	**4.5**	**2.9**	**4.6**	**3.4**
Naphthalene	**21**	**15**	**21**	**16**
Perylene	<0.71	<0.71	<0.71	<0.73
Phenanthrene	**1.9**	**1.7**	**2.6**	**1.6**
Pyrene	<0.71	<0.71	<0.71	<0.73

Notes:
Volumes are provided in cubic meters at actual temperature and pressure conditions
Values in bold indicate detected concentrations

Table 3: Polynuclear Aromatic Hydrocarbons (PAHs)
Montgomery County RRF Ambient Air Sampling Program

SAMPLE ID	Goth
SAMPLE LOCATION	Goth-PUF-1
SAMPLE DATE	December 16, 2016
SAMPLE VOLUME (m^3)	284.8
% Downwind of RRF	77.6
ANALYTE	ng/m^3
Naphthalene	**21.5**
2-Methylnaphthalene	**4.38**
Acenaphthylene	**0.201**
Acenaphthene	**0.33**
Fluorene	**0.966**
Phenanthrene	**2.63**
Anthracene	**0.164**
Fluoranthene	**0.934**
Pyrene	**0.549**
Benzo(a)Anthracene	**0.158**
Chrysene	**0.233**
Benzo(b)Fluoranthene	**0.23**
Benzo(k)Fluoranthene	**0.114**
Benzo(e)Pyrene	**0.12**
Benzo(a)Pyrene	**0.108**
Perylene	**0.0302**
Indeno(1,2,3-cd)Pyrene	**0.116**
Dibenzo(a,h)Anthracene	**0.034**
Benzo(ghi)Perylene	**0.128**

Notes:
Volumes are provided in cubic meters at actual temperature and pressure conditions
Values in bold indicate detected concentrations

5.3 Chlorinated Dioxins and Chlorinated Furans (PCDDs/PCDFs)

The Gothic Day 1 sample was submitted for analyses of PCDDs/PCDFs by High Resolution Gas Chromatography/High Resolution Mass Spectrometry (HRGC/HRMS). Analyses were conducted by SGS laboratories in Wilmington, North Carolina employing EPA Reference Method 8290. Results are summarized in Table 4 for each of seventeen (17) 2,3,7,8 substituted congeners and eight homologue groups (Cl_4-Cl_7). All data are reported in units of pg/m^3.

Table 4: Dioxins/Furans Sampling Results

Sample ID		Goth-PUF-1			
Sample Date		12/15/16 12:16 - 12/16/16 12:30			
Sampling Location		Gothic Barn			
Sample Volume (m3)		284.7			
Parameter		Conc.	Flag	TEQ	TEQ
TO-9A Dioxins/Furans (pg/m3)	***TEF***			Subtotal[a]	Subtotal[b]
2,3,7,8-TCDD	1.0000	< 0.036	U	3.63E-02	0
1,2,3,7,8-PeCDD	1.0000	< 0.108	U	1.08E-01	0
1,2,3,4,7,8-HxCDD	0.1000	< 0.035	U	3.45E-03	0
1,2,3,6,7,8-HxCDD	0.1000	< 0.045	U	4.46E-03	0
1,2,3,7,8,9-HxCDD	0.1000	< 0.052	U	5.21E-03	0
1,2,3,4,6,7,8-HpCDD	0.0100	**0.316**		3.16E-03	3.16E-03
OCDD	0.0003	**0.421**		1.26E-04	1.26E-04
2,3,7,8-TCDF	0.1000	< 0.037	U	3.68E-03	0
1,2,3,7,8-PeCDF	0.0300	< 0.033	U	9.96E-04	0
2,3,4,7,8-PeCDF	0.3000	**0.107**		3.21E-02	3.21E-02
1,2,3,4,7,8-HxCDF	0.1000	**0.074**	**J, EMPC**	7.42E-03	7.42E-03
1,2,3,6,7,8-HxCDF	0.1000	**0.081**		8.08E-03	8.08E-03
2,3,4,6,7,8-HxCDF	0.1000	**0.082**	**J, EMPC**	8.23E-03	8.23E-03
1,2,3,7,8,9-HxCDF	0.1000	< 0.064	U	6.41E-03	0
1,2,3,4,6,7,8-HpCDF	0.0100	**0.164**		1.64E-03	1.64E-03
1,2,3,4,7,8,9-HpCDF	0.0100	< 0.050	U	4.96E-04	0
OCDF	0.0003	< 0.091	U	2.73E-05	0
Total TCDD	N/A	**1.860**		N/A	
Total PeCDD	N/A	**2.140**		N/A	
Total HxCDD	N/A	**1.490**		N/A	
Total HpCDD	N/A	**0.316**		N/A	
Total TCDF	N/A	**2.320**		N/A	
Total PeCDF	N/A	**0.943**		N/A	
Total HxCDF	N/A	**0.296**		N/A	
Total HpCDF	N/A	**0.164**		N/A	
Sum of Total PCDDs/PCDFs Tetra – Octa (Cl4 - Cl8)		**10.04**			
Total TEQ				**0.230**	**0.061**

Notes:
Volumes are provided in cubic meters at actual temperature and pressure conditions.
Volumes are not available for field blank samples, since no air was collected through those samples
Values in **bold** represent detected concentrations.
J - Estimated Value
U - Analytic was analyzed for, but not detected above the specified estimated detection limit.
EMPC - Estimated Maximum Possible Concentration.
TEF - Toxic Equivalency Factor; van den Berg, et.al, 2006, "The 2005 World Health Organization Re-evaluation of Human and Mamallian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds".
TEQ - Toxicity Equivalence; sum of individual 2,3,7,8-PCDDs/PCDFs TEQ Subtotals, values presented in scientific notation (e.g. 1.0E-04 = 0.0001)
'a - TEQ Subtotal calculated using RL as concentration for non-detect results
'b - TEQ Subtotal calculated using 0 as concentration for non-detect results
N/A - Not Applicable.

5.4 Metals and Total Suspended Particulate (TSP)

Five samples were collected and analyzed for total suspended particulate (TSP) and metals. Seven metals were selected for analyses to match those monitored as part of the prior four operational phase ambient air monitoring programs conducted in the vicinity of the MCRRF. The most recent set of ambient air samples were collected in the winter of 2013-14. Table 5 summarizes the results for the seven metals (in units of ng/m^3) and for total suspended particulate (TSP) (in units of $\mu g/m^3$).

Table 5: Total Suspended Particulates and Metals Results

Sample Location	Sample ID	% Downwind RRF	Volume m3 (STP)	Results															
				Arsenic		*Beryllium*		*Cadmium*		*Chromium*		*Lead*		*Mercury*		*Nickel*		*Particulate(TSP)*	
				ug	ng/m3	ug	ng/m3	ug	ng/m3	ug	ng/m3	ug	ng/m3	ug	ng/m3	ug	ng/m3	g	ug/m3
Poolesville	Poolesville-1-TSP	42.3	1,673.0	<1.71	<1.02	<0.049	<0.03	**0.14**	**0.080**	**2.4**	**1.43**	**2.44**	**1.46**	**0.05**	**0.03**	**1.15**	**0.690**	**0.0209**	**12.5**
Goth	Goth-1-TSP	77.6	1,657.0	<1.71	<1.03	**0.102**	**0.06**	**0.98**	**0.06**	**3.62**	**2.19**	**12.70**	**7.69**	**0.25**	**0.15**	**1.88**	**1.130**	**0.0832**	**50.2**
Goth	Goth-2-TSP	0.0	1,643.0	<1.71	<1.04	**0.05**	**0.003**	**0.18**	**0.011**	**2.43**	**1.48**	**2.49**	**1.52**	0.04280	<0.03	**1.03**	**0.630**	**0.028**	**17.0**
Chiswell	Chiswell-1-TSP	43.3	1,641.0	<1.71	<1.04	**0.056**	**0.03**	**3.3**	**2.010**	**2.68**	**1.63**	**3.46**	**2.11**	0.06	**0.04**	**1.43**	**0.870**	**0.0224**	**13.7**
Chiswell	Chiswell-2-TSP	1.0	1,643.0	<1.71	<1.04	< 0.049	<0.03	**0.69**	**0.420**	**2.22**	**1.35**	**2.67**	**1.63**	0.04280	<0.03	**2.28**	**1.390**	**0.0269**	**16.4**
Field Blank	Blank	N/A	N/A	<1.71	N/A	< 0.049	N/A	<0.122	N/A	**1.82**	N/A	<1.22	N/A	0.0428	N/A	0.52	N/A	**0.0002**	N/A

Notes:
Actual volumes are provided in cubic meters
Volumes are not available for field blank samples, since no air was collected
Values in bold indicate detected concentrations
N/A - Not Applicable
ND - Not Detected

5.5 Meteorological Data

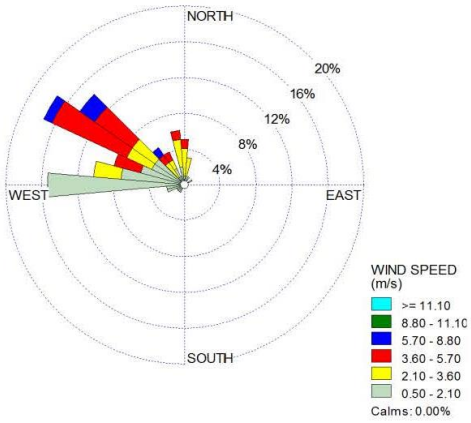
Wind speed and wind directional data were provided to TRC by Montgomery County. Onsite met data was collected on a tower located 0.6 km to the east of the RRF's main stack. Averaging time of the WS and WD data is 15 minutes. These data were used to prepare composite wind roses for each of the sampling events, as well as, perform analyses of PM_{10} and $PM_{2.5}$ data as a function of wind direction. The composite wind roses associated with the two 24 hour sampling events that took place at each of the three sites are shown as follows:

Figure 3 – Gothic Barn
Figure 4- Poolesville Town Hall.
Figure 5 – Chiswell Farm.

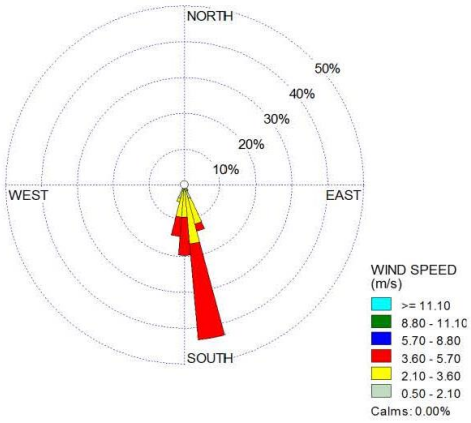
Bars on the wind roses show the frequency that winds blow from each 10° direction. The color segments of a bar indicate wind speed (per the legend at bottom right of each figure). For example, a bar pointing to the North label would indicate winds are blowing from the North, sending air to the South.

As noted in Figure 2 sampling events took place only at these three sites. Sampling events did not take place at the Beallsville Fire department site because construction activities were ongoing and would have likely influenced the measurements. PM_{10} and $PM_{2.5}$ data only were collected at this location.

Figure 3: Gothic Barn – Sampling Location and Wind Roses During Sampling Events



12/15/2016 12:15 to 12/16/2016 12:30



12/16/2016 12:45 to 12/17/2016 12:45

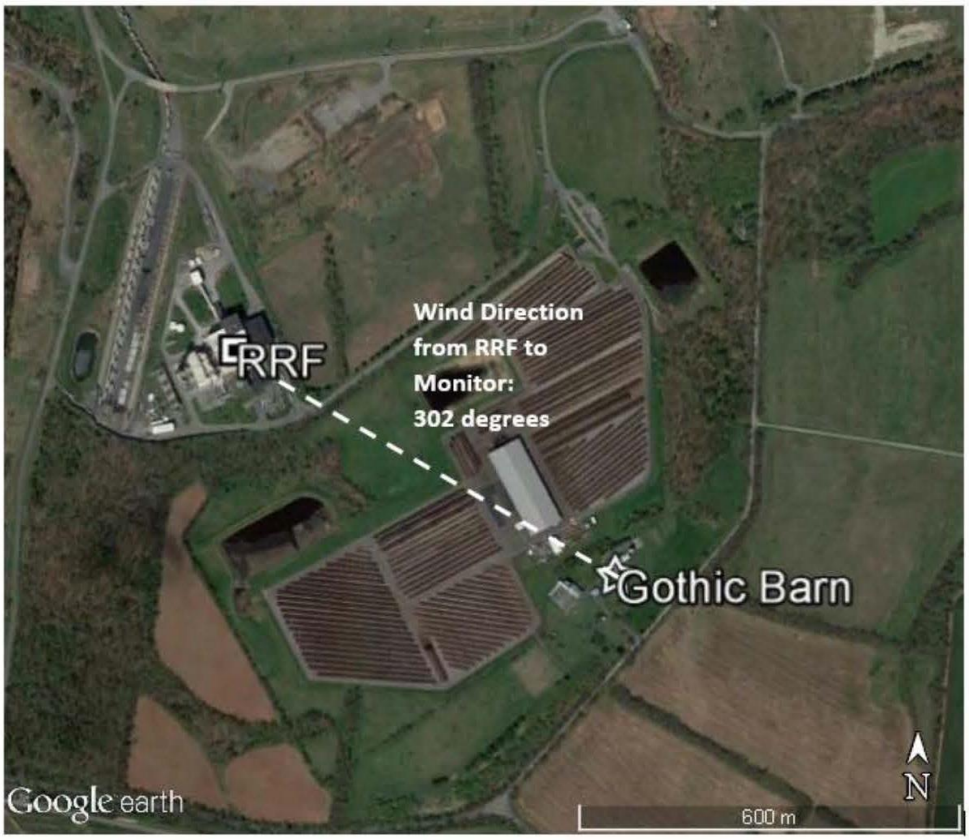


Figure 4: Poolesville Town Hall – Sampling Location and Wind Roses During Sampling Events

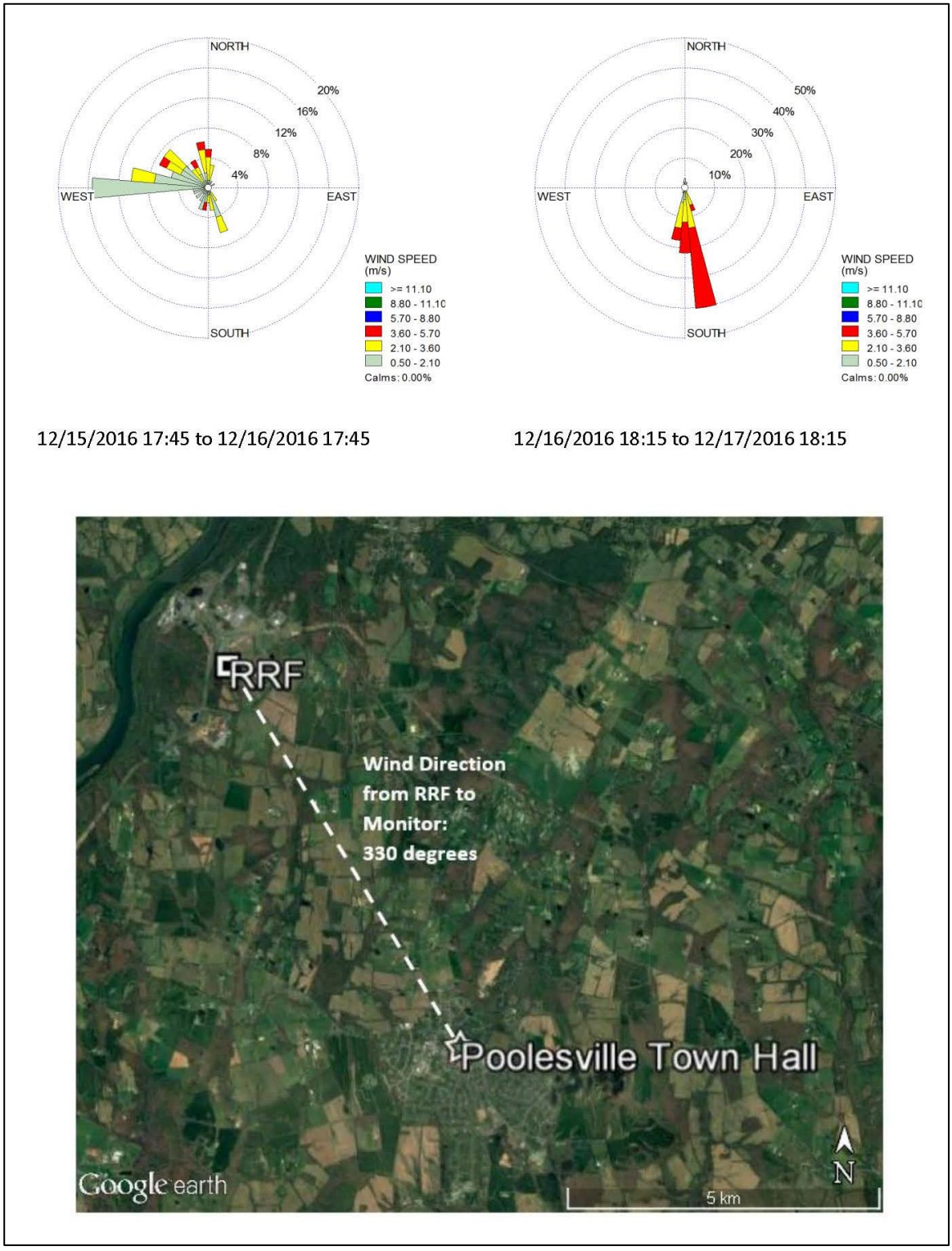
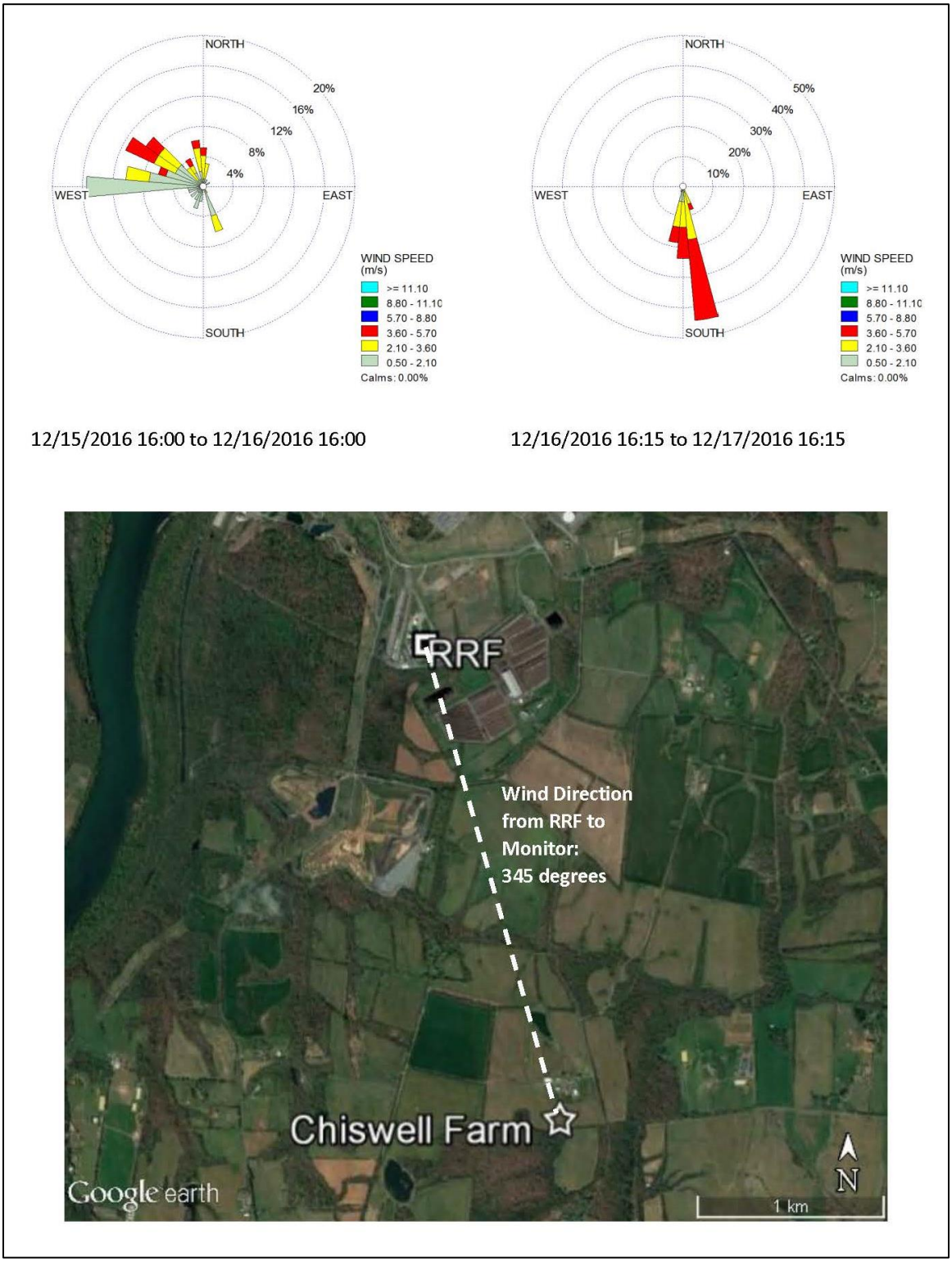


Figure 5: Chiswell Farm – Sampling Location and Wind Roses During Sampling Events



The wind data were analyzed to determine whether each sample was upwind or downwind (or neither) of the fire location during the sampling period. Based on this analysis, it was determined that some locations were predominantly or entirely upwind of the fire (i.e., unaffected by potential emissions from the fire) while, in contrast, the Gothic Barn site on Day 1 was downwind. Table 6 summarizes the percentage of time during each 24-hour sampling period that each site was downwind and upwind of the fire.

Table 6: Station Location Relative to Fire Location (upwind/downwind as a %)

Location	Day	Date Range	Upwind[a] Frequency	Downwind[a] Frequency
Chiswell Farm	1	12/15/2016 16:00 to 12/16/2016 16:00	12.4%	43.3%
Chiswell Farm	2	12/16/2016 16:15 to 12/17/2016 16:15	99.0%	1.0%
Gothic Barn	1	12/15/2016 12:15 to 12/16/2016 12:30	0.0%	77.6%
Gothic Barn	2	12/16/2016 12:45 to 12/17/2016 12:45	58.8%	0.0%
Poolesville Town Hall	1	12/15/2016 17:45 to 12/16/2016 17:45	16.5%	42.3%
Poolesville Town Hall	2	12/16/2016 18:15 to 12/17/2016 18:15	88.7%	6.2%

Note: Frequencies based on 90 degree sectors.

[a] All values represent % of time during each 24 hour event.

5.6 Particulate Data (PM_{10} and $PM_{2.5}$)

PM_{10} and $PM_{2.5}$ data were collected on a continuous basis at all four locations in the monitoring network. National Ambient Air Quality Standards (NAAQS) for both PM_{10} and $PM_{2.5}$ are defined on a 24-hour average basis. The NAAQS for PM_{10} and $PM_{2.5}$ are 0.15 and 0.035 mg/m^3, respectively. These monitoring results are shown in Figures 6A-12B for each of the four sites as follows:

- Chiswell $PM_{2.5}$ Figures 6A and 6B
- Chiswell PM_{10} Figures 7A and 7B
- Gothic Barn $PM_{2.5}$ Figures 8A and 8B
- Gothic Barn PM_{10} Figures 9A and 9B
- Beallsville $PM_{2.5}$ Figures 10A and10B
- Beallsville PM_{10} Figures 11A and 11B
- Poolesville PM_{10} Figures 12A and 12B

The "A" figures show 24-hour concentrations during all wind conditions, while the "B" figures show 24-hour concentrations during only those periods where the winds were predominantly downwind (blowing from the RRF to the respective monitor at least 50% of the period).

The source PM data for these graphs, collected on a granular 5-minute basis is displayed together with 15-minute near-cotemporaneous wind directional data in Appendix B of this report. Note that $PM_{2.5}$ data collected at the Poolesville site was determined to not be representative of actual $PM_{2.5}$ concentrations at the site as a result of the data validation process. The unit used for monitoring at this location reported numerous flow error faults indicative of a system malfunction such as a leak. These flow error faults were not observed in any of the data sets for the other seven monitoring units. All of these data sets were determined to be valid, as a result.

Figure 6A: Chiswell Farm PM $_{2.5}$ (mg/m^3)

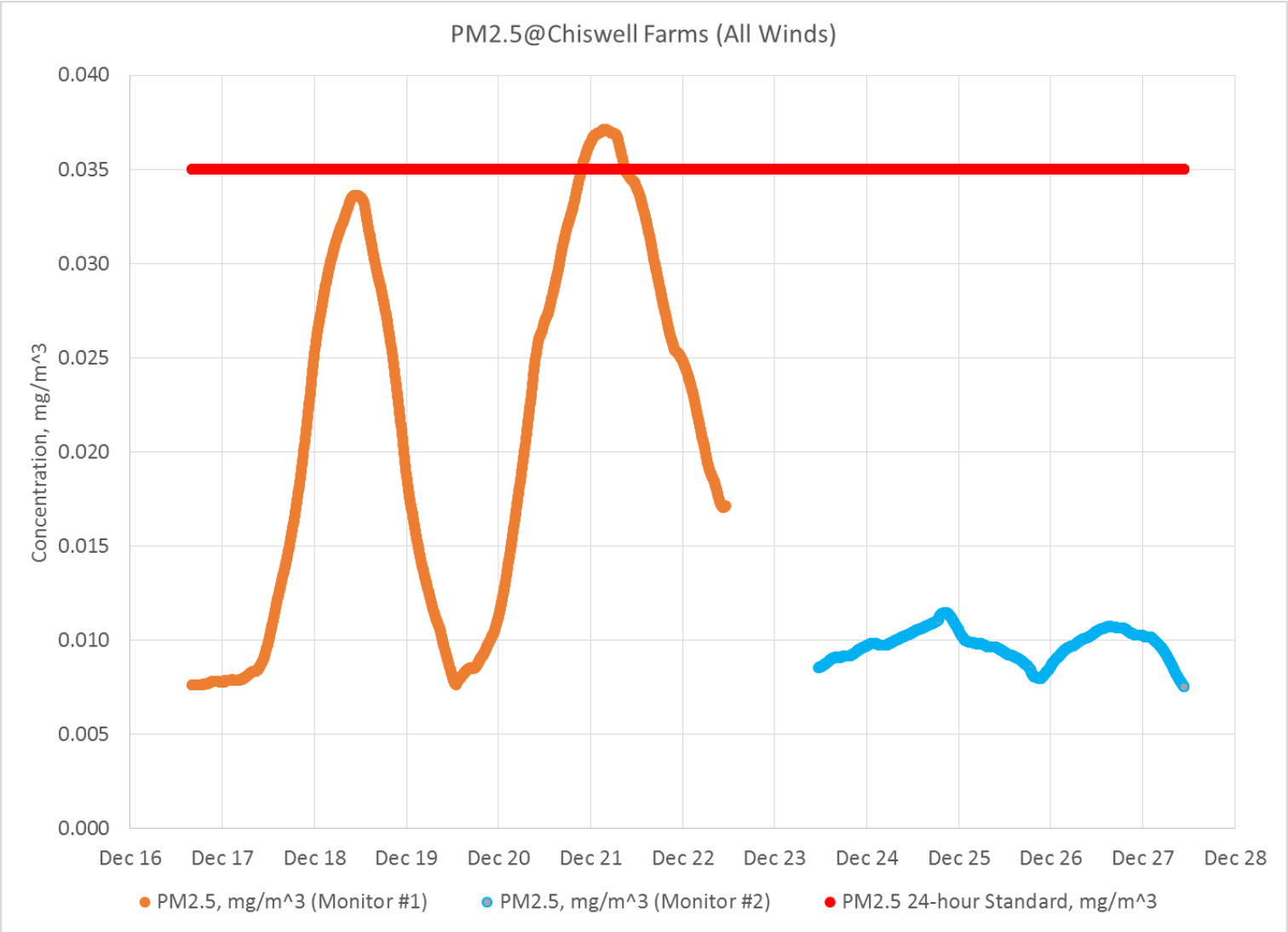


Figure 6B: Chiswell Farm PM $_{2.5}$ (mg/m3)

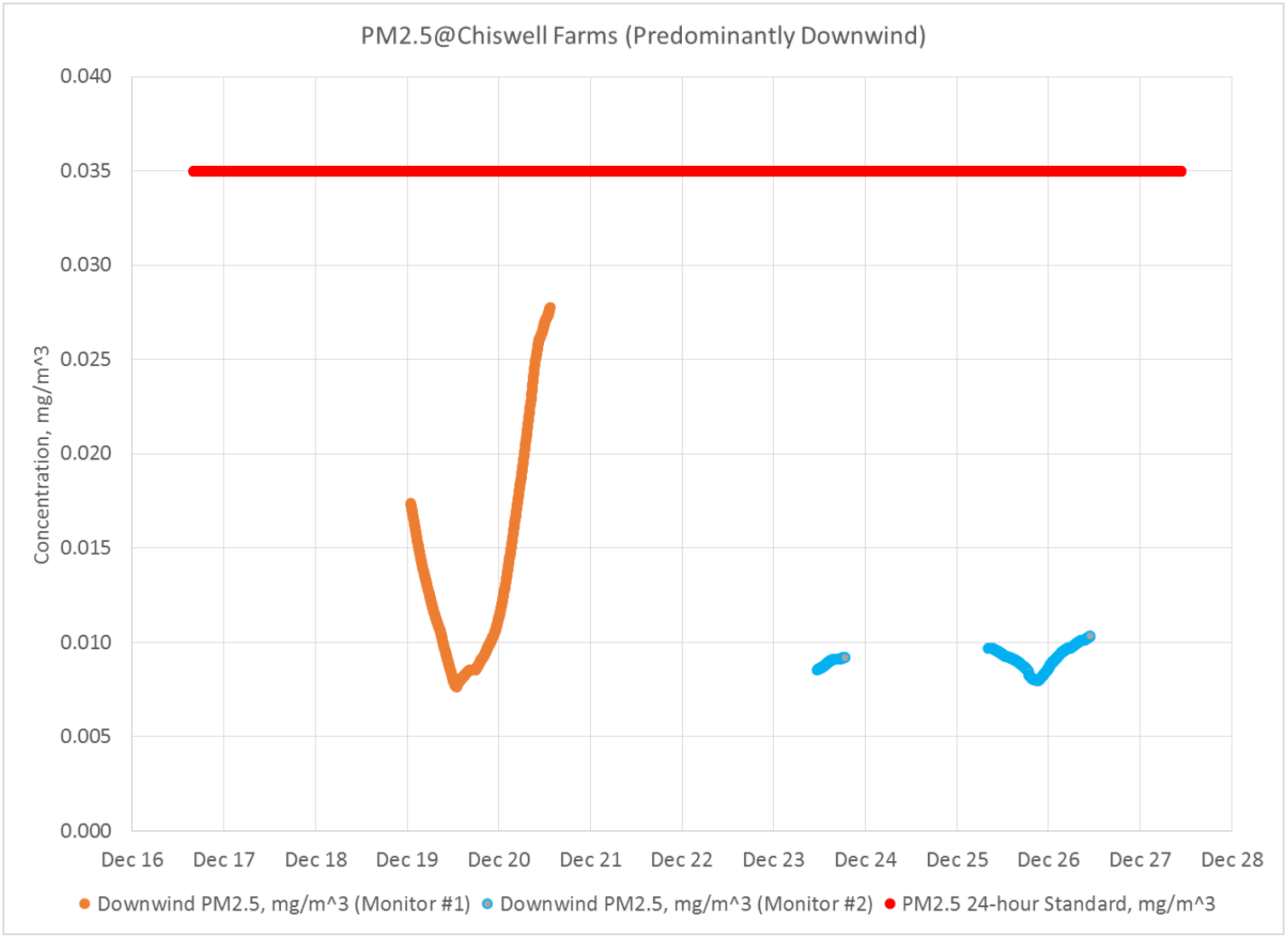


Figure 7A: Chiswell PM $_{10}$ (mg/m^3)

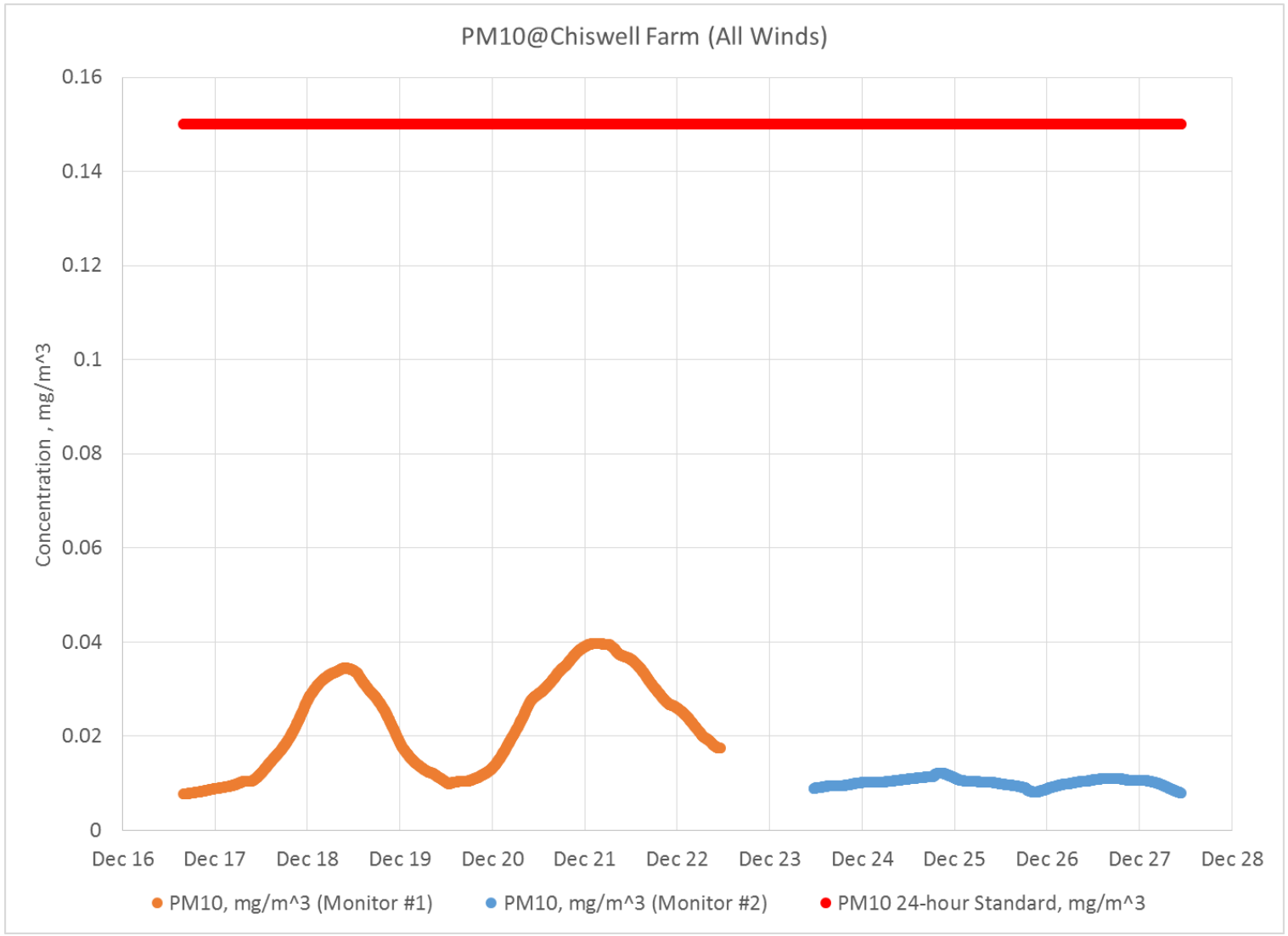


Figure 7B: Chiswell PM $_{10}$ (mg/m^3)

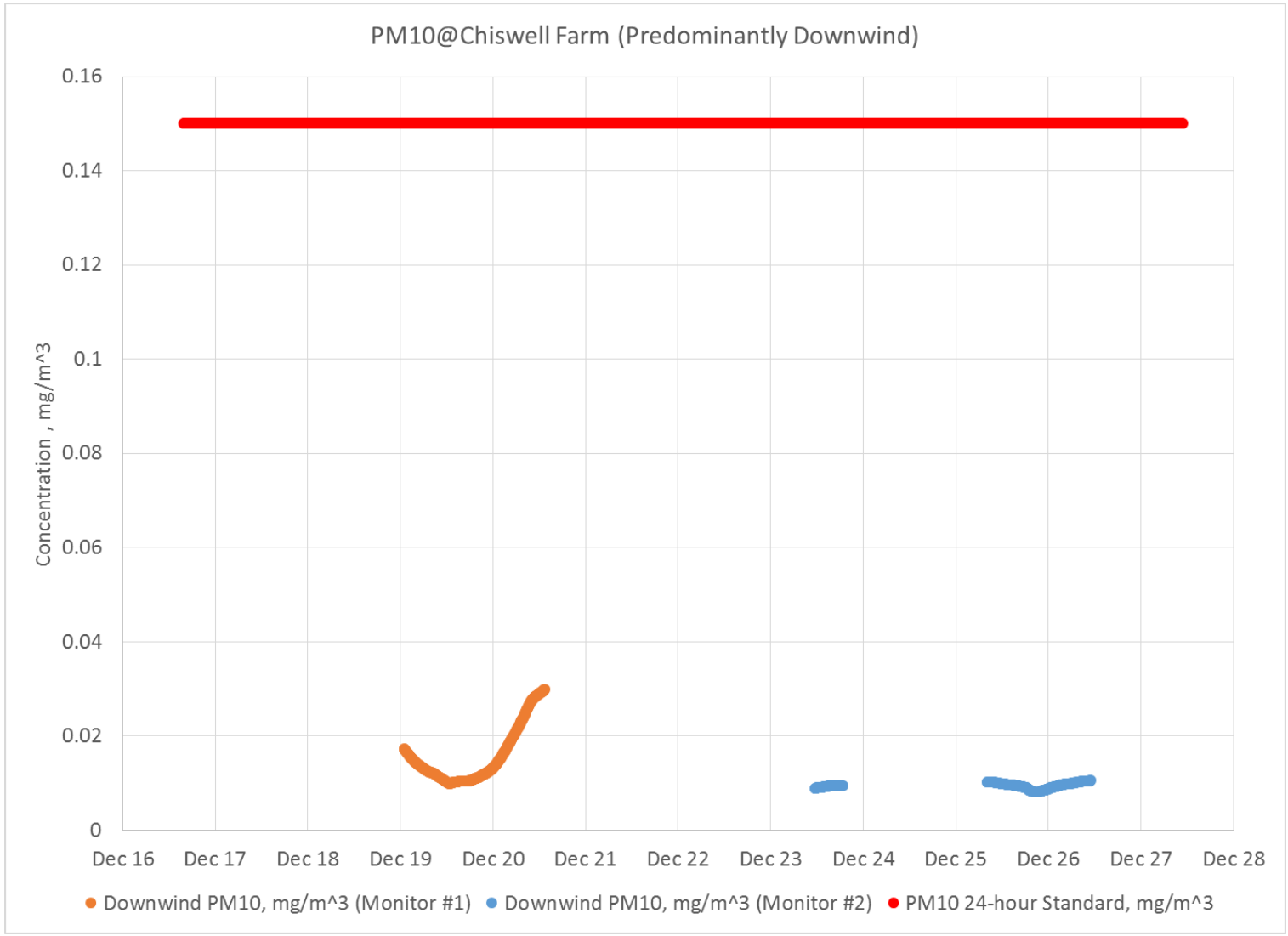


Figure 8A: Gothic Barn PM $_{2.5}$ (mg/m^3)

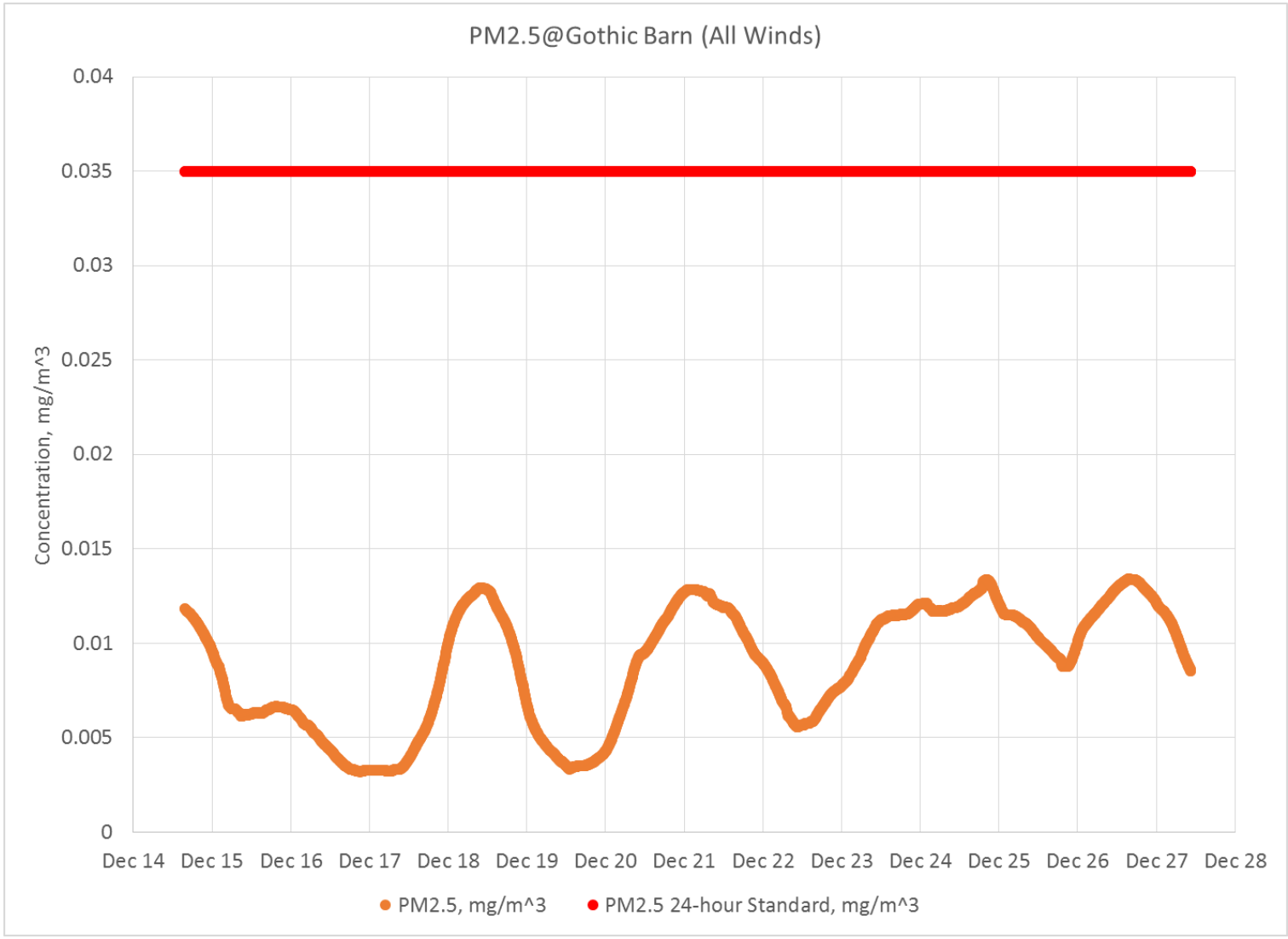


Figure 8B: Gothic Barn PM $_{2.5}$ (mg/m3)

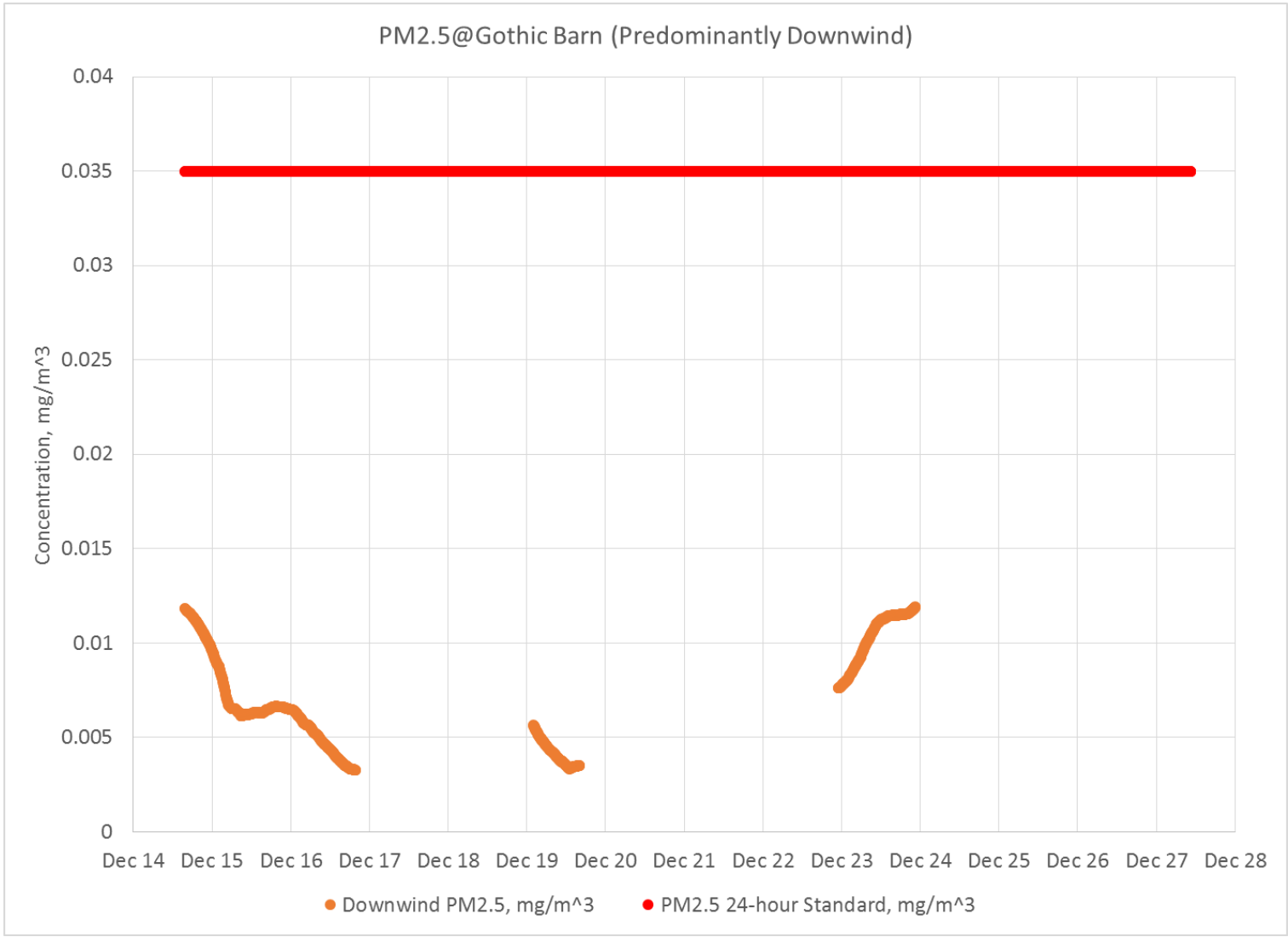


Figure 9A: Gothic Barn PM $_{10}$ (mg/m^3)

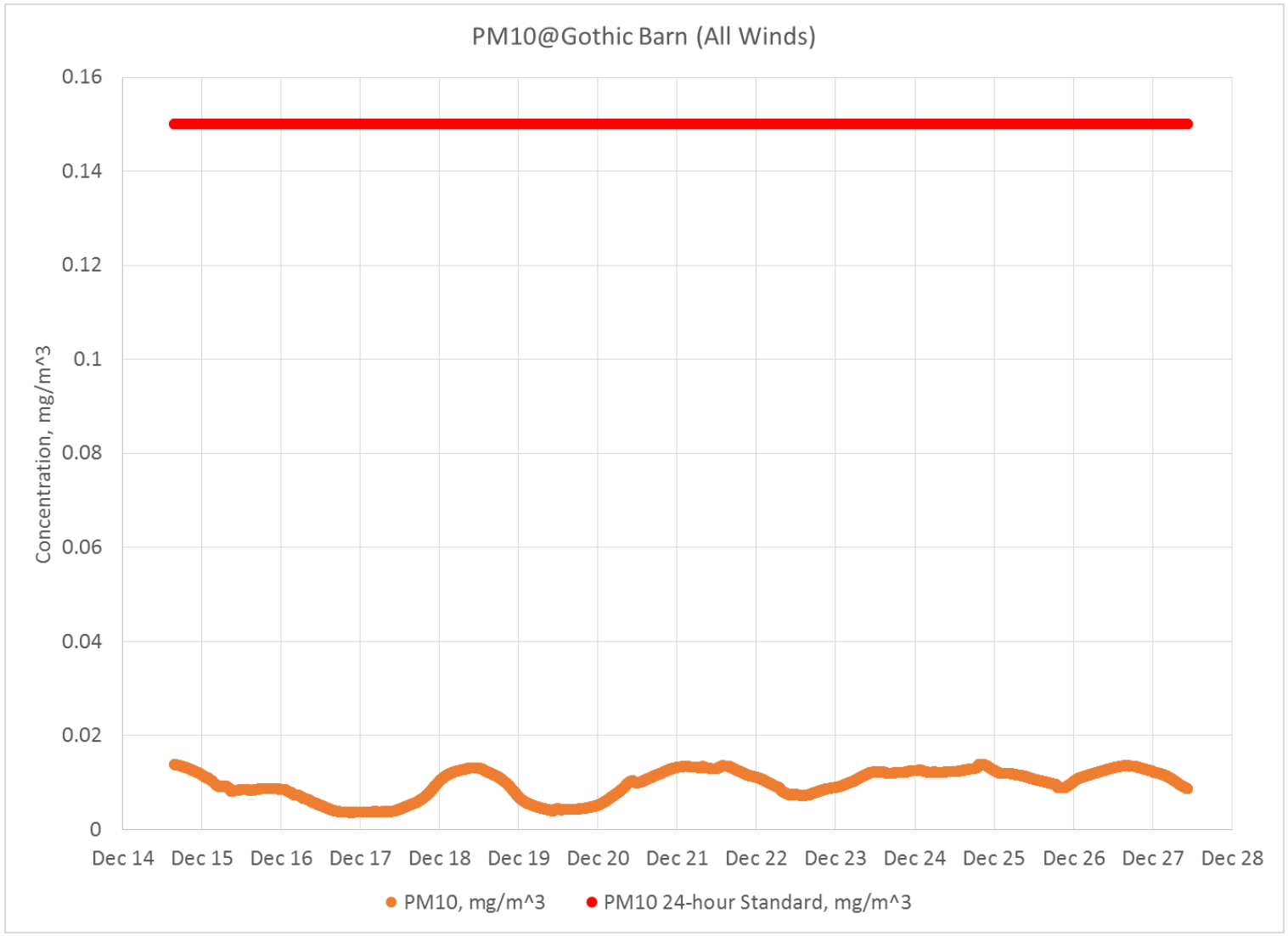


Figure 9B: Gothic Barn PM $_{10}$ (mg/m^3)

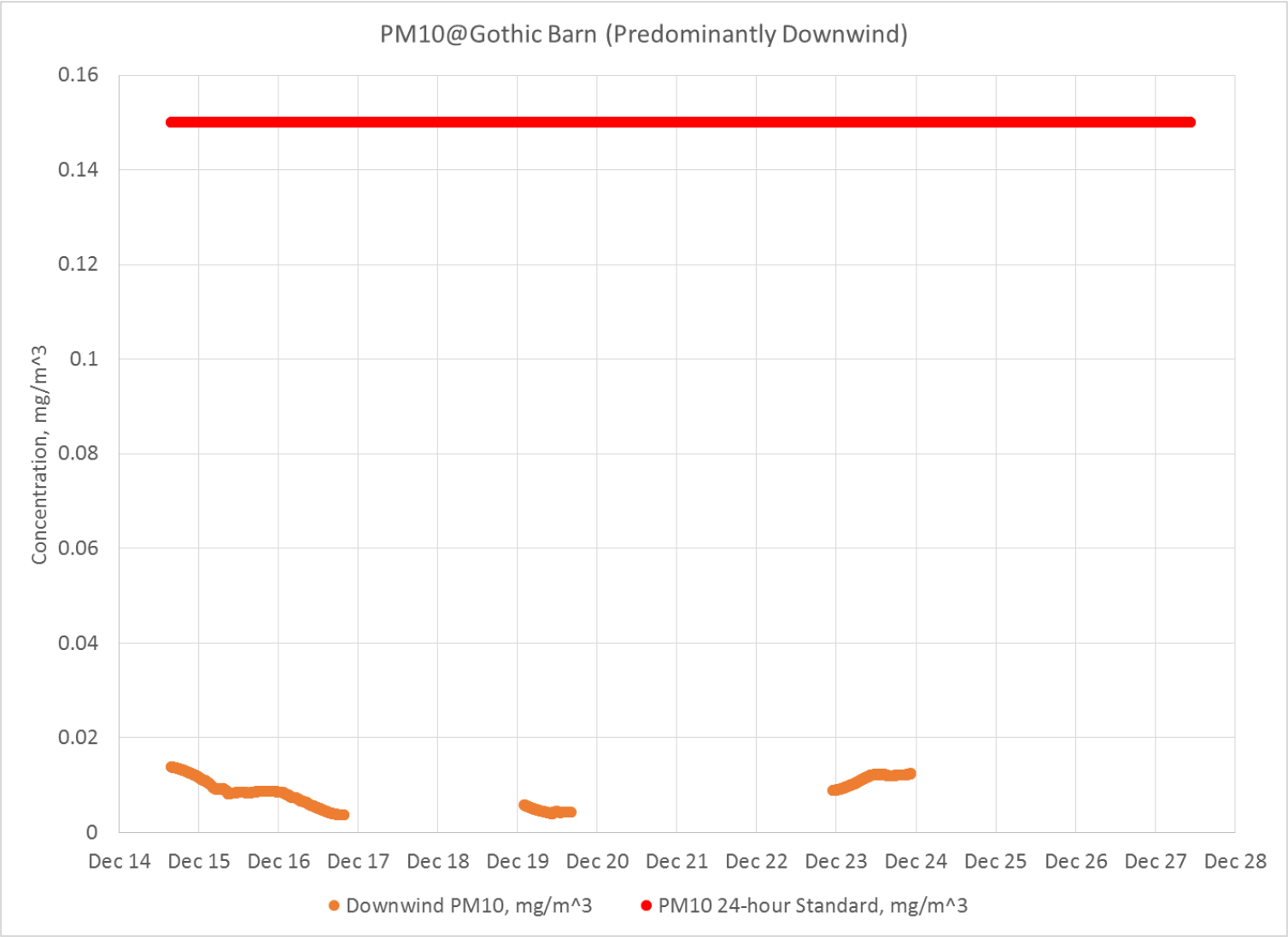


Figure 10A: Beallsville PM $_{2.5}$ (mg/m^3)

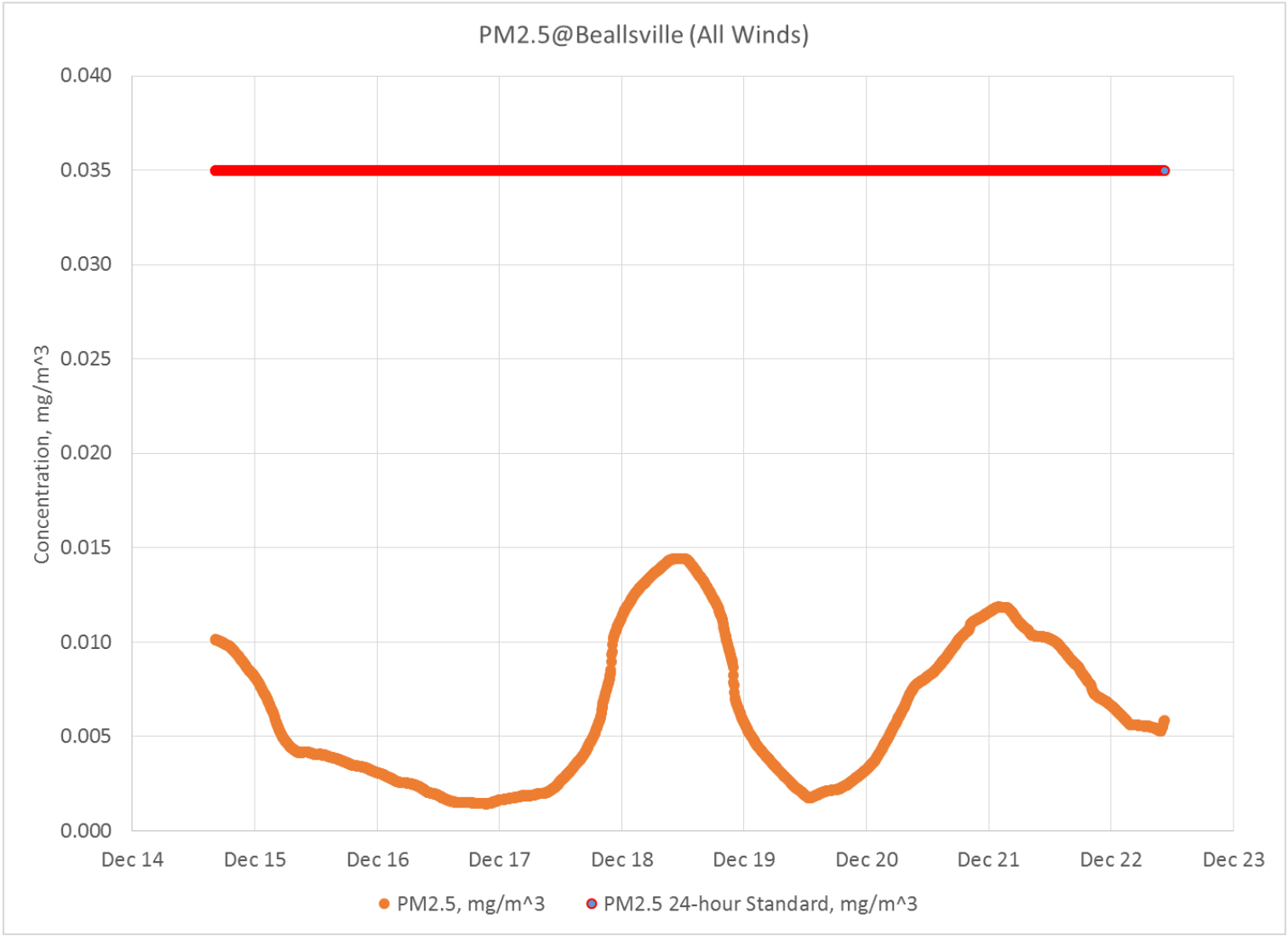


Figure 10B: Beallsville PM $_{2.5}$ (mg/m3)

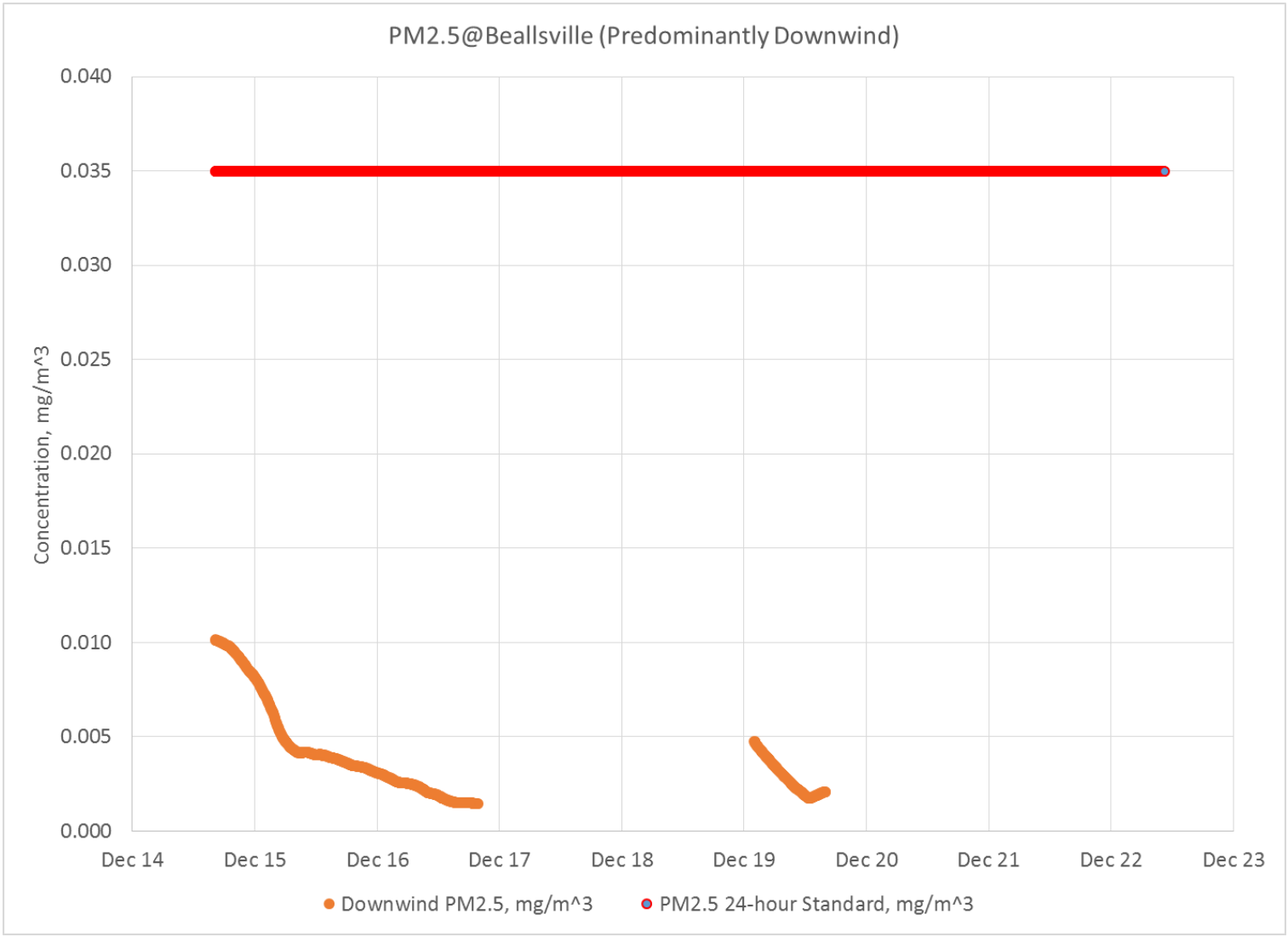


Figure 11A: Beallsville PM $_{10}$ (mg/m^3)

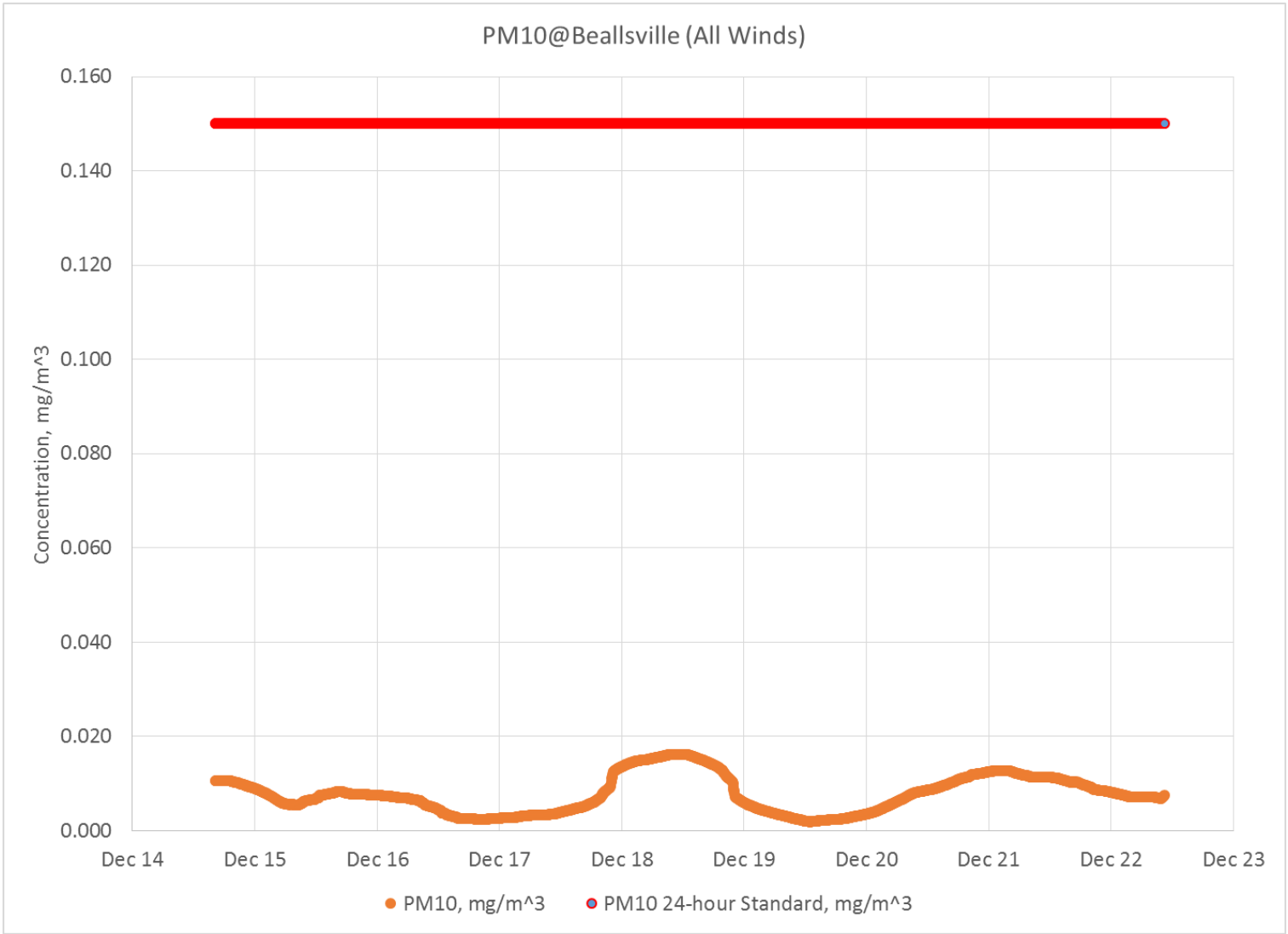


Figure 11B: Beallsville PM $_{10}$ (mg/m^3)

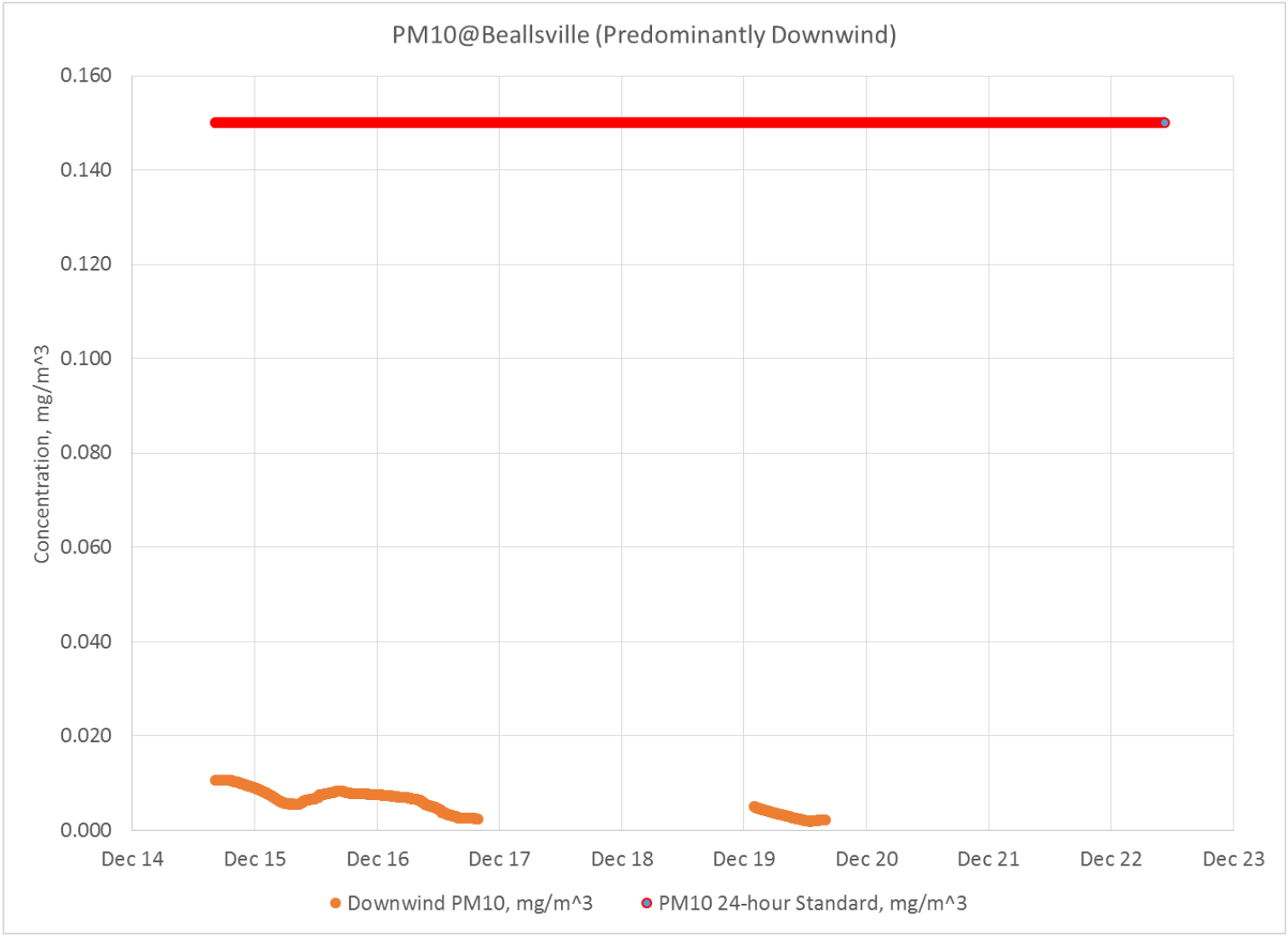


Figure 12A: Poolesville PM $_{10}$ (mg/m^3)

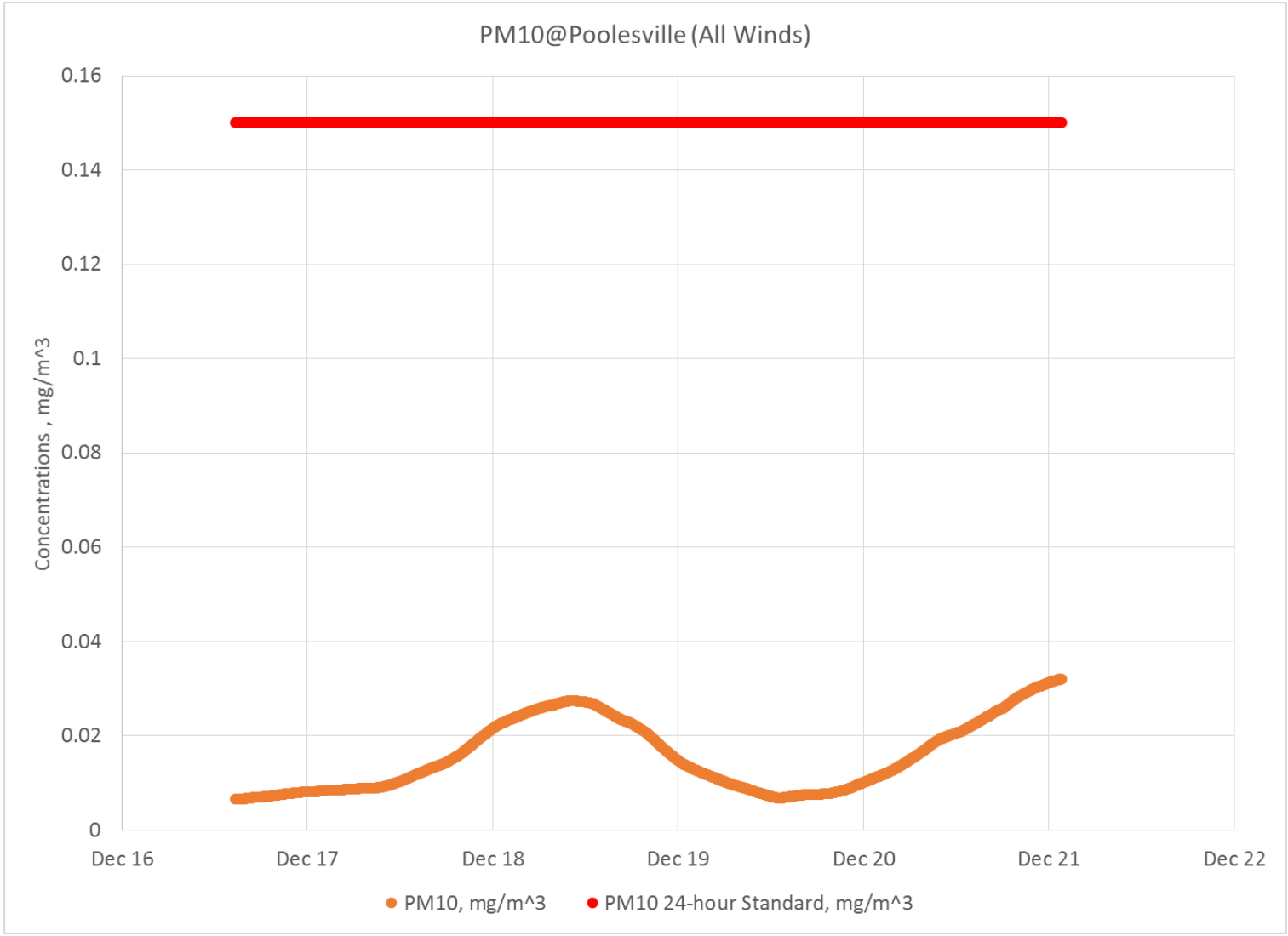
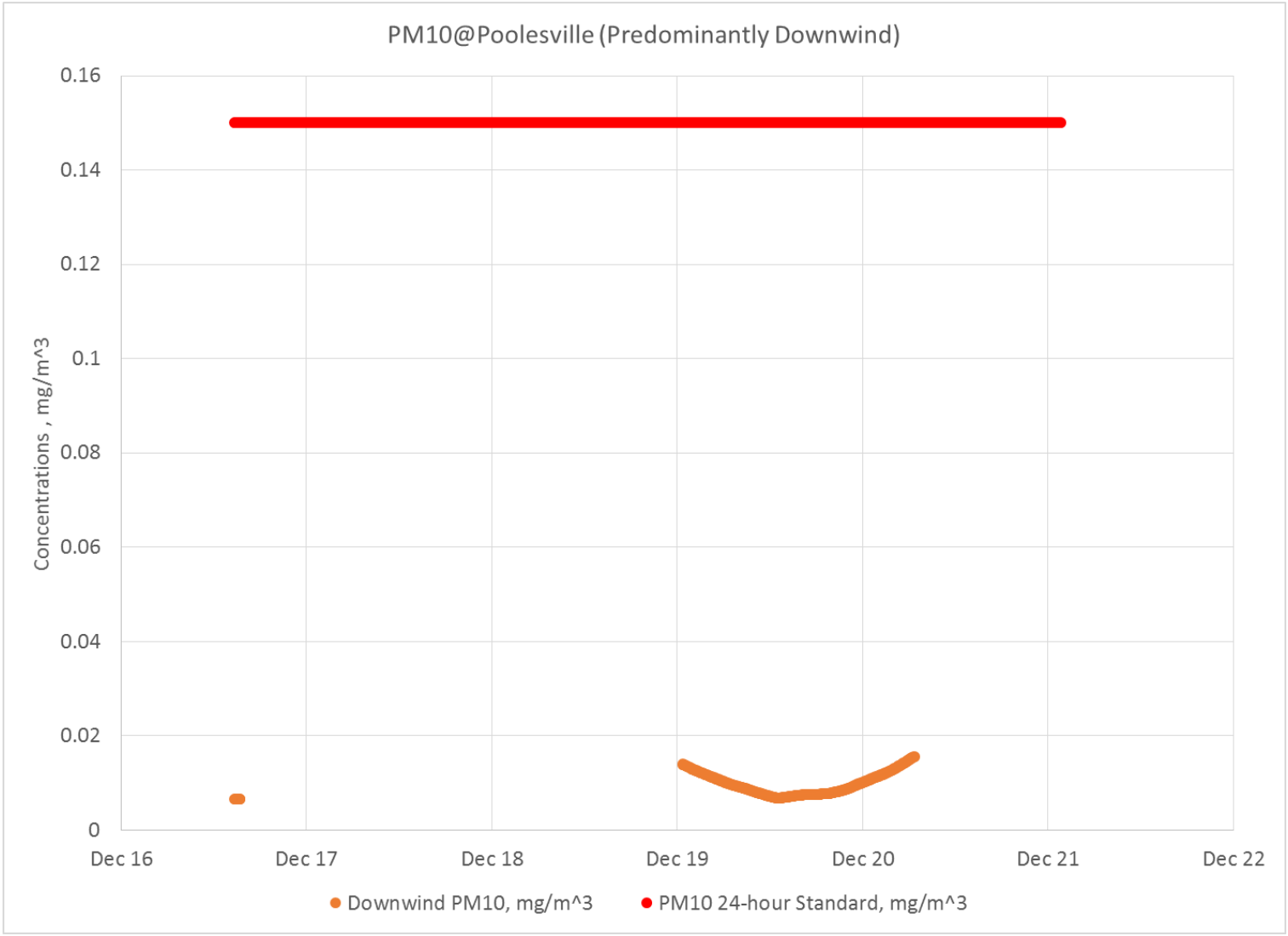


Figure 12B: Poolesville PM $_{10}$ (mg/m^3)



6.0 DISCUSSION OF RESULTS

6.1 Volatile Organics

Results provided in Table 1 indicate that thirteen of the sixty-two compounds analyzed were measured in the set of six ambient air samples. Results for the majority of these volatile organics were observed to be comparable across sampling sites. These observations suggest that the detected compounds (benzene, toluene, several chlorinated aliphatics and a number of chlorofluorocarbons) represent background concentrations in ambient air in the study region. These data do not support any influences attributable to the fire.

6.2 Polynuclear Aromatic Hydrocarbons (PAHs)

Results for PAHs are presented in Tables 2 and 3. Five of the twenty PAHs contained on the EPA Method TO 13-A target compound list were detected in the samples analyzed by CONTEST labs. The concentrations detected in these four samples were comparable. For example, concentrations observed for Day 2 samples collected at the Chiswell and Gothic Farm sites were nearly identical. Winds on Day 2 originated almost exclusively from the south and thus both sites were not influenced by the fire. These data most likely represent atmospheric background levels for PAHs in the region. On Day 1 of sampling, the Poolesville and Chiswell sampling locations were almost never downwind of the fire and their concentrations too were comparable to each other and the Day 2 results.

Results for the Day 1 sample at the Gothic Barn site, which was downwind of the fire, also show comparable concentrations to those measured at the other sites. There was, however, a wider variety of PAHs measured in this sample attributable to the PAHs target compound list used by SGS laboratory.

6.3 PCDDs/PCDFs

Results for the single 24-hour sampling event on December 15-16 at the Gothic Barn site are shown in Table 4. The fire remained in progress during a large portion of this sampling event. Based on the wind analysis, this site was downwind of the fire 78 % of the time during the sampling period. A total concentration of 10.0 pg/m^3 was measured in this sample representing total Cl_4-Cl_8 PCDDs/PCDFs. This concentration is higher than concentrations that have been measured in prior ambient air monitoring programs conducted by Montgomery County in the vicinity of the MCRRF. For example, mean concentrations of total Cl_4-Cl_8 PCDDs/PCDFs of 1.05 pg/m^3 and 1.40 pg/m^3 were measured in 2015 and 2008, respectively, at the Beallsville Fire Department. These sampling events were 30 days in duration, however, as opposed to the 24-hour sampling event at the Gothic Barn site. These data suggest that ambient air levels of

PCDDs/PCDFs at the Gothic Barn site were influenced by the fire during the Day 1 sampling event.[1, 2]

6.4 Metals

The measured metals concentrations, shown in Table 5, are largely comparable to the levels measured during the Fourth Operational Phase Ambient Monitoring Program conducted by the county in the winter of 2013-2014. This suggests that the data collected from December 15-17 likely reflect atmospheric background for the region. The highest concentrations for beryllium, chromium, lead and mercury were measured in the Day 1 Gothic Farm sample and may reflect some influences of the fire event. Among these compounds, there is a National Ambient Air Quality Standard (NAAQS) for lead of 150 ng/m^3 (24-hour time weighted average). The highest measured 24-hour lead concentration (7.69 ng/m^3 at the Gothic Barn) was well below the NAAQS.

6.5 Particulate

6.5.1 Total Suspended Particulate (TSP) – 24-Hour Sampling Results

The TSP 24-hour concentrations, shown in Table 5, ranged from 12.5 to 50.2 µg/m^3 across the set of five ambient air samples. The highest value of 50.2 µg/m^3 was reported for the Gothic Barn Day 1 sample. The remaining values ranged from 12.5 to 17.0 µg/m^3. All concentrations represent 24 hour average values and are significantly lower than the prior National Ambient Air Quality Standard (NAAQS) for TSP of 150 µg/m^3. With the exception of the Gothic Barn Day 1 results, TSP concentrations were consistent with values reported for the Lucketts School and Beallsville Fire Department sites during, the winter of 2013-2014 ambient monitoring program performed by Montgomery County (24.2 µg /m^3 and 16.8 µg /m^3 at the Lucketts, Virginia site and the Beallsville Fire Department site, respectively). As noted above, the Gothic Barn site on Day 1 was situated downwind of the fire 78 % of the time during the sampling period and the result at this location suggests an influence of the fire on the TSP concentration.[3]

6.5.2 PM_{10} and $PM_{2.5}$

PM_{10} and $PM_{2.5}$ data for each of the four monitoring sites are shown in relation to wind directional data in the series of plots provided in Appendix B of this report. The charts provided in Appendix B compare monitored PM_{10} and $PM_{2.5}$ concentrations (mg/m3) (5-minute readings) versus wind direction (degrees wind-blown from) (15-minute average). Concentrations are shown as blue triangles, and wind directions are shown as orange circles when all wind directions are plotted, or as gray circles when only predominantly downwind wind directions were plotted. The x-axis shows the date, where a "tick" mark indicates midnight (start of day).

[1] Fourth Operational Phase Ambient Air Monitoring Program, Winter 2013-2014 and 2014-2015 Final Report June 2016 Table 8-1: pg 47.
[2] An Inventory of Sources and Environmental Release of Dioxin – Like Compounds in the United States for Years 1987, 1995 and 2000, EPA/600/P-03/002 F November 2006.
[3] Fourth Operational Phase Ambient Air Monitoring Program, Winter 2013-2014 and 2014-2015, Final Report June 2016.

Those graphs show the granular level data from which figures in Section 5.6 are derived. Note that the PM graphs in Appendix B do not show wind speed, and highly variable wind directions are generally indicators of light wind speed. Site specific analyses of these data are provided in the discussion to follow.

Chiswell Farm:

The Chiswell Farm monitor was located 1.7 miles south/southeast of the fire. A wind direction of approximately 345 degrees would have been required to bring smoke directly from the fire to the monitor. The 24-hour period beginning 12/18/2016 1:00 PM was that during which the winds were most directly and consistently blowing from the fire toward the monitor. During this period, the PM_{10} and $PM_{2.5}$ were 0.00992 mg/m^3 and 0.00772 mg/m^3, respectively.

Poolesville Town Hall:

The Poolesville Town Hall PM_{10} monitor was located 4.5 miles southeast of the fire. A wind direction of approximately 330 degrees would have been required to bring smoke directly from the fire to the monitor. The 24-hour period beginning 12/18/2016 1:00 PM was that during which the winds were most directly and consistently blowing from the fire toward the monitor. During this period, the PM_{10} was 0.00671 mg/m^3.

Gothic Barn:

The Gothic Barn monitor was located 0.45 miles southeast of the fire. A wind direction of approximately 302 degrees would have brought smoke directly from the fire to the monitor. The 24-hour period beginning 12/15/2016 12:28 AM was that during which the winds were most directly and consistently blowing from the fire toward the monitor. During this period, the PM_{10} and $PM_{2.5}$ were 0.00850 mg/m_3 and 0.00645 mg/m^3, respectively. Overall, $PM_{2.5}$ data, and to a lesser extent the PM_{10} data indicate influence from the fire.

Beallsville Fire Station:

The Beallsville Fire Station monitor was located 2.8 miles southeast of the fire. A wind direction of approximately 302 degrees would have brought smoke directly from the fire to the monitor. The 24-hour period beginning 12/15/2016 12:23 AM was that during which the winds were most directly and consistently blowing from the fire toward the monitor. During this period, the PM_{10} and $PM_{2.5}$ were 0.00743 mg/m^3 and 0.00304 mg/m^3, respectively.

6.6 Acute Toxicity Evaluation

Acute Toxicity Evaluation

The potential for acute inhalation effects, based on exposure to metals, PCDDs/PCDFs (as 2, 3, 7, 8-TCDD-TEQ), PAHs and VOCs as measured in the monitored air, was evaluated. This was accomplished by comparing air concentrations of the monitored pollutants against their respective acute inhalation exposure criteria (AIEC). As previously described, all air samples

were collected on a 24-hour composite basis. Since there are limited exposure criteria available in the literature that are defined on a 24-hr basis, the acute values used for this comparison were obtained from CalEPA (CalEPA 2016) and the Department of Energy, Subcommittee for Consequence Assessment and Protective Action (SCAPA) Protective Action Criteria (PAC) for Chemicals database (SCAPA 2016). The SCAPA PAC dataset is a hierarchy-based system of the three common public exposure emergency response guideline systems: Acute Exposure Guideline Levels (AEGLs), Emergency Response Planning Guidelines (ERPGs) and Temporary Emergency Exposure Limits (TEELs).

The PAC dataset uses the following criteria in order of preference and is consistent with the USEPA Human Health Risk Assessment Protocol (HHRAP, 2005):

1. USEPA Acute Exposure Guideline Level-1 60 minute (AEGL-1) values,
2. USEPA Acute Exposure Guideline Level-1 60 minute (AEGL-1) Interim values,
3. AIHA Emergency Response Planning Guidelines, Level-1 (ERPG-1) values, and
4. Temporary Emergency Exposure Limits, Level-1 values (TEEL-1.)

Per the HHRAP recommendation, the CalEPA Acute Reference Exposure Levels (ARELs) are used as the first choice when available. For measured pollutants that lack a published AREL, the designated PAC Level-1 value was used. These values are designed to protect a variety of exposure groups including sensitive groups such as the elderly and children. In addition, they are intended to protect against a wide variety of endpoints such as mild discomfort (e.g. irritation of eyes, nose or respiratory tract) or mild health effects such as headaches. However these effects are not disabling and are short-term and reversible upon the exposure ending.

Table 7 shows the air sampling results in comparison with the appropriate AIEC. As discussed in the Results section, the VOC data do not support any influences attributable to the fire, but rather are considered to reflect background concentrations in the study region. Detections of beryllium, chromium, lead, mercury, and PCDDs/PCDFs measured in the Day 1 Gothic Farm sample may represent contributions attributable to the fire event. However, as shown in Table 7, all of the detected air concentrations were significantly lower than their respective AIEC, regardless of whether the sample was downwind or upwind of the fire location.

Table 7: Summary of Data and Acute Inhalation Exposure Criteria (AIEC)
Montgomery County Resource Recovery Facility - Post-Fire Evaluation

Sample:	Goth Day 1	Goth Day 2	Chiswell Day 1	Chiswell Day 2	Poolesville Day 1	Poolesville Day 2		
Predominant wind direction relative to fire location[1]:	Downwind	Upwind	Downwind	Upwind	Downwind	Upwind		
	Air	Air	Air	Air	Air	Air	AIEC	
	Concentration	Concentration	Concentration	Concentration	Concentration	Concentration	(Inhalation)	AIEC
Constituent	(mg/m^3)	(mg/m^3)	(mg/m^3)	(mg/m^3)	(mg/m^3)	(mg/m3)	(mg/m^3)	Source
Inorganics								
Arsenic	ND (< 0.00000103)	ND (< 0.00000104)	ND (< 0.00000104)	ND (< 0.00000104)	ND (< 0.00000102)	NA	0.0002	AREL CalEPA 2016
Beryllium	0.00000006	0.000000003	0.00000003	ND (< 0.00000003)	ND (< 0.00000003)	NA	0.0023	TEEL-1 SCAPA 2016
Cadmium	0.000000059	0.000000011	0.00000201	0.00000042	0.00000008	NA	0.1	AEGL-1 SCAPA 2016
Chromium	0.00000219	0.00000148	0.00000163	0.00000135	0.00000143	NA	1.5	TEEL-1 SCAPA 2016
Lead	0.00000769	0.00000152	0.00000211	0.00000163	0.00000146	NA	0.15	TEEL-1 SCAPA 2016
Mercury (as Elemental Hg)	0.00000015	ND (< 0.00000003)	0.00000004	ND (< 0.00000003)	0.00000003	NA	0.0006	AREL CalEPA 2016
Nickel	0.00000113	0.00000063	0.00000087	0.00000139	0.00000069	NA	4.5	TEEL-1 SCAPA 2016
2,3,7,8-TCDD	2.30E-10	NA	NA	NA	NA	NA	1.30E-04	TEEL-1 SCAPA 2016
PAHs								
Acenaphthene	0.00000033	ND (< 0.00000071)	ND (< 0.00000071)	ND (< 0.00000071)	ND (< 0.00000073)	NA	3.6	TEEL-1 SCAPA 2016
Acenaphthylene	0.000000201	ND (< 0.00000071)	ND (< 0.00000071)	ND (< 0.00000071)	ND (< 0.00000073)	NA	10	TEEL-1 SCAPA 2016
Anthracene	0.000000164	ND (< 0.00000071)	ND (< 0.00000071)	ND (< 0.00000071)	ND (< 0.00000073)	NA	48	TEEL-1 SCAPA 2016
Benzo(a)anthracene	0.000000158	ND (< 0.00000071)	ND (< 0.00000071)	ND (< 0.00000071)	ND (< 0.00000073)	NA	0.6	TEEL-1 SCAPA 2016
Benzo(a)pyrene	0.000000108	ND (< 0.00000071)	ND (< 0.00000071)	ND (< 0.00000071)	ND (< 0.00000073)	NA	0.6	TEEL-1 SCAPA 2016
Benzo(b)fluoranthene	0.00000023	ND (< 0.00000071)	ND (< 0.00000071)	ND (< 0.00000071)	ND (< 0.00000073)	NA	0.12	TEEL-1 SCAPA 2016
Benzo(e)fluoranthene (b)	0.00000012	ND (< 0.00000071)	ND (< 0.00000071)	ND (< 0.00000071)	ND (< 0.00000073)	NA	0.12	TEEL-1 SCAPA 2016
Benzo(k)fluoranthene (b)	0.000000114	ND (< 0.00000071)	ND (< 0.00000071)	ND (< 0.00000071)	ND (< 0.00000073)	NA	0.12	TEEL-1 SCAPA 2016
Benzo(ghi)perylene	0.000000128	ND (< 0.00000071)	ND (< 0.00000071)	ND (< 0.00000071)	ND (< 0.00000073)	NA	30	TEEL-1 SCAPA 2016
Chrysene	0.000000233	ND (< 0.00000071)	ND (< 0.00000071)	ND (< 0.00000071)	ND (< 0.00000073)	NA	0.6	TEEL-1 SCAPA 2016
Dibenzo(a,h)anthracene	0.000000034	ND (< 0.00000071)	ND (< 0.00000071)	ND (< 0.00000071)	ND (< 0.00000073)	NA	0.093	TEEL-1 SCAPA 2016
Fluoranthene	0.000000934	0.00000081	ND (< 0.00000071)	0.00000077	ND (< 0.00000073)	NA	8.2	TEEL-1 SCAPA 2016
Fluorene	0.000000966	0.00000077	ND (< 0.00000071)	0.00000097	ND (< 0.00000073)	NA	6.6	TEEL-1 SCAPA 2016
Indeno(1,2,3-cd)pyrene	0.000000116	ND (< 0.00000071)	ND (< 0.00000071)	ND (< 0.00000071)	ND (< 0.00000073)	NA	1.2	TEEL-1 SCAPA 2016
1-Methylnapthalene	NA	0.000003	0.0000021	0.0000031	0.0000023	NA	20	TEEL-1 SCAPA 2016
2-Methylnaphthalene	0.00000438	0.0000045	0.0000029	0.0000046	0.0000034	NA	9	TEEL-1 SCAPA 2016
Naphthalene	0.0000215	0.000021	0.000015	0.000021	0.000016	NA	79	TEEL-1 SCAPA 2016
Perylene (c)	3.02E-08	ND (< 0.00000071)	ND (< 0.00000071)	ND (< 0.00000071)	ND (< 0.00000073)	NA	30	TEEL-1 SCAPA 2016
Phenanthrene	0.00000263	0.0000019	0.0000017	0.0000026	0.0000016	NA	5.4	TEEL-1 SCAPA 2016
Pyrene	0.000000549	ND (< 0.00000071)	ND (< 0.00000071)	ND (< 0.00000071)	ND (< 0.00000073)	NA	0.15	TEEL-1 SCAPA 2016
VOCs								
Benzene	0.00052	0.00068	0.00041	0.00047	0.00058	0.00057	0.027	AREL CalEPA 2016
Carbon Tetrachloride	0.00045	0.00045	0.0004	0.00048	0.00046	0.00047	1.9	AREL CalEPA 2016
Chloromethane	0.00007	0.0011	0.00098	0.0012	0.0011	0.00099	311	ERPG-1 SCAPA 2016
Dichlorodifluoromethane (Freon 12)	0.0018	0.0018	0.0019	0.0019	0.0018	0.0017	14850	TEEL-1 SCAPA 2016
Ethyl acetate	ND (<0.00013)	0.0022	ND (<0.00013)	0.00043	ND (<0.00013)	ND (<0.00013)	4320	TEEL-1 SCAPA 2016
Heptane	ND (<0.00014)	0.00018	ND (<0.00014)	ND (<0.00014)	0.00016	0.00016	2050	TEEL-1 SCAPA 2016
2-Hexanone (MBK)	0.00022	0.00037	0.00023	0.00037	0.00021	0.00045	41	TEEL-1 SCAPA 2016
4-Methyl-2-pentanone (MIBK)	ND (<0.00014)	ND (<0.00014)	ND (<0.00014)	ND (<0.00014)	ND (<0.00014)	0.0002	308	TEEL-1 SCAPA 2016
Naphthalene	0.00027	0.00028	ND (<0.00018)	ND (<0.00018)	ND (<0.00018)	ND (<0.00018)	79	TEEL-1 SCAPA 2016
Tetrachloroethylene	0.00089	ND (<0.00024)	ND (<0.00024)	ND (<0.00024)	ND (<0.00024)	ND (<0.00024)	20	AREL CalEPA 2016
Toluene	0.00038	0.00066	0.00024	0.00041	0.0005	0.00065	37	AREL CalEPA 2016
Trichlorofluoromethane (Freon 11)	0.0013	0.0018	0.0013	0.0014	0.0017	0.0014	511	TEEL-1 SCAPA 2016
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	ND (<0.0011)	0.0014	ND (<0.0011)	ND (<0.0011)	0.0012	ND (<0.0011)	9588	TEEL-1 SCAPA 2016

[1]See Table 6 for Upwind and Downwind Frequency

(a) WHO-2005 TEQ (ND=DL; EMPC = EMPC)

(b) as Benzo(b)fluoranthene

(c) as Benzo(g,h,i)perylene

NA = Not Analyzed

ND = Not Detected

AIEC - Acute Inhalation Exposure Criteria

AREL - Acute Reference Exposure Level (1-hr exposure)

AEGL -1 Acute Exposure Guideline Level - 1 (1-hr exposure)

ERPG - 1 Emergency Response Planing Guideline - Level 1 (1 hr exposure)

TEEL-1 = Temporary Emergency Exposure Limit - Level 1 (1-hour exposure)

References:

California EPA (CalEPA) 2016. Office of Environmental Health Hazard Assessment (OEHHA) Acute, 8-hour and Chronic Reference Exposure Level (REL) Summary. June 28. Accessed on-line at: http://oehha.ca.gov/air/general-info/oehha-acute-8-hour-and-chronic-reference-exposure-level-rel-summary

Subcommittee for Consequence Assessment and Protective Action (SCAPA). 2016. Protective Action Criteria (PAC): Chemicals with AEGLs, ERPGs, & TEELs. May. Available for download at: https://energy.gov/ehss/protective-action-criteria-pac-aegls-erpgs-teels-rev-29-chemicals-concern-may-2016

U.S. Environmental Protection Agency (USEPA). 2005a. Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities. Final. EPA530-D-05-006. September.

7.0 FINDINGS AND CONCLUSIONS

- $PM_{2.5}$ and PM_{10} data at the Gothic Barn monitoring station indicated influences attributable to the fire.
- $PM_{2.5}$ and PM_{10} data also indicate contributions from other sources in the region and not attributable to the fire.
- Volatile organic compound levels are representative of atmospheric background for those compounds that were measured (13 of 62 target compounds.) Results did not indicate any effects from the fire.
- Polynuclear aromatic hydrocarbons (PAHs) concentrations found in all five (5) samples likely represent atmospheric background for the region in winter.
- Chlorinated dioxins and chlorinated furans (PCDDs/PCDFs) exceeding background levels found in the Gothic Barn Day 1 sample are most likely elevated due to the fire event.
- PCDDs/PCDFs concentrations (Cl_4 – Cl_8) of 10.0 pg/m^3 found in the Gothic Barn Day 1 sample are elevated above background concentrations representative of the region (1.05-1.40 pg/m^3)
- The lead concentration (7.69 ng/m^3) measured at the Gothic Barn during the Day 1 sample was elevated above atmospheric background for the region (2.0 ng/m^3) but significantly below the NAAQS for lead of 150 ng/m^3 (24 hour average).
- No evidence of a violation of a NAAQS was found in air downwind of the fire.
- No exceedance of any Acute Inhalation Exposure Criteria was observed, regardless of wind direction.

Appendix A

Glossary of Terms and Acronyms

GLOSSARY OF ACRONYMS

RRF – Resource Recovery Facility; a facility that processes waste converting it to energy to power homes and businesses.

MCRRF – Montgomery County Resource Recovery Facility, located in Dickerson, Maryland.

TSP – Total Suspended Particulate

PM10 – coarse particulate matter of diameter less than or equal to 10 micrometers (microns)

PM2.5 – fine particulate matter of diameter less than or equal to 2.5 micrometers (microns)

EPA – Environmental Protection Agency

PCDDs/PCDFs – Polychlorinated Dibenzo-p-Dioxins/Polychlorinated Dibenzofurans; Dioxins and furans consist of a class of 210 chlorinated organic compounds (i.e., PCDDs and PCDFs). Of these, 17 specific PCDD/PCDF compounds, called congeners, are considered to be toxic and have been assigned relative toxicity factors known as Toxic Equivalency Factors (TEFs). A TEF reflects the relative toxicity of an individual PCDD or PCDF compound compared to 2,3,7,8-TCDD, the most toxic and well-studied congener among the PCDDs/ PCDFs. The overall concentration of a sample is calculated by multiplying the concentration values for each of the 17 PCDDs/PCDFs by its TEF. The sum of the products of the TEFs and associated congener concentrations then becomes the 2,3,7,8-TCDD toxic equivalent (TEQ), a value which can be used to evaluate a sample containing a mixture of PCDDs/PCDFs. Many of the dioxin/furan results discussed in this report are expressed as TEQ values.

NAAQS – National Ambient Air Quality Standards; The Clean Air Act identifies two types of national ambient air quality standards. Primary standards provide public health protection, including protecting the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. EPA has set National Ambient Air Quality Standards for six principal pollutants, which are called "criteria" pollutants. Criteria pollutants include: carbon monoxide, lead, nitrogen dioxide, ozone, sulfur dioxide, and particulate matter.

CFR – Code of Federal Regulations

MDL – Method Detection Limit

MRL – Method Reporting Limit

HRGC-HRMS – High Resolution Gas Chromatograph-High Resolution Mass Spectrometer

QA/QC – Quality Assurance Quality Control

DATA QUALIFIERS

U – Reported concentration below the Method Detection Limit

ND – Nondetect result

J – Reported concentration is an estimate as a result of QA/QC review and/or the data validation process

UNITS

lpm – liters per minute

m – meters

m^3 **-** cubic meter

ng – nanogram (1 ng = 10^{-9} grams)

ug – microgram (1 ug = 10^{-6} grams)

pg – pictogram (1 pg = 10^{-12} grams); 1 pg = 10^{-6} ug

mL – milliliters

WIND DIRECTIONS

Wind Rose – a diagram that shows the relative frequency of how wind speed and wind direction are distributed at a particular location.

N – North; winds blowing from the north correspond to 348.46º to 360º to 11.25º

NNE – North Northeast; 11.26º to 33.45º

NE – Northeast; 33.46º to 55.95º

ENE – East Northeast; 55.96º to 78.45º

E – East; 78.46º to 100.95º

ESE – East Southeast; 100.96º to 123.45º

SE – Southeast; 123.46º to 145.95º

SSE – South Southeast; 145.96º to 168.45º

S – South; 168.46º to 190.95º

SSW – South Southwest; 190.96º to 213.45º

SW – Southwest; 213.46º to 235.95º

SSW – South Southwest; 235.96º to 258.45º

W – West; 258.46º to 280.95º

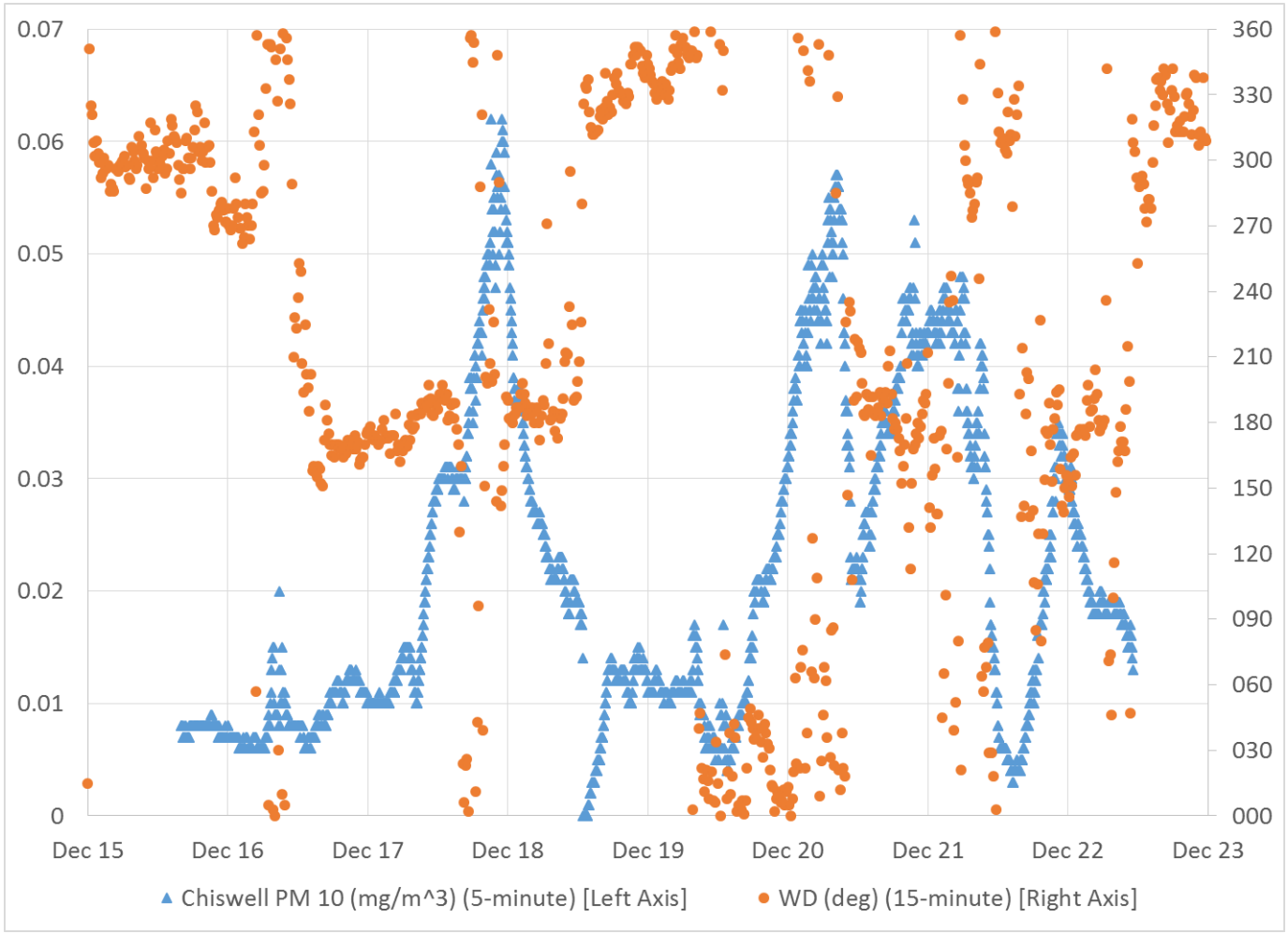
WNW – West Northwest; 280.96º to 303.45º

NW – Northwest; 303.46º to 325.95º

NNW – North Northwest; 325.96º to 348.45º

Appendix B

Particulate Concentrations as a Function of Wind Directional Data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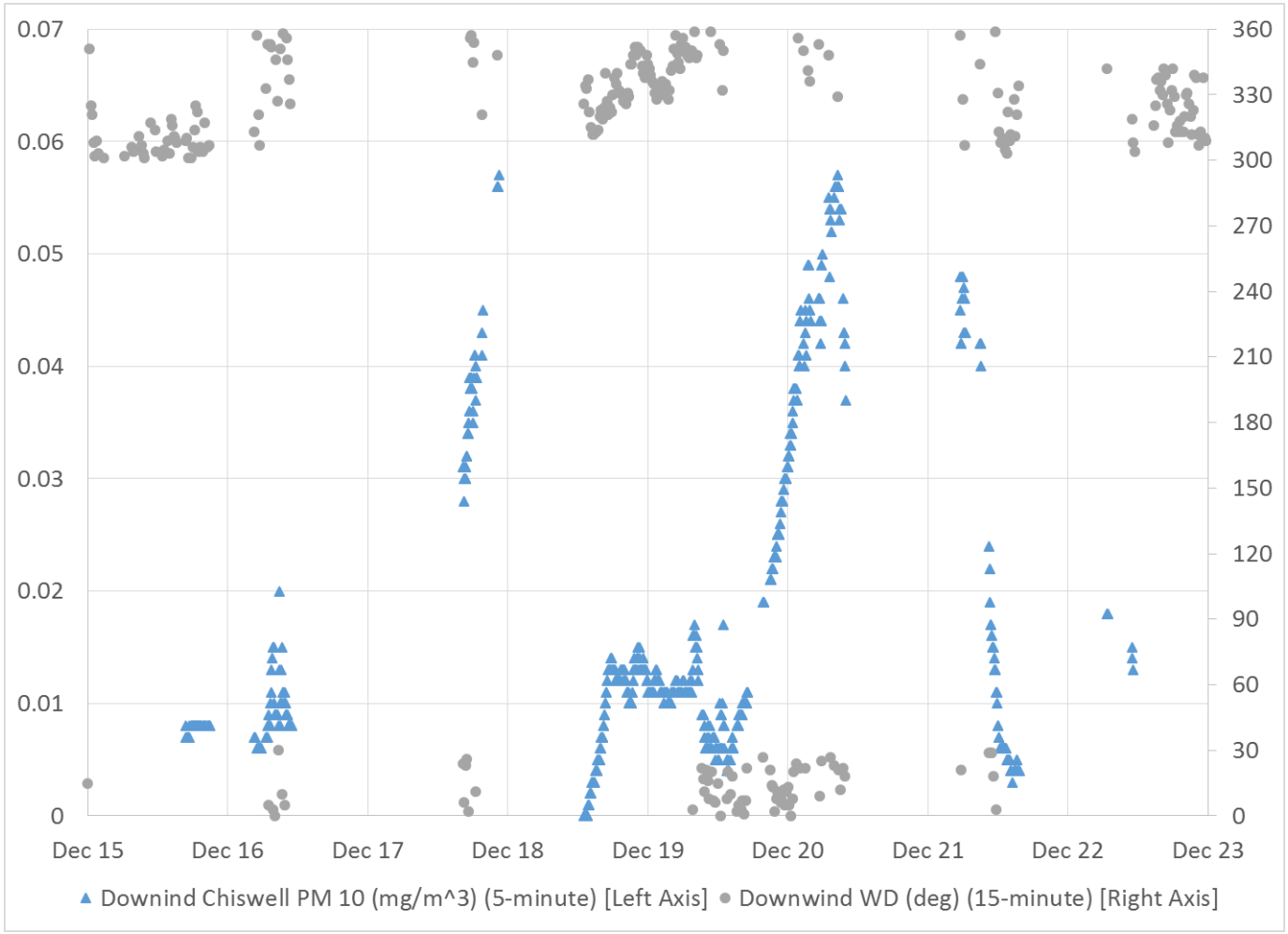
Chiswell PM 10 (mg/m^3) (5-minute) [Left Axis]
WD (deg) (15-minute) [Right Axis]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Downind Chiswell PM 10 (mg/m^3) (5-minute) [Left Axis]
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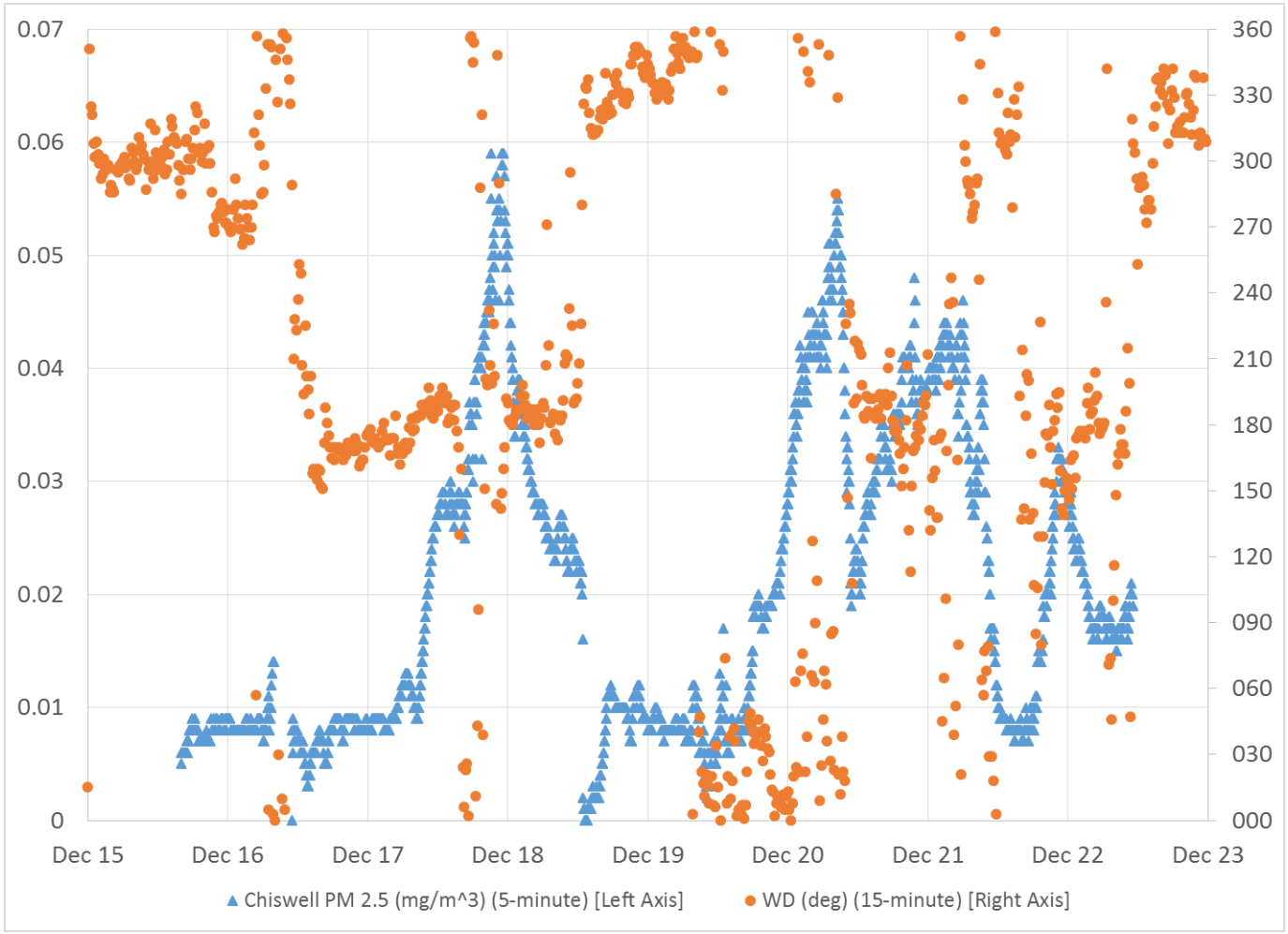
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Chiswell PM 2.5 (mg/m^3) (5-minute) [Left Axis]
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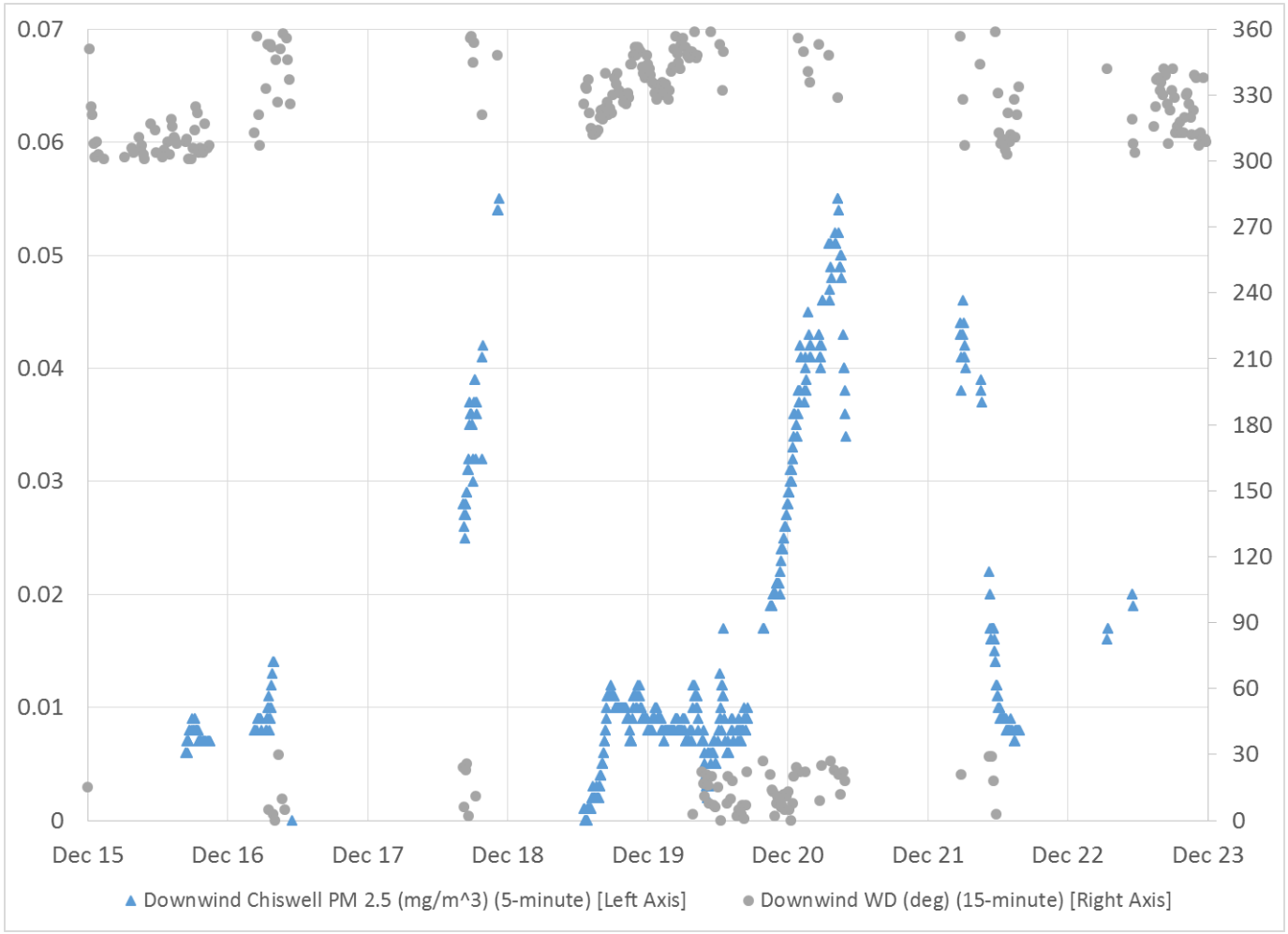
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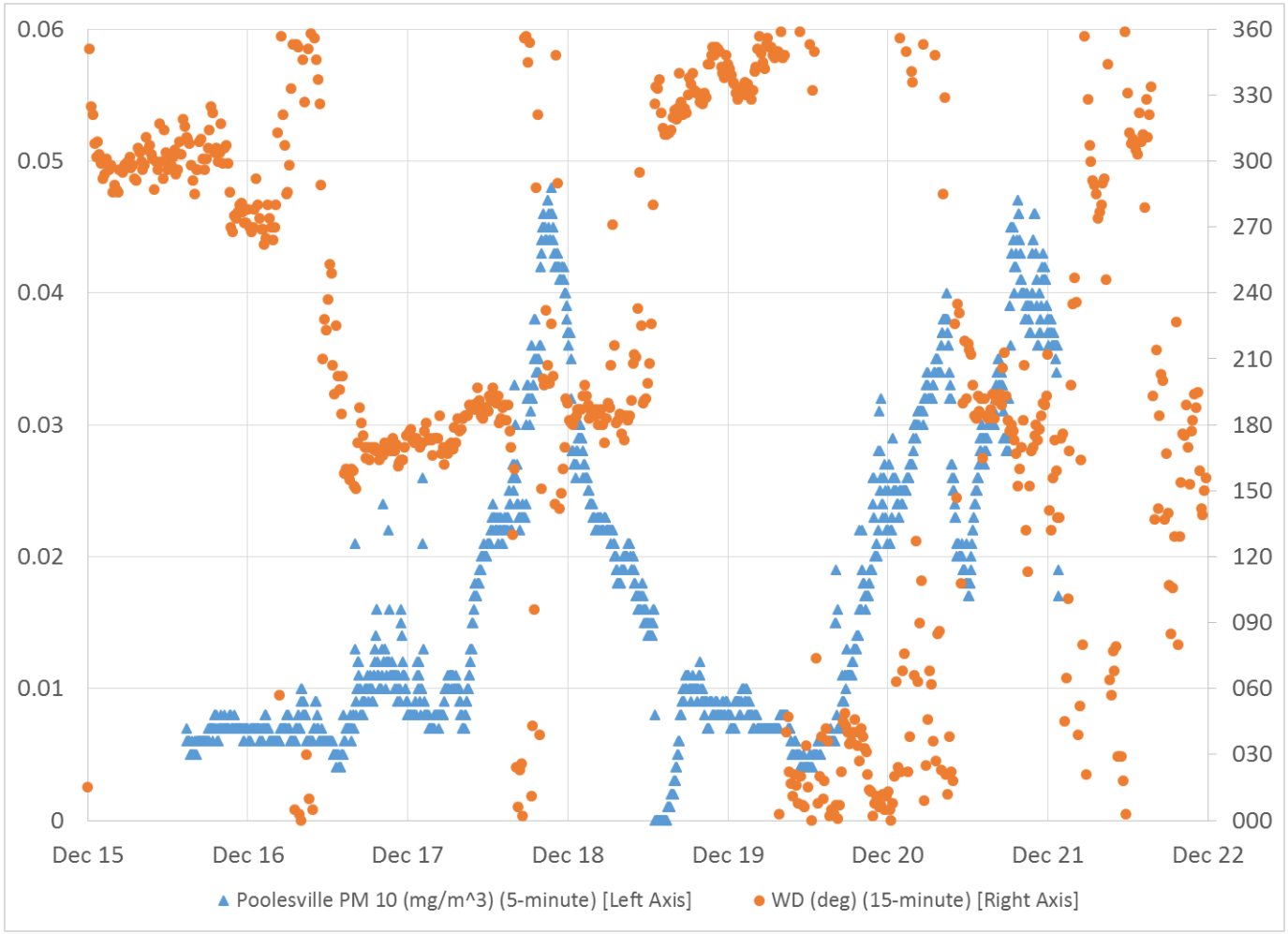
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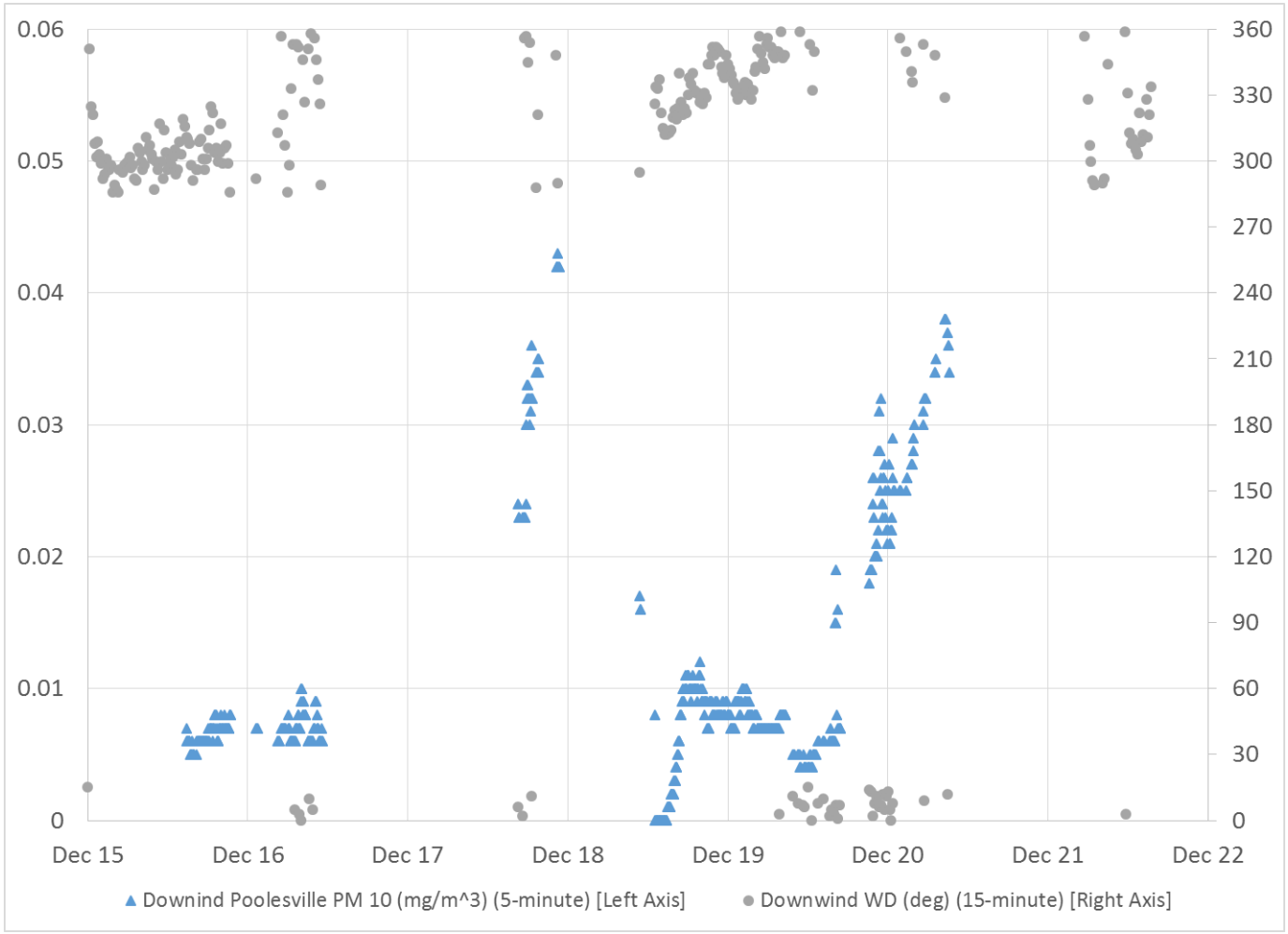
Poolesville PM 10 (mg/m^3) (5-minute) [Left Axis]
WD (deg) (15-minute) [Right Axis]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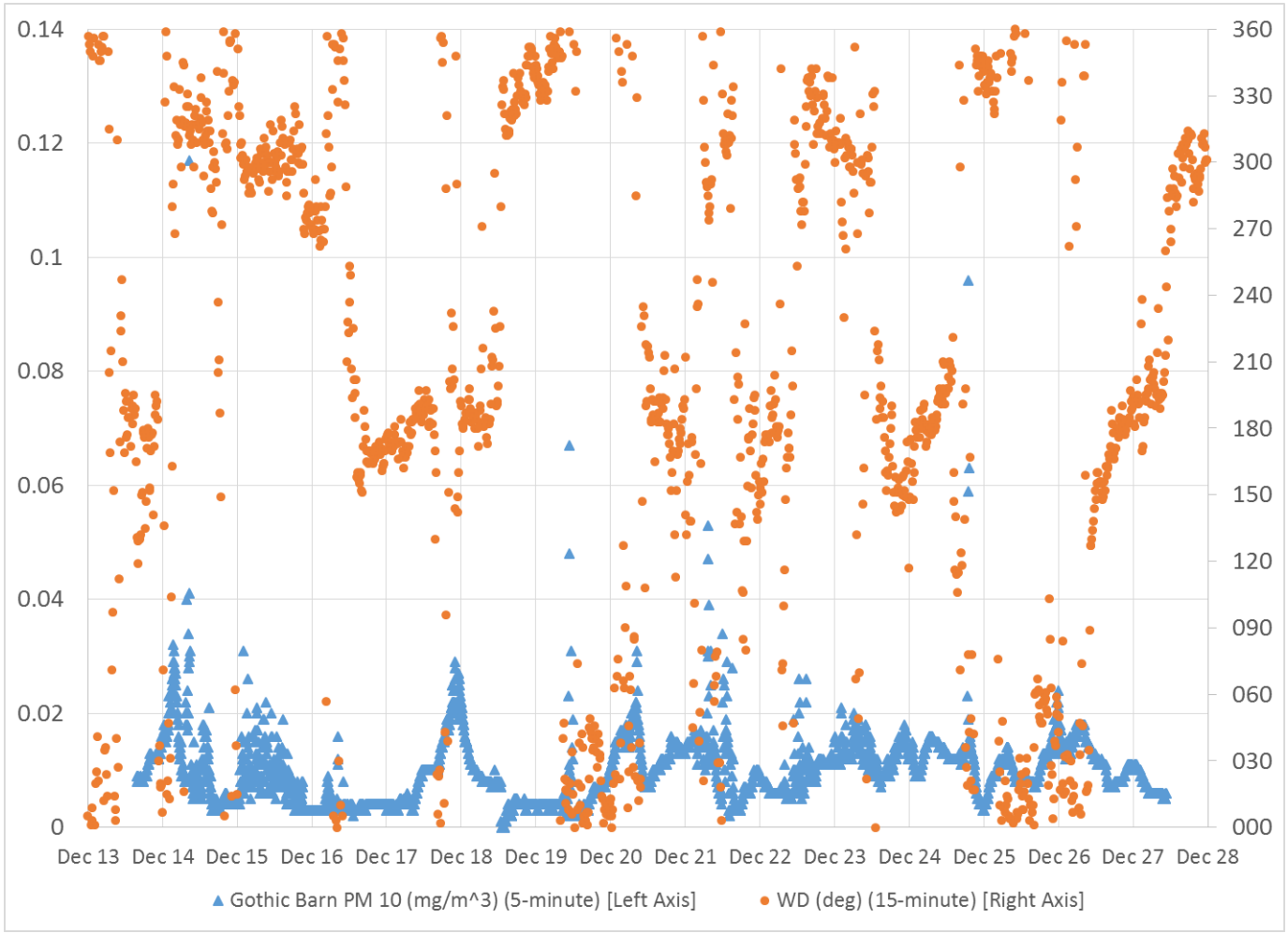
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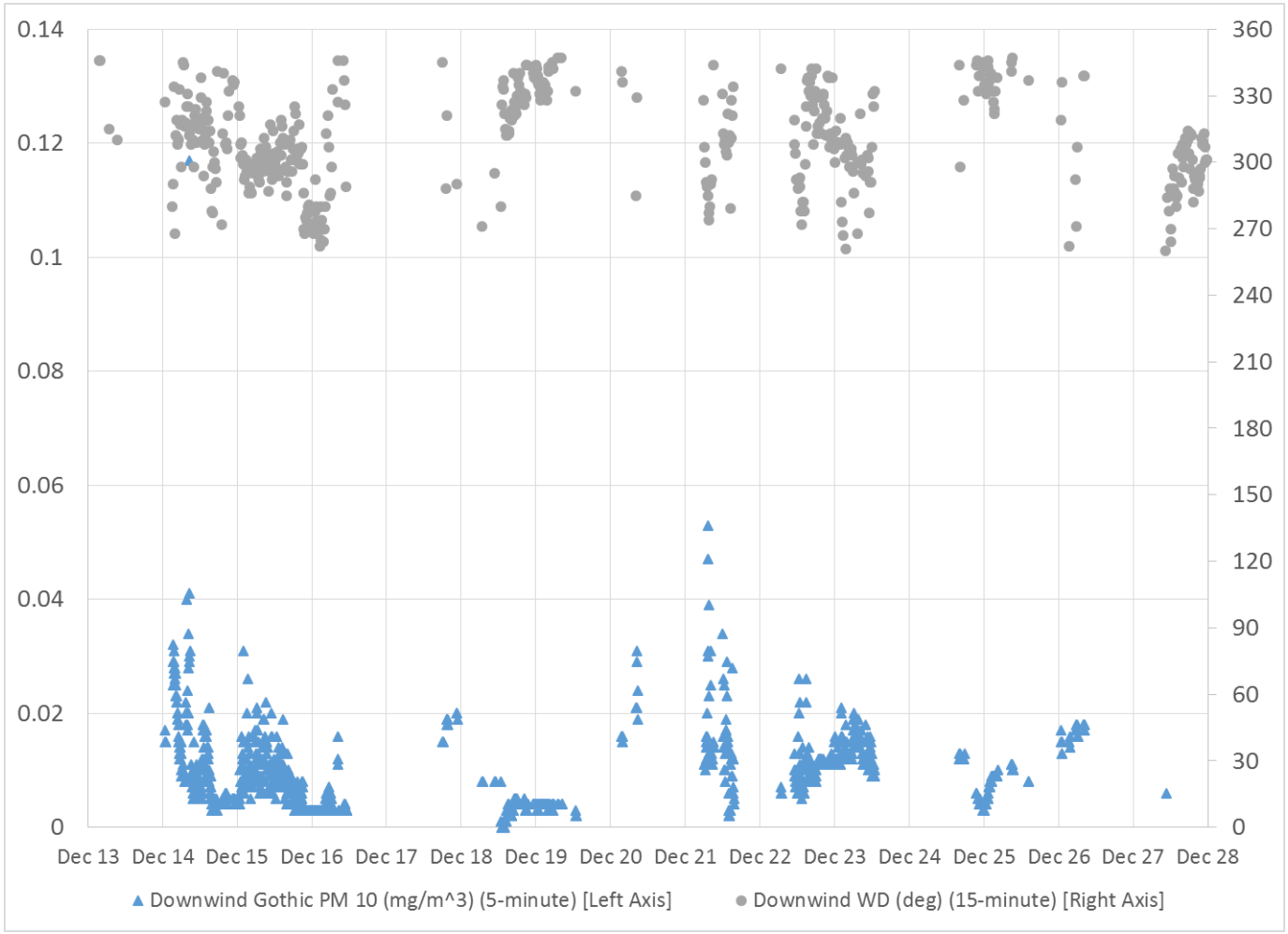
Gothic Barn PM 10 (mg/m^3) (5-minute) [Left Axis]
WD (deg) (15-minute) [Right Axis]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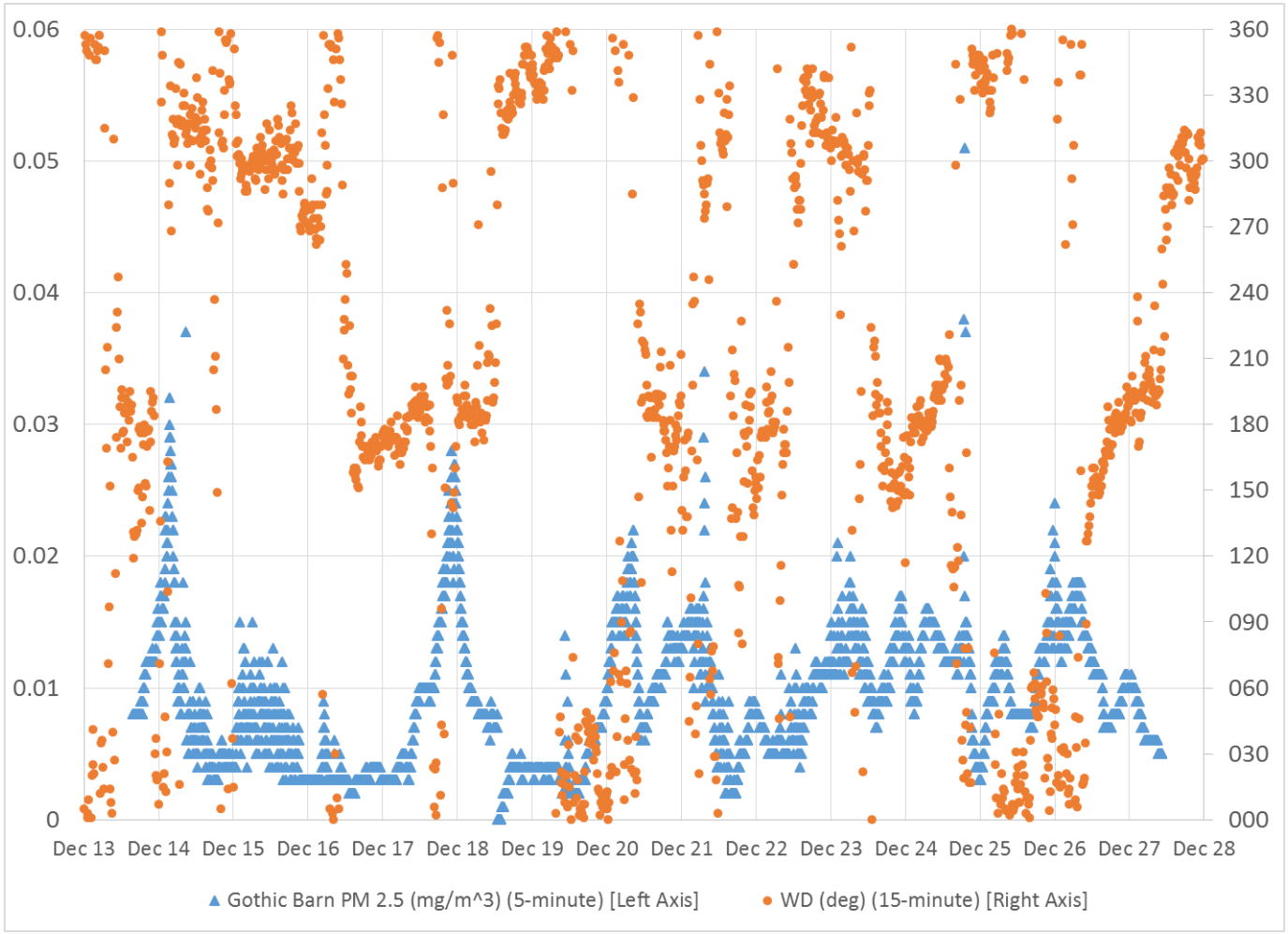
Downwind WD (deg) (15-minute) [Right Axis]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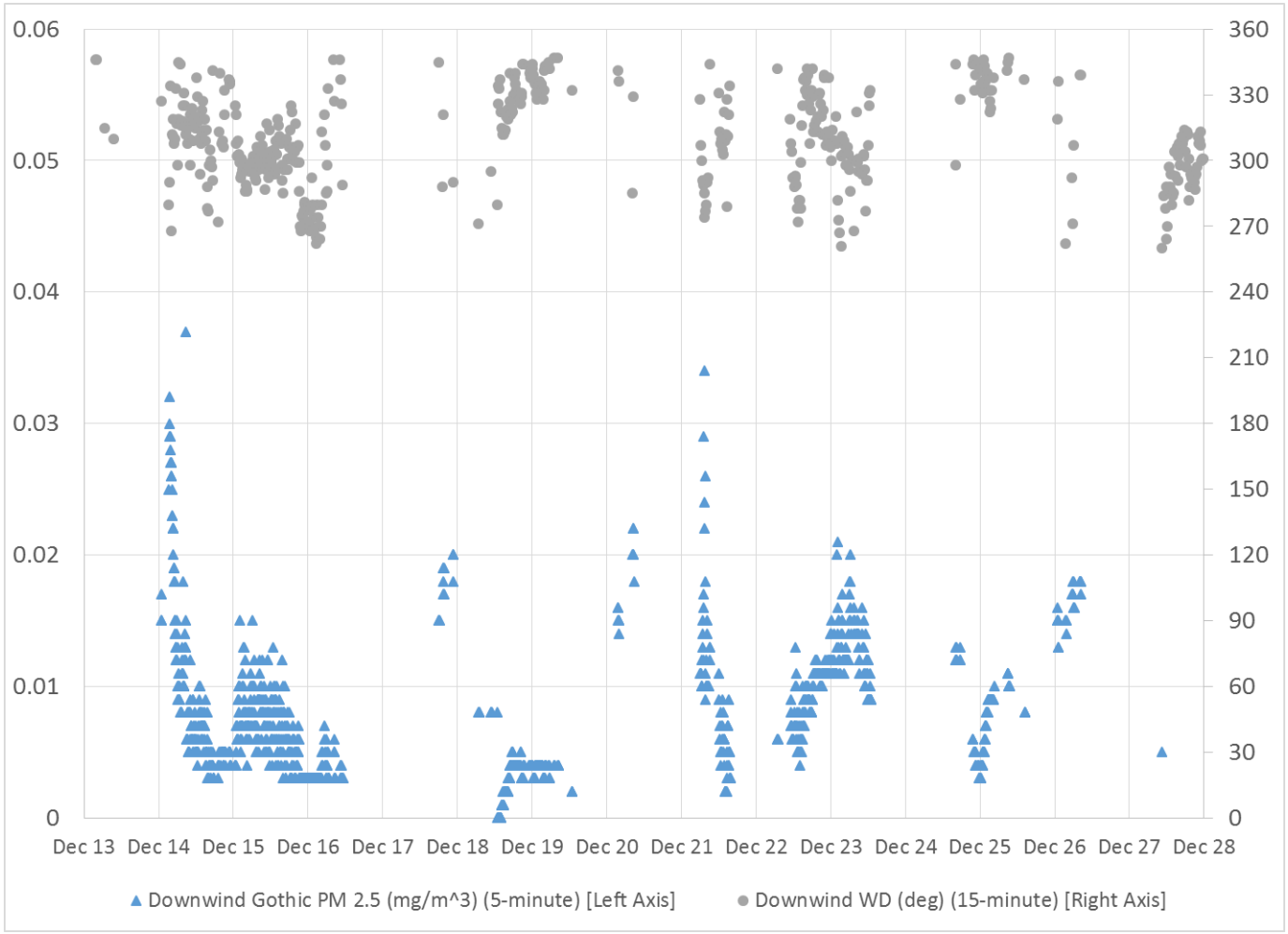
Gothic Barn PM 2.5 (mg/m^3) (5-minute) [Left Axis]
WD (deg) (15-minute) [Right Axis]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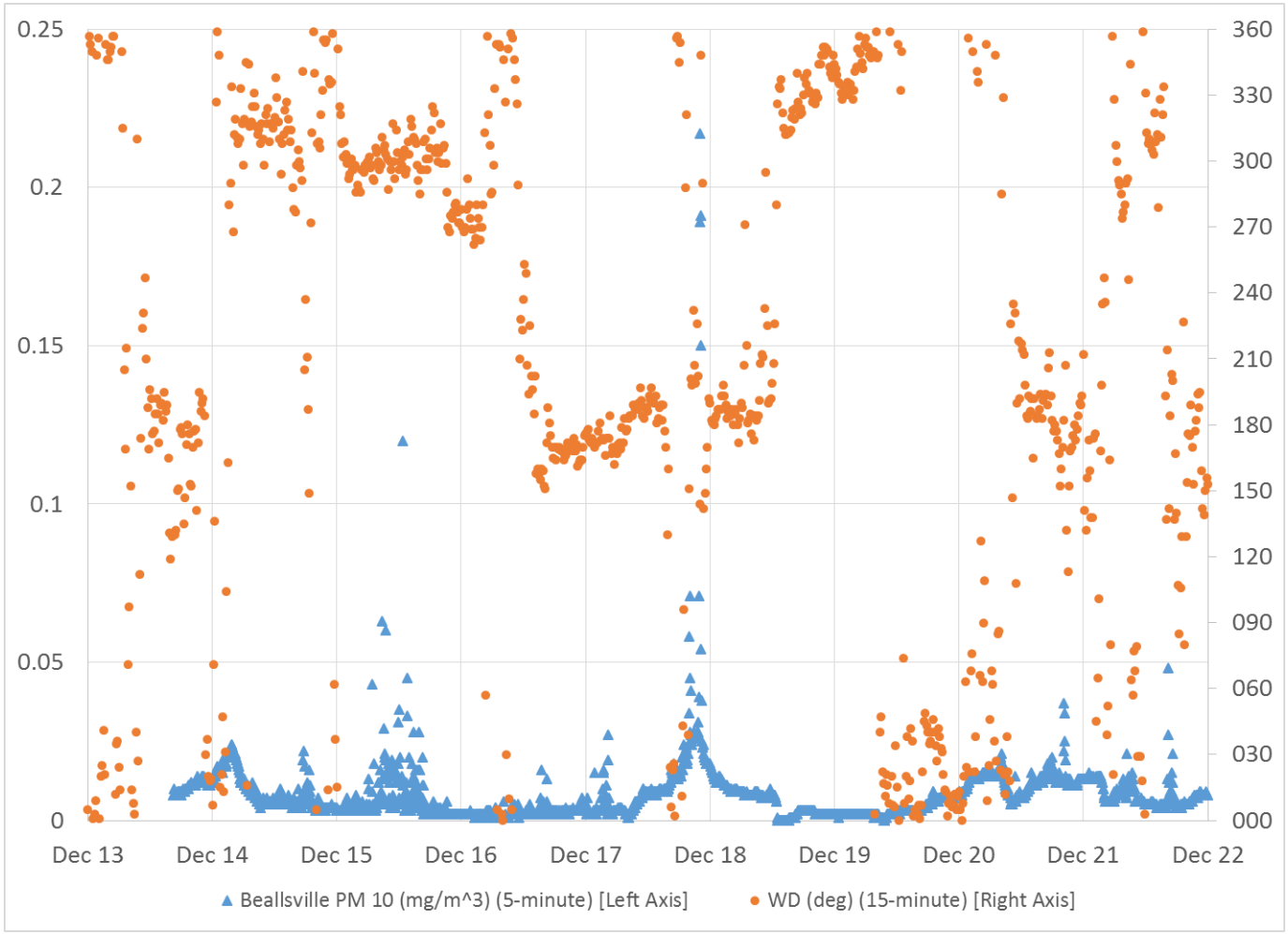
Downwind Gothic PM 2.5 (mg/m^3) (5-minute) [Left Axis]
Downwind WD (deg) (15-minute) [Right Axis]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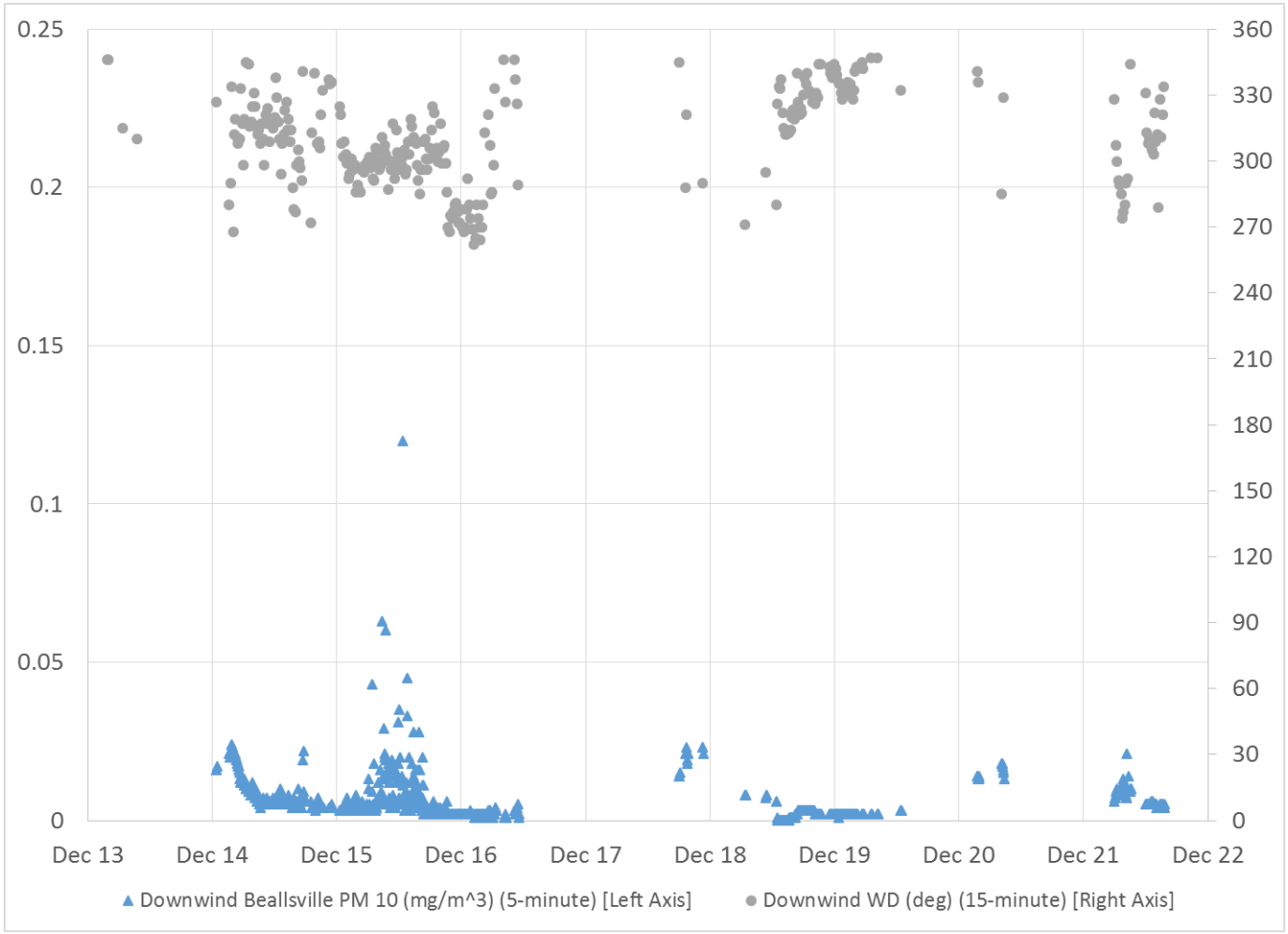
Beallsville PM 10 (mg/m^3) (5-minute) [Left Axis]
WD (deg) (15-minute) [Right Axis]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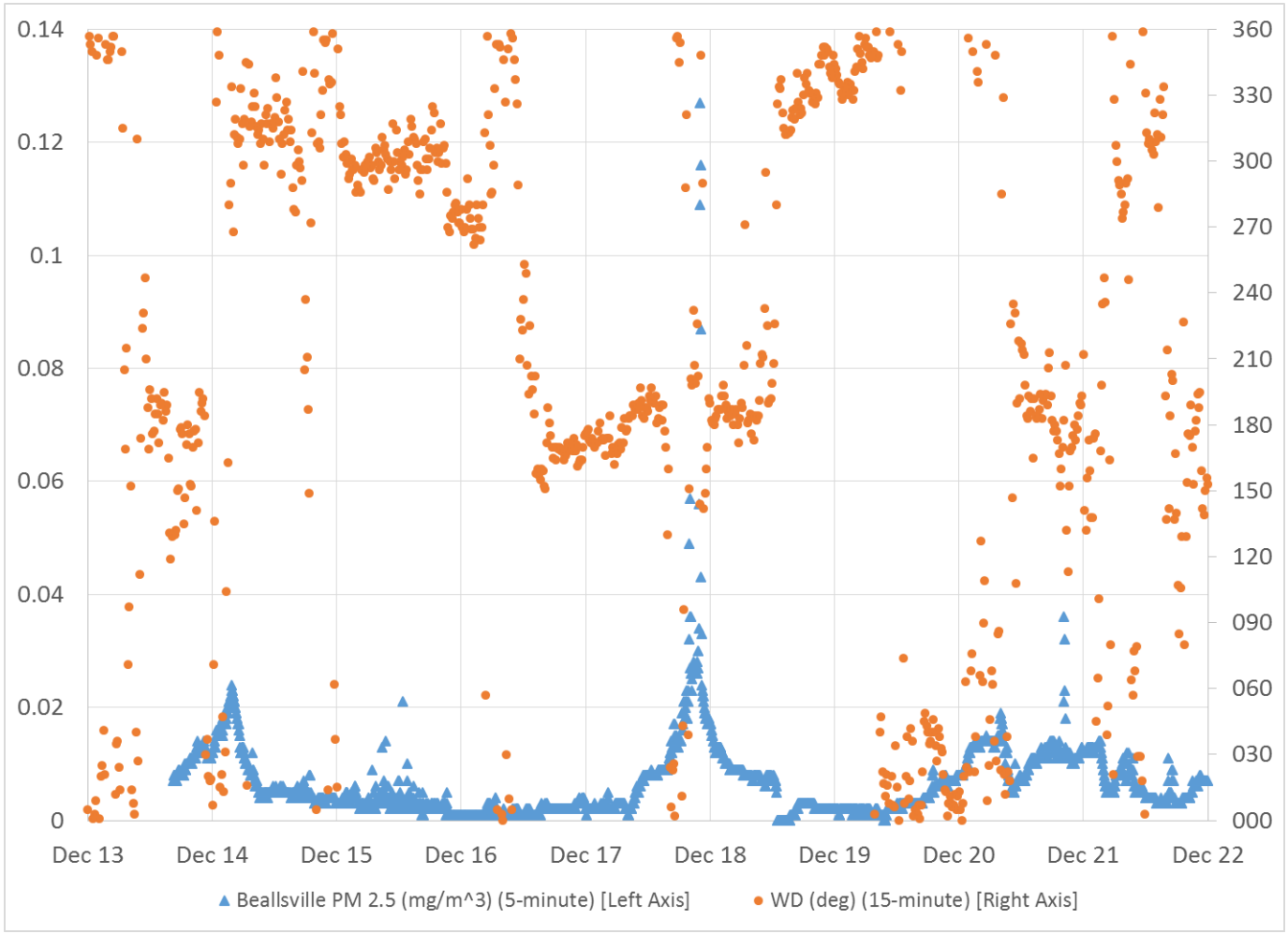
Downwind Beallsville PM 10 (mg/m^3) (5-minute) [Left Axis]
Downwind WD (deg) (15-minute) [Right Axis]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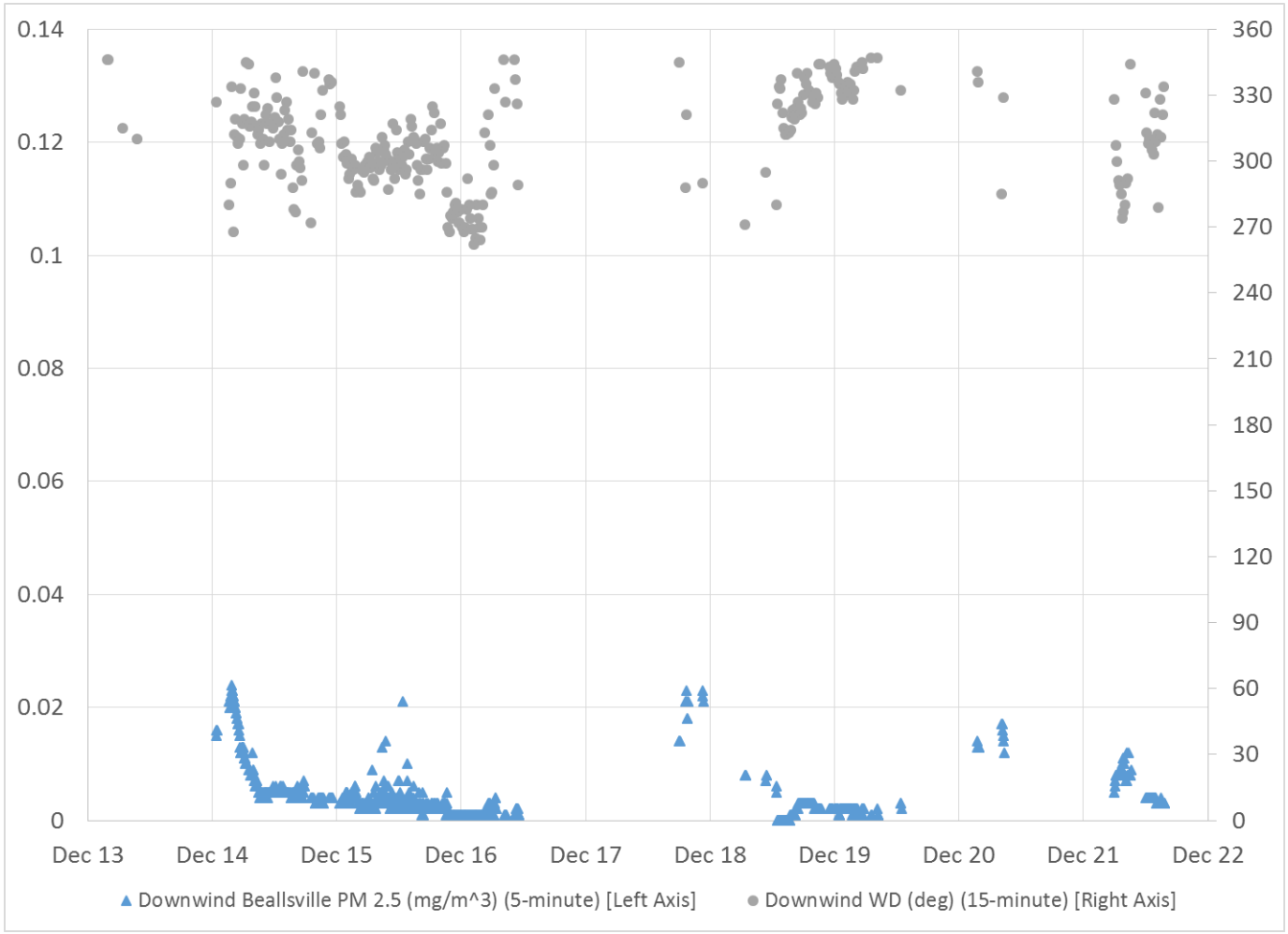
Beallsville PM 2.5 (mg/m^3) (5-minute) [Left Axis]
WD (deg) (15-minute) [Right Axis]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Downwind Beallsville PM 2.5 (mg/m^3) (5-minute) [Left Axis]
Downwind WD (deg) (15-minute) [Right Axis]

Appendix C

Lab Reports (Separate PDF File)