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September 30, 2016

Ms. Heather McTeer Toney
Regional Administrator
U.S. EPA, Region 4
Sam Nunn Atlanta Federal Center
61 Forsyth Street, SW
Atlanta, Georgia 30303

Dear Ms. McTeer Toney:

On behalf of the Commonwealth of Kentucky, the Energy and Environment Cabinet (Cabinet) submits the following list of recommendations for areas in Kentucky as to whether the areas are considered attainment (meeting the standard), nonattainment (not meeting the standard) or unclassifiable (area cannot be classified as meeting or not meeting the standard on the basis of available information) relative to the 2015 Ozone National Ambient Air Quality Standard. The Cabinet's submittal is in accordance with Section 107 (d)(1)(A) of the Clean Air Act and follows the U.S. EPA the February 25, 2016 memorandum and guidance, *"Area Designations for the 2015 Revised Ozone National Ambient Air Quality Standard."*

The Cabinet's recommendation is consistent with the EPA memorandum and applies the five factors the U.S. EPA recommended as a framework for area-specific analyses to support final nonattainment area boundary recommendations. Based on 2013-2015 ambient air monitoring data, along with the U.S. EPA guidance, the Cabinet recommends "nonattainment" designations for partial county boundaries in Boone, Campbell, and Kenton counties. All other areas in the Commonwealth are recommended to be designated as "unclassifiable/attainment."

The Cabinet appreciates the opportunity to provide the attached boundary recommendations for Kentucky. If you have any questions or comments concerning this matter, please contact Mr. Sean Alteri, Director, Division for Air Quality, at (502)782-6541.

Sincerely,

Charles G. Snavely
Secretary

Kentucky 2015 Ozone NAAQS Designation Recommendations

County	Recommended Designation	County	Recommended Designation
Adair	Unclassifiable/Attainment	Fayette	Unclassifiable/Attainment
Allen	Unclassifiable/Attainment	Fleming	Unclassifiable/Attainment
Anderson	Unclassifiable/Attainment	Floyd	Unclassifiable/Attainment
Ballard	Unclassifiable/Attainment	Franklin	Unclassifiable/Attainment
Barren	Unclassifiable/Attainment	Fulton	Unclassifiable/Attainment
Bath	Unclassifiable/Attainment	Gallatin	Unclassifiable/Attainment
Bell	Unclassifiable/Attainment	Garrard	Unclassifiable/Attainment
Boone (partial)	Nonattainment	Grant	Unclassifiable/Attainment
Bourbon	Unclassifiable/Attainment	Graves	Unclassifiable/Attainment
Boyd	Unclassifiable/Attainment	Grayson	Unclassifiable/Attainment
Boyle	Unclassifiable/Attainment	Green	Unclassifiable/Attainment
Bracken	Unclassifiable/Attainment	Greenup	Unclassifiable/Attainment
Breathitt	Unclassifiable/Attainment	Hancock	Unclassifiable/Attainment
Breckinridge	Unclassifiable/Attainment	Hardin	Unclassifiable/Attainment
Bullitt	Unclassifiable/Attainment	Harlan	Unclassifiable/Attainment
Butler	Unclassifiable/Attainment	Harrison	Unclassifiable/Attainment
Caldwell	Unclassifiable/Attainment	Hart	Unclassifiable/Attainment
Calloway	Unclassifiable/Attainment	Henderson	Unclassifiable/Attainment
Campbell (partial)	Nonattainment	Henry	Unclassifiable/Attainment
Carlisle	Unclassifiable/Attainment	Hickman	Unclassifiable/Attainment
Carroll	Unclassifiable/Attainment	Hopkins	Unclassifiable/Attainment
Carter	Unclassifiable/Attainment	Jackson	Unclassifiable/Attainment
Casey	Unclassifiable/Attainment	Jefferson	Unclassifiable/Attainment
Christian	Unclassifiable/Attainment	Jessamine	Unclassifiable/Attainment
Clark	Unclassifiable/Attainment	Johnson	Unclassifiable/Attainment
Clay	Unclassifiable/Attainment	Kenton (partial)	Nonattainment
Clinton	Unclassifiable/Attainment	Knott	Unclassifiable/Attainment
Crittenden	Unclassifiable/Attainment	Knox	Unclassifiable/Attainment
Cumberland	Unclassifiable/Attainment	LaRue	Unclassifiable/Attainment
Daviess	Unclassifiable/Attainment	Laurel	Unclassifiable/Attainment
Edmonson	Unclassifiable/Attainment	Lawrence	Unclassifiable/Attainment
Elliot	Unclassifiable/Attainment	Lee	Unclassifiable/Attainment
Estill	Unclassifiable/Attainment	Leslie	Unclassifiable/Attainment

County	Recommended Designation	County	Recommended Designation
Letcher	Unclassifiable/Attainment	Owen	Unclassifiable/Attainment
Lewis	Unclassifiable/Attainment	Owsley	Unclassifiable/Attainment
Lincoln	Unclassifiable/Attainment	Pendleton	Unclassifiable/Attainment
Livingston	Unclassifiable/Attainment	Perry	Unclassifiable/Attainment
Logan	Unclassifiable/Attainment	Pike	Unclassifiable/Attainment
Lyon	Unclassifiable/Attainment	Powell	Unclassifiable/Attainment
McCracken	Unclassifiable/Attainment	Pulaski	Unclassifiable/Attainment
McCreary	Unclassifiable/Attainment	Robertson	Unclassifiable/Attainment
McLean	Unclassifiable/Attainment	Rockcastle	Unclassifiable/Attainment
Madison	Unclassifiable/Attainment	Rowan	Unclassifiable/Attainment
Magoffin	Unclassifiable/Attainment	Russell	Unclassifiable/Attainment
Marion	Unclassifiable/Attainment	Scott	Unclassifiable/Attainment
Marshall	Unclassifiable/Attainment	Shelby	Unclassifiable/Attainment
Martin	Unclassifiable/Attainment	Simpson	Unclassifiable/Attainment
Mason	Unclassifiable/Attainment	Spencer	Unclassifiable/Attainment
Meade	Unclassifiable/Attainment	Taylor	Unclassifiable/Attainment
Menifee	Unclassifiable/Attainment	Todd	Unclassifiable/Attainment
Mercer	Unclassifiable/Attainment	Trigg	Unclassifiable/Attainment
Metcalfe	Unclassifiable/Attainment	Trimble	Unclassifiable/Attainment
Monroe	Unclassifiable/Attainment	Union	Unclassifiable/Attainment
Montgomery	Unclassifiable/Attainment	Warren	Unclassifiable/Attainment
Morgan	Unclassifiable/Attainment	Washington	Unclassifiable/Attainment
Muhlenberg	Unclassifiable/Attainment	Wayne	Unclassifiable/Attainment
Nelson	Unclassifiable/Attainment	Webster	Unclassifiable/Attainment
Nicholas	Unclassifiable/Attainment	Whitley	Unclassifiable/Attainment
Ohio	Unclassifiable/Attainment	Wolfe	Unclassifiable/Attainment
Oldham	Unclassifiable/Attainment	Woodford	Unclassifiable/Attainment

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Introduction

On October 1, 2015, the U.S. Environmental Protection Agency (EPA) promulgated a revised National Ambient Air Quality Standard (NAAQS) for the 8-hour ozone standard from the previous 0.075 ppm (80 FR 65292). Both the primary and secondary standards were lowered to 0.070 parts per million (ppm). The primary standard provides public health protection, particularly for vulnerable populations such as children, older adults, people with asthma and other lung diseases and others with adverse health effects. The secondary standard provides public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation and buildings. The EPA based this decision on current health research associated with ozone exposure, which identified that the 2008 ozone standard was not sufficient in protecting public health and welfare.

Under section 107(d) of the Clean Air Act (CAA), states are required to submit area designation recommendations to the EPA no later than one year after promulgation of the new or revised NAAQS. The date of the required submission by states for the current ozone standard is October 1, 2016. This document presents the Kentucky Energy and Environment Cabinet's recommendations regarding attainment and nonattainment designations and boundaries for the 2015 ozone NAAQS, as required by Section 107(d)(1)(A) of the CAA.

The EPA issued an attachment in their February 25, 2016 memorandum "Area Designations for the 2015 Ozone National Ambient Air Quality Standards." The attachment provided five factors the EPA recommended as a framework for area-specific analyses to support nonattainment area boundary recommendations and final boundary determinations. The factors are:

1. Air quality data
2. Emissions and emissions-related data
3. Meteorological data
4. Geography/topography
5. Jurisdictional boundaries

These factors were used to evaluate whether an area should be designated as attainment (meeting the standard), nonattainment (not meeting the standard) or unclassifiable (area cannot be classified as meeting or not meeting the standard on the basis of available information).

Kentucky has ozone monitors located in 30 counties throughout the State. Examination of the 2013-2015 design values indicated that one (1) monitor is not attaining the revised 8-hour ozone NAAQS. The design value for the monitor located in Campbell County, Kentucky is 0.071 ppm which is above the 2015 ozone standard. All other monitors in Kentucky are attaining the standard based on certified and quality assured data for 2013-2015.

The EPA guidance states that a nonattainment area must include not only the violating monitor, but any surrounding areas that may be contributing to the violating monitor as well. In Kentucky, the violating monitor is located in Campbell County, which is part of the Cincinnati, OH-KY-IN Core Based Statistical Area (CBSA). The Cincinnati, OH-KY-IN CBSA encompasses three states and fifteen counties. It includes Dearborn, Ohio, and Union Counties in Indiana; Brown, Butler, Clermont, Hamilton and Warren Counties in Ohio; and Boone,

Bracken, Campbell, Gallatin, Grant, Kenton and Pendleton Counties in Kentucky. Figure 1 shows the Kentucky counties located in the Cincinnati, OH-KY-IN CBSA.

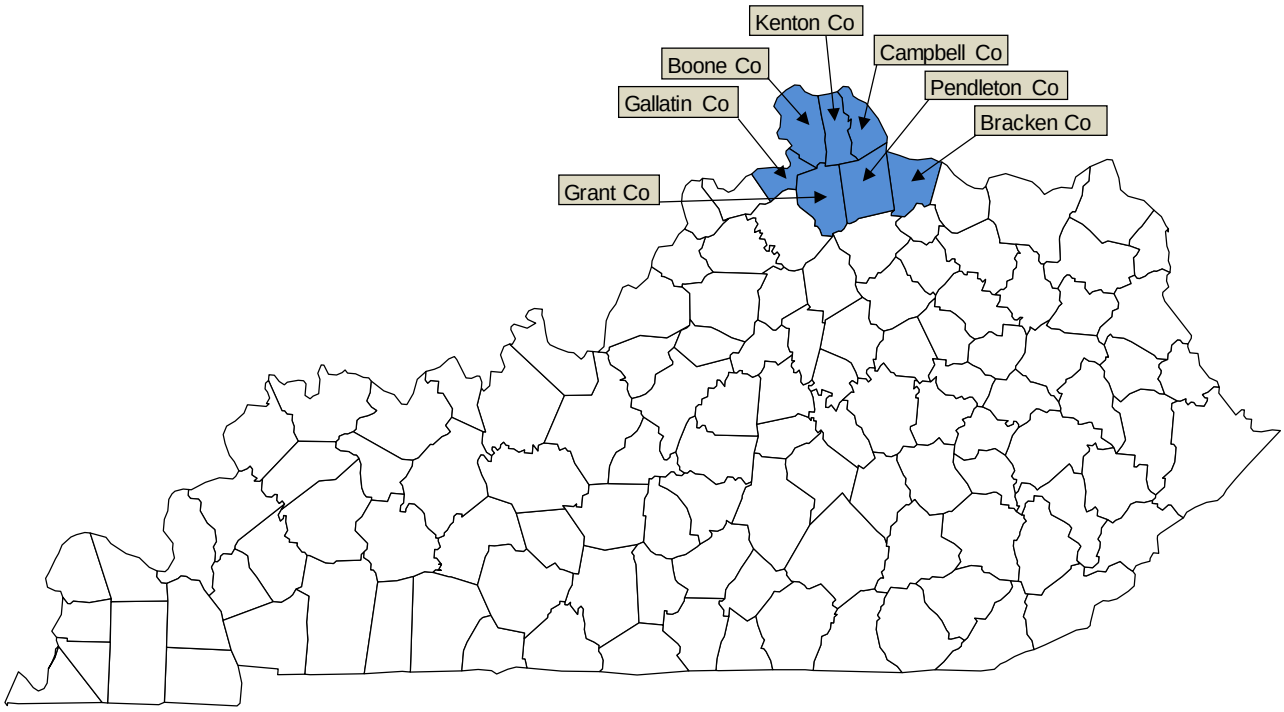


Figure 1: Kentucky Portion of the Cincinnati, OH-KY-IN CBSA

Designation Recommendation

Based on certified and quality assured ozone monitoring data for 2013-2015, and using the EPA recommended factors for analysis, Kentucky recommends portions of the following Kentucky counties be designated as nonattainment for the revised 8-hour ozone standard: Boone, Campbell, and Kenton. Kentucky recommends a designation of unclassifiable/attainment for the remaining counties in the state. Kentucky is not making recommendations regarding counties in Indiana or Ohio.

The following sections of this document provide a description and discussion of Kentucky's application of the five factors from the EPA's guidance in determination of the recommended nonattainment and unclassifiable/attainment areas. Also included, are the specific census tracts for Boone, Campbell, and Kenton counties for the partial nonattainment area.

Boone County, KY

Air Quality

Pursuant to 40 CFR 50:19 (b) and (d) the 8-hour primary and secondary NAAQS are met at an ambient air quality monitoring site when the 3-year average of the annual fourth-highest daily maximum 8-hour average ozone concentration is less than or equal to 0.070 ppm, as determined in accordance with Appendix U of Part 50. The Boone County ozone monitor (21-015-0003) shows the 3-year average (2013-2015) of the annual fourth-highest daily maximum 8-hour average ozone concentration is 0.061 parts per million, which achieves the 8-hour ozone National Ambient Air Quality Standard (NAAQS – 0.070 ppm).

Table 1 provides a summary of the annual fourth-highest daily maximum 8-hour average ozone concentrations recorded at monitors located in the Cincinnati, OH-KY-IN Core Based Statistical Area (CBSA), for 2013-2015. Not all counties in the Cincinnati, OH-KY-IN CBSA have monitors for ozone. Monitor values included in Table 1 only reflect those monitors that were operational during the 2013 to 2015 design value period. Only the monitor in Campbell County, KY indicates a design value above the revised ozone NAAQS for the CBSA.

Table 1
Cincinnati, OH-KY-IN CBSA
3-year Average* of Annual 8-hour concentrations for Ozone

County/Site	AQS Code	Annual 4th High (ppm)			Design Value (ppm)
		2013	2014	2015	
Kentucky					
Boone	21-015-0003	0.059	0.062	0.062	0.061
Campbell	21-037-3002	0.072	0.071	0.071	0.071
Ohio					
Butler	39-017-0004	0.068	0.070	0.070	0.069
Butler	39-017-0018	0.068	0.069	0.070	0.069
Butler	39-017-9991	0.069	0.069	0.068	0.068
Clermont	39-025-0022	0.066	0.068	0.070	0.068
Hamilton	39-061-0006	0.069	0.070	0.072	0.070
Hamilton	39-061-0010	0.064	0.073	0.070	0.069
Hamilton	39-061-0040	0.069	0.069	0.071	0.069
Warren	39-165-0007	0.067	0.071	0.071	0.069

*NAAQS 8-hour (3 year average of the 4th max value). 0.070ppm
n/a indicates no monitor data for that county.

Emissions and Emissions-Related Data

The U.S. EPA requires an emissions inventory to be developed in order to identify the level of emissions in a specific area and adjacent regions that may have contributed to an ozone violation. The EPA Ozone Designations Mapping Tool was used to obtain 2011 NEI v2 emissions inventory data. The 2011 NEI v2 is the latest available national emissions inventory data and is the source of the point, non-point, on-road, non-road and event emissions, and was used to evaluate Boone County's impact on the violating monitor. VOC and NOx emissions, by category, are provided in Tables 2 and 3.

Table 2
2011 NEI VOC Emissions (tpy)
Cincinnati, OH-KY-IN CBSA

County	VOC					
	Point	Non-point	On-road	Non-road	Event	Total
KENTUCKY						
Boone	1019.03	3708.82	1156.27	960.74	210.59	**7055.45**
Bracken	13.41	2604.87	143.77	98.86	0.0	**2860.91**
Campbell	160.58	2658.31	785.96	260.64	0.0	**3865.49**
Gallatin	87.39	1872.80	230.24	95.01	49.75	**2335.19**
Grant	79.78	3246.13	422.24	239.93	2.86	**3990.94**
Kenton	232.80	3289.76	1405.33	418.90	0.0	**5346.79**
Pendleton	127.59	3137.17	227.50	44.20	80.48	**3616.94**
KY Total	**1720.58**	**20517.86**	**4371.31**	**2118.28**	**343.68**	**29071.71**
INDIANA						
Dearborn	1573.32	3500.17	752.90	152.55	144.58	**6123.52**
Ohio	0.01	1571.07	111.12	30.63	46.31	**1759.14**
Union	0.00	1500.88	127.38	218.28	0.00	**1846.54**
IN Total	**1573.33**	**6572.12**	**991.40**	**401.46**	**190.89**	**9729.20**
OHIO						
Brown	28.90	4558.87	969.87	111.49	24.69	**5693.82**
Butler	1146.62	6081.24	4556.78	1076.33	0.0	**12860.97**
Clermont	180.86	5500.53	2654.57	719.53	0.0	**9055.49**
Hamilton	978.46	10759.16	10490.15	2734.21	0.0	**24961.98**
Warren	262.03	4760.18	2741.38	812.53	0.0	**8576.12**
OH Total	**2596.87**	**31659.98**	**21412.75**	**5454.09**	**24.69**	**61148.38**
Total Emissions	**5890.78**	**58749.96**	**26775.46**	**7973.83**	**559.26**	**99949.29**

Table 3
2011 NEI NO_x Emissions (tpy)
Cincinnati, OH-KY-IN CBSA

County	NOx					
	Point	Non-point	On-road	Non-road	Event	Total
KENTUCKY						
Boone	3569.19	801.83	3455.45	682.30	21.32	**8530.09**
Bracken	3.72	469.43	267.93	72.38	0.0	**813.46**
Campbell	82.95	666.79	1583.28	247.83	0.0	**2580.85**
Gallatin	609.76	357.34	832.85	42.53	5.00	**1847.48**
Grant	13.00	510.39	1590.13	96.12	0.28	**2209.92**
Kenton	147.17	818.13	3449.61	521.34	0.0	**4936.25**
Pendleton	949.22	350.98	385.47	77.48	7.90	**1771.05**
KY Total	**5375.01**	**3974.89**	**11564.72**	**1739.98**	**34.50**	**22689.10**
INDIANA						
Dearborn	6530.65	296.72	1610.93	196.33	6.62	**8641.25**
Ohio	0.00	76.65	164.59	28.77	2.75	**272.76**
Union	0.00	190.63	226.35	135.37	0.00	**552.35**
IN Total	**6530.65**	**564.00**	**2001.87**	**360.47**	**9.37**	**9466.36**
OHIO						
Brown	4.40	383.53	1288.36	254.07	2.39	**1932.75**
Butler	3989.32	1962.75	7108.70	1569.52	0.0	**14630.29**
Clermont	16000.81	592.15	4374.25	833.68	0.0	**21800.89**
Hamilton	9664.54	3798.10	19232.85	3145.46	0.0	**35840.95**
Warren	569.13	799.42	4743.52	1189.90	0.0	**7301.97**
OH Total	**30228.20**	**7535.95**	**36747.68**	**6992.63**	**2.39**	**81506.85**
Total Emissions	**42133.86**	**12074.84**	**50314.27**	**9093.08**	**46.26**	**113662.31**

Table 4
VOC Emissions as % of Total VOC Emissions
Cincinnati, OH-KY-IN CBSA

County	Point	Non Point	On-Road	Non-Road	Total MSA
Hamilton, OH	16.6	17.5	39.4	35.3	**25.4**
Butler, OH	19.5	9.9	17.1	13.9	**13.1**
Clermont, OH	3.1	8.9	10.0	9.3	**9.2**
Warren, OH	4.4	7.7	10.3	10.5	**8.7**
Boone, KY	17.3	6.5	4.3	12.4	**7.2**
Dearborn, IN	27.0	5.7	2.8	2.0	**6.2**
Brown, OH	0.5	7.4	3.6	1.4	**5.8**
Kenton, KY	4.0	5.7	5.3	5.4	**5.5**
Grant, KY	1.4	5.3	1.6	3.1	**4.1**
Campbell, KY	2.7	4.3	2.9	3.4	**3.9**
Pendleton, KY	2.2	5.1	0.9	0.6	**3.7**
Bracken, KY	0.2	4.6	0.5	1.3	**2.9**
Gallatin, KY	1.5	3.3	0.9	1.2	**2.4**
Ohio. IN	0.0	2.6	0.4	0.4	**1.8**
Union, IN	0.0	2.6	0.5	2.7	**1.8**

Table 5
NOx Emissions as % of Total NOx Emissions
Cincinnati, OH-KY-IN CBSA

County	Point	Non Point	On-Road	Non-Road	Total MSA
Hamilton, OH	22.9	32.0	38.4	35.1	**31.4**
Clermont, OH	38.0	5.0	8.7	9.3	**19.1**
Butler, OH	9.5	16.5	14.2	17.5	**12.8**
Dearborn, IN	15.5	2.5	3.2	2.2	**7.6**
Boone, KY	8.5	6.7	6.9	7.6	**7.5**
Warren, OH	1.4	6.7	9.5	13.3	**6.4**
Kenton, KY	0.4	6.9	6.9	5.8	**4.3**
Campbell, KY	0.2	5.6	3.2	2.8	**2.3**
Grant, KY	3.1	4.3	3.2	1.1	**1.9**
Brown, OH	0.0	3.2	2.6	2.8	**1.7**
Gallatin, KY	1.4	3.0	1.7	0.5	**1.6**
Pendleton, KY	2.3	3.0	0.8	0.9	**1.5**
Bracken, KY	0.0	4.0	0.5	0.8	**0.7**
Union, IN	0.0	0.8	1.5	1.5	**0.5**
Ohio. IN	0.0	0.6	0.3	0.3	**0.2**

Point Sources

Table 2 indicates 2011 point source emissions of VOC in Boone County were 1,019.03 tpy. Total VOC point source emissions from the Cincinnati, OH-KY-IN CBSA were 5,890.78 tpy. Boone County only accounts for approximately 17.3% of the total VOC point source emissions in the CBSA. Table 4 shows the percentages of VOC emissions for point sources in the CBSA, by county.

As seen in Table 3, point source emissions of NO_X in Boone County were estimated to be 3,569.19 tpy in 2011, which represents 8.5% of the total 42,133.86 tpy of the overall NO_X point source emissions from the Cincinnati, OH-KY-IN CBSA. Table 5 shows the percentages of NO_x emissions for point sources in the CBSA, by county.

Non-Point (Area) Emissions

Table 2 shows that non-point (or "area") VOC emissions in Boone County were estimated to be 3,708.82 tpy for 2011, which represents approximately 6.5% of the total 57,249.08 tpy of the overall VOC non-point source emissions from the Cincinnati, OH-KY-IN CBSA. Table 4 shows the percentages of VOC emissions for non-point sources in the CBSA, by county.

As seen in Table 3, non-point NOx emissions from Boone County were estimated at 801.83 tpy in 2011, which represents approximately 6.7% of the total 11,884.21 tpy of the overall NOx non-point source emissions from the Cincinnati, OH-KY-IN CBSA. Table 5 shows the percentages of NOx emissions for non-point sources in the CBSA, by county.

On-Road Mobile

As indicated in Table 2, on-road mobile source VOC emissions from Boone County were estimated to be 1,156.27 tpy in 2011, which represents approximately 4.3% of the total 26,648.08 tpy of the overall VOC on-road mobile source emissions from the Cincinnati, OH-KY-IN CBSA. Table 4 shows the percentages of VOC emissions for on-road mobile sources in the CBSA, by county.

As seen in Table 3, on-road mobile source NO_x emissions from Boone County were estimated at 3,455.45 tpy in 2011, which represents approximately 6.9% of the total 50,087.92 tpy of the overall NO_x on-road mobile source emissions from the Cincinnati, OH-KY-IN CBSA. Table 5 shows the percentages of NO_x emissions for on-road mobile sources in the CBSA, by county.

Based on 2014 information obtained from the U.S Census Website, http://onthemap.ces.gov, the commuting traffic from other counties into Boone County is 71.0%, while the commuting traffic from Boone County into other counties is 61.1%.

Table 6 below provides Vehicle Miles Travelled (VMT) for all areas within the Cincinnati, OH-KY-IN CBSA for the year 2011. The counties within the Ohio portion of the CBSA contribute to the majority of VMT within the CBSA. Although Boone County is not the main contributor to VMT, it does

contribute a significant number of VMT within the CBSA. High VMT is associated with urban areas and linked with motor vehicle emissions that may contribute to ozone formation.

Table 6
2011 VMT Totals, Cincinnati, OH-KY-IN CBSA

	2011 VMT Totals
Kentucky	
Boone County	**1,558,794,112**
Bracken County	**104,160,119**
Campbell County	**1,010,009,434**
Gallatin County	**245,765,593**
Grant County	**529,145,674**
Kenton County	**1,720,886,038**
Pendleton County	**184,074,537**
KY Total	**5,352,835,507**
Ohio	
Brown County	**468,171,663**
Butler County	**3,099,030,997**
Clermont County	**1,951,343,156**
Hamilton County	**9,004,357,566**
Warren County	**2,139,774,797**
OH Total	**16,662,678,179**
Indiana	
Dearborn County	**690,348,611**
Ohio County	**71,591,617**
Union County	**105,444,221**
IN Total	**867,384,449**
Total VMT for CBSA	**22,882,898,135**

Non-Road Mobile Sources

As listed in Table 2, non-road mobile source VOC emissions from Boone County were estimated at 960.74 tpy in 2011, which represents approximately 12.4% of the total 7755.55 tpy of the overall VOC non-road mobile source emissions from the Cincinnati, OH-KY-IN CBSA. Table 4 shows the percentages of VOC emissions for non-road mobile sources in the CBSA, by county.

As seen in Table 3, non-road mobile source NO_x emissions from Boone County were estimated at 682.30 tpy in 2011, which represents approximately 7.6% of the total 8,957.71 tpy of the overall NO_x non-road mobile source emissions from the Cincinnati, OH-KY-IN CBSA. Table 5 shows the percentages of NO_x emissions for non-road mobile sources in the CBSA, by county.

Comparison of Total Emissions

A comparison of total emissions across the entire Cincinnati, OH-KY-IN CBSA was performed using data from the Ozone Designations Mapping Tool. The percentages shown in last column in both Tables 4 and 5 demonstrate that the majority of VOC and NO_X emissions within the Cincinnati, OH-KY-IN CBSA come from the Ohio portion of the CBSA.

Population

Based on U.S. Census Bureau estimates for 2015, there are 127,712 persons living in Boone County (Refer to table 7). This represents approximately 519.1 persons per square mile. The population of Boone County is approximately 13.3% rural with the remaining 86.7% living in incorporated areas. The largest cities in Boone County are Florence and Union.

Boone County's population from 2010 to 2015 *increased* by approximately 7.5% (118,811 to 127,712). For the entire Cincinnati, OH-KY-IN CBSA, Boone County represents approximately 5.9% of the total population in the CBSA and 29**%** of the Kentucky portion of the CBSA (Refer to table 8).

Table 7
Northern Kentucky Area Population
Growth Data

County	Census 2010	2015*	% Growth 2010 - 2015
Boone	118,811	127,712	7.5%
Bracken	8,488	8,321	-2.0%
Campbell	90,336	92,066	1.9%
Gallatin	8,589	8,636	0.5%
Grant	24,662	24,757	0.4%
Kenton	159,720	165,012	3.3%
Pendleton	14,877	14,408	-3.1%

*U.S. Census Bureau estimates.

Table 8
2015 Population
Cincinnati, OH-KY-IN CBSA

CBSA Estimated Population	2015*	2015 Population Density (1,000 per square mile)	% of Total	
Kentucky			**of KY Portion**	**of CBSA**
Boone County	**127,712**	**0.52**	**29.0%**	**5.9%**
Bracken County	**8,321**	**0.04**	**1.9%**	**0.5%**
Campbell County	**92,066**	**0.61**	**20.9%**	**4.3%**
Gallatin County	**8,636**	**0.09**	**2.0%**	**0.4%**
Grant County	**24,757**	**0.10**	**5.6%**	**1.2%**
Kenton County	**165,012**	**1.03**	**37.4%**	**7.6%**
Pendleton County	**14,408**	**0.05**	**3.3%**	**0.7%**
KY Total	**440,912**	**--**	**100%**	**20.6%**
Ohio			**of OH Portion**	
Brown County	**43,839**	**0.09**	**2.7%**	**2.0%**
Butler	**376,353**	**0.81**	**22.8%**	**17.4%**
Clermont County	**201,973**	**0.45**	**12.2%**	**9.4%**
Hamilton County	**807,598**	**1.99**	**48.8%**	**37.4%**
Warren County	**224,469**	**0.56**	**13.6%**	**10.4%**
OH Total	**1,654,232**	**--**	**100%**	**76.7%**
Indiana			**of IN Portion**	
Dearborn County	**49,455**	**0.16**	**79.0%**	**2.3%**
Ohio County	**5,938**	**0.07**	**9.5%**	**0.3%**
Union County	**7,182**	**0.04**	**11.5%**	**0.3%**
IN Total	**62,575**	**--**	**100%**	**2.9%**
Total Estimated Population	**2,157,719**	**--**	**100%**	**100%**

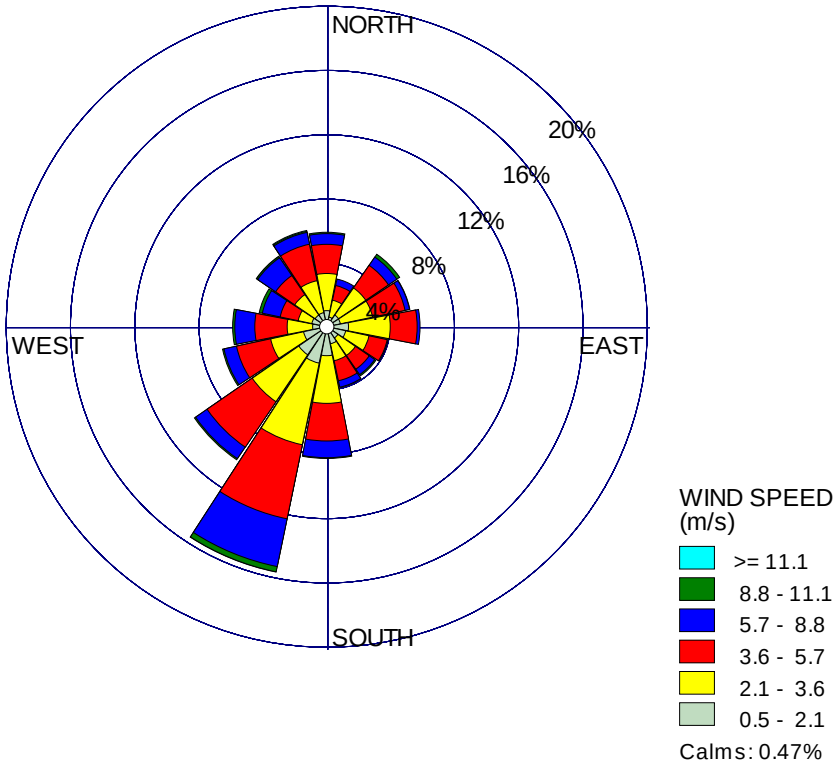
*U.S. Census Bureau estimates.

Areas of dense population and high VMT can display elevated nonpoint and on-road source emissions. As seen in Tables 2 and 3, two of the sectors with the highest emission contribution are from nonpoint (VOC) and on-road (NOx). This correlation indicates that VMT and population density within Boone County may be contributing to violating monitors within the CBSA.

Meteorological Information

Wind speed and wind direction data collected at the Cincinnati-Northern Kentucky Airport (NWS Station 93814) for the period 2013-2015 shows that the majority of the time the wind in the area came from the southwest and typically from 2.1-3.6 miles per hour (Refer to figure 1). According to Kentucky Mesonet (http://www.kymesonet.org/), the average high temperature for July for the period 2013-2015 was 90.1º F and the average low temperature for July was 53.7º F. The average July precipitation for the same period (2013-2015) was 4.63 inches.

Figure 1: Wind Rose Average 2013-2015 March 1st - October 31st



Several 48-hour back trajectory HYSPLITS for Kentucky have been included in Section 8 for days in 2013-2015 when the 8-hour ambient monitoring concentration for ozone had their highest readings. These HYSPLITS show that for the majority of the time the air column does come from the southwest which indicates that the emission levels from Boone County may be affecting the violating monitor located in Campbell County.

Geography and Topography

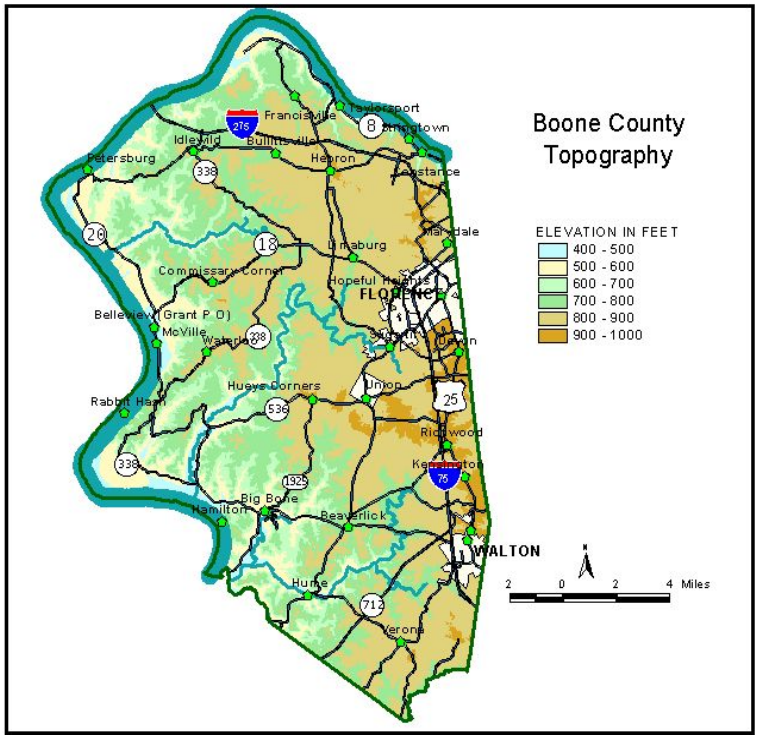
Boone County is part of the Cincinnati, OH-KY-IN CBSA and has a land area of 246 square miles. Located on the banks of the Ohio River, Boone County lies to the west of Kenton County, to the north of Grant County, to the northeast of Gallatin County, and to the southwest of Cincinnati, Ohio. The lowest elevation is 455 feet, the normal pool level of the Ohio River. Maximum local relief, 435 feet, is at the

bluffs and steep slopes of the Ohio River at Constance. Local reliefs of 300 to 400 feet are found elsewhere along the Ohio. The highest elevation (greater than 964 feet) appears to be on a ridge midway between Walton and Kensington.

Most of the county is a moderately to deeply dissected upland of the Outer Bluegrass Region. Local relief away from the river is commonly 100 to 200 feet. Some of the ridges between tributary valleys are flat-topped, particularly in the north-central part of the county, where elevations range from 800 to 900 feet. Many of these areas are the sites of local development, such as the Greater Cincinnati-Northern Kentucky Airport.

Boone County does not have any geographical or topographical distinctions that interfere with air pollution transport. Therefore, this factor is not a significant part of the overall analysis.

Figure 2: Boone County Topography



Jurisdictional Boundaries

The authority for air quality planning in the Boone County area resides with the Kentucky Energy and Environment Cabinet. Transportation planning for Boone County is performed by the Ohio, Kentucky, and Indiana Regional Council of Governments (OKI). Historically, portions of Boone, Campbell, and Kenton counties have been designated as nonattainment. These Kentucky counties along with Butler, Clermont, Clinton, Hamilton, Warren, Ohio and Dearborn, Indiana were designated nonattainment for the 1997 and 2008 ozone standards. The 2008 ozone standard nonattainment area was confined to specific census tracts in the northern part of Boone, Campbell and Kenton counties.

Conclusion and Recommendation

Boone County, based on 2013-2015 ozone monitoring data, is meeting the 8-hour ozone standard with a 3-year average of 0.061 parts per million.

As seen in Table 9, Boone County's VOC and NOx emissions are relatively less than other counties located within the Cincinnati, OH-KY-IN CBSA. Boone County contributes approximately:

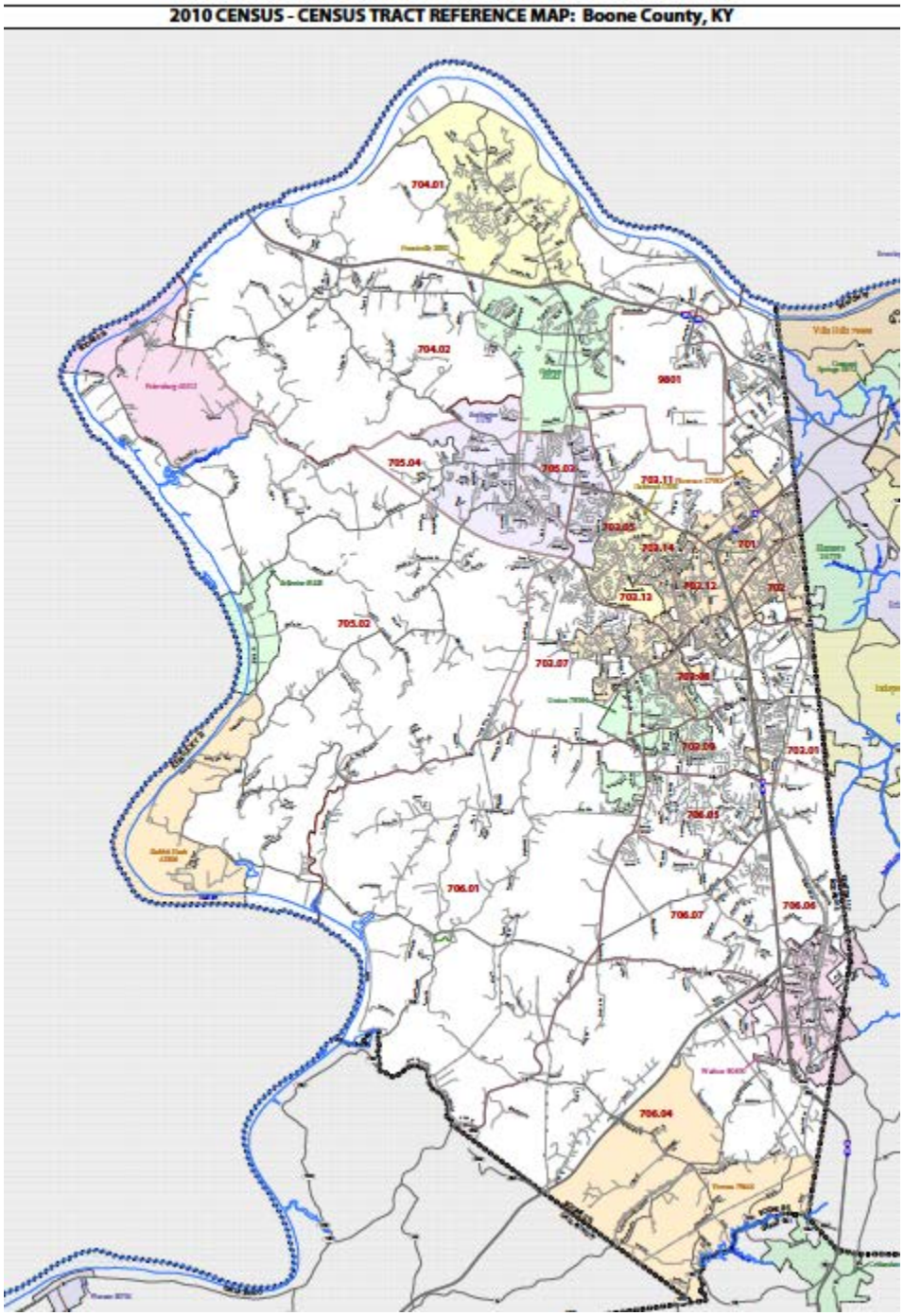
- 7.1% of the total VOC emissions
- 7.5% of the total NO_x emissions

Table 9
VOC and NO_x Percentages for
Cincinnati, OH-KY-IN CBSA (2011 NEI)

County	VOC %	NO_X %
KENTUCKY		
Boone	7.1	7.5
Bracken	2.9	0.7
Campbell	3.8	2.3
Gallatin	2.3	1.6
Grant	4.0	1.9
Kenton	5.3	4.3
Pendleton	3.6	1.6
KY Total	**29.0%**	**19.9%**
OHIO		
Brown	5.7	1.7
Butler	12.9	12.9
Clermont	9.1	19.2
Hamilton	25.0	31.6
Warren	8.6	6.4
OH Total	**61.3%**	**71.8**
INDIANA		
Dearborn	6.1	7.6
Ohio	1.8	0.2
Union	1.8	0.5
IN Total	**9.7%**	**8.3%**
Total Emissions %	**100.0%**	**100.0%**

The ozone monitor in Boone County is attaining the 2015 8-hour ozone NAAQS. There are no distinguishable geographical or topographical elements that would affect VOC or NOx levels. The emission contributions from Boone County are not as significant as other areas within the CBSA. The dominating factors that influence Boone County's contribution to the violating monitor within the area involve population, VMT and commuting traffic. Figure 3 shows 2010 Census Tracts for Boone County. Data gathered from EPA's Ozone Mapping Tool was used to analyze which portions of Boone County could be contributing to the violating monitor in Campbell County based on high population areas. Although Boone County does not have the highest population within the CBSA, the significant VMT levels along with commuting patterns suggest that there is a large urban population that leads to increased on-road and nonpoint source emissions. Due to the wind direction coming from the southwest the majority of the time, the emissions from Boone may be contributing to the violating monitor in Campbell County, KY. Therefore, it is suggested that a portion of Boone County be designated as "nonattainment" for the 2015 8-hour ozone NAAQS. Specifically, the following census tracts within Boone County should be designated as nonattainment: 702, 703.01, 703.04, 703.05, 703.06, 703.07, 703.08, 703.09, 704.01, 704.02, 705.01, 705.02, and 706.03.

Figure 3: 2010 Census Tracts for Boone County, KY



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Bracken County, KY

Air Quality

Pursuant to 40 CFR 50:19 (b) and (d) the 8-hour primary and secondary NAAQS are met at an ambient air quality monitoring site when the 3-year average of the annual fourth-highest daily maximum 8-hour average ozone concentration is less than or equal to 0.070 ppm, as determined in accordance with Appendix U of Part 50. Currently, there is no ozone monitor located in Bracken County.

Ozone air monitoring data and design values for 2013-2015 for the Cincinnati, OH-KY-IN Core Based Statistical Area (CBSA) were retrieved from https://www.epa.gov/air-trends/air-quality-design-values#report. Per the EPA website, "The design values shown here are computed using Federal Reference Method or equivalent data reported by State, Tribal, and Local monitoring agencies to EPA's Air Quality System (AQS) as of June 24, 2016." Table 1 provides a summary of the annual fourth-highest daily maximum 8-hour average ozone concentrations recorded at monitors located in the Cincinnati, OH-KY-IN Core Based Statistical Area (CBSA), for 2013-2015. Not all counties in the Cincinnati, OH-KY-IN CBSA have monitors for ozone. Monitor values included in Table 1 only reflect those monitors that were operational during the 2013 to 2015 design value period. Only the monitor in Campbell County, KY indicates a design value above the revised ozone NAAQS for the CBSA.

Table 1
Cincinnati, OH-KY-IN CBSA
3-year Average* of Annual 8-hour concentrations for Ozone

County/Site	AQS Code	Annual 4th High (ppm)			Design Value (ppm)
		2013	2014	2015	
Kentucky					
Boone	21-015-0003	0.059	0.062	0.062	0.061
Campbell	21-037-3002	0.072	0.071	0.071	0.071
Ohio					
Butler	39-017-0004	0.068	0.070	0.070	0.069
Butler	39-017-0018	0.068	0.069	0.070	0.069
Butler	39-017-9991	0.069	0.069	0.068	0.068
Clermont	39-025-0022	0.066	0.068	0.070	0.068
Hamilton	39-061-0006	0.069	0.070	0.072	0.070
Hamilton	39-061-0010	0.064	0.073	0.070	0.069
Hamilton	39-061-0040	0.069	0.069	0.071	0.069
Warren	39-165-0007	0.067	0.071	0.071	0.069

*NAAQS 8-hour (3 year average of the 4th max value). 0.070ppm
n/a indicates no monitor data for that county.

Emissions and Emissions-Related Data

The U.S. EPA requires an emissions inventory to be developed in order to identify the level of emissions in a specific area and adjacent regions that may have contributed to an ozone violation. The EPA Ozone Designations Mapping Tool was used to obtain 2011 NEI v2 emissions inventory data. The 2011 NEI v2 is the latest available national emissions inventory data and is the source of the point, non-point, on-road, non-road and event emissions, and was used to evaluate Bracken County's impact on the violating monitor. VOC and NOx emissions, by category, are provided in Tables 2 and 3.

Table 2
2011 NEI VOC Emissions (tpy)
Cincinnati, OH-KY-IN CBSA

County	VOC (tons per year)					
	Point	Non-point	On-road	Non-road	Event	Total
KENTUCKY						
Boone	1019.03	3708.82	1156.27	960.74	210.59	**7055.45**
Bracken	13.41	2604.87	143.77	98.86	0.0	**2860.91**
Campbell	160.58	2658.31	785.96	260.64	0.0	**3865.49**
Gallatin	87.39	1872.80	230.24	95.01	49.75	**2335.19**
Grant	79.78	3246.13	422.24	239.93	2.86	**3990.94**
Kenton	232.80	3289.76	1405.33	418.90	0.0	**5346.79**
Pendleton	127.59	3137.17	227.50	44.20	80.48	**3616.94**
KY Total	**1720.58**	**20517.86**	**4371.31**	**2118.28**	**343.68**	**29071.71**
INDIANA						
Dearborn	1573.32	3500.17	752.90	152.55	144.58	**6123.52**
Ohio	0.01	1571.07	111.12	30.63	46.31	**1759.14**
Union	0.00	1500.88	127.38	218.28	0.00	**1846.54**
IN Total	**1573.33**	**6572.12**	**991.40**	**401.46**	**190.89**	**9729.20**
OHIO						
Brown	28.90	4558.87	969.87	111.49	24.69	**5693.82**
Butler	1146.62	6081.24	4556.78	1076.33	0.0	**12860.97**
Clermont	180.86	5500.53	2654.57	719.53	0.0	**9055.49**
Hamilton	978.46	10759.16	10490.15	2734.21	0.0	**24961.98**
Warren	262.03	4760.18	2741.38	812.53	0.0	**8576.12**
OH Total	**2596.87**	**31659.98**	**21412.75**	**5454.09**	**24.69**	**61148.38**
Total Emissions	**5890.78**	**58749.96**	**26775.46**	**7973.83**	**559.26**	**99949.29**

Table 3
2011 NEI NO_x Emissions (tpy)
Cincinnati, OH-KY-IN CBSA

County	NOx (tons per year)					
	Point	Non-point	On-road	Non-road	Event	Total
KENTUCKY						
Boone	3569.19	801.83	3455.45	682.30	21.32	**8530.09**
Bracken	3.72	469.43	267.93	72.38	0.0	**813.46**
Campbell	82.95	666.79	1583.28	247.83	0.0	**2580.85**
Gallatin	609.76	357.34	832.85	42.53	5.00	**1847.48**
Grant	13.00	510.39	1590.13	96.12	0.28	**2209.92**
Kenton	147.17	818.13	3449.61	521.34	0.0	**4936.25**
Pendleton	949.22	350.98	385.47	77.48	7.90	**1771.05**
KY Total	**5375.01**	**3974.89**	**11564.72**	**1739.98**	**34.50**	**22689.10**
INDIANA						
Dearborn	6530.65	296.72	1610.93	196.33	6.62	**8641.25**
Ohio	0.00	76.65	164.59	28.77	2.75	**272.76**
Union	0.00	190.63	226.35	135.37	0.00	**552.35**
IN Total	**6530.65**	**564.00**	**2001.87**	**360.47**	**9.37**	**9466.36**
OHIO						
Brown	4.40	383.53	1288.36	254.07	2.39	**1932.75**
Butler	3989.32	1962.75	7108.70	1569.52	0.0	**14630.29**
Clermont	16000.81	592.15	4374.25	833.68	0.0	**21800.89**
Hamilton	9664.54	3798.10	19232.85	3145.46	0.0	**35840.95**
Warren	569.13	799.42	4743.52	1189.90	0.0	**7301.97**
OH Total	**30228.20**	**7535.95**	**36747.68**	**6992.63**	**2.39**	**81506.85**
Total Emissions	**42133.86**	**12074.84**	**50314.27**	**9093.08**	**46.26**	**113662.31**

Table 4
VOC Emissions as % of Total VOC Emissions
Cincinnati, OH-KY-IN CBSA

County	Point	Non Point	On-Road	Non-Road	Total MSA
Hamilton, OH	16.6	17.5	39.4	35.3	**25.4**
Butler, OH	19.5	9.9	17.1	13.9	**13.1**
Clermont, OH	3.1	8.9	10.0	9.3	**9.2**
Warren, OH	4.4	7.7	10.3	10.5	**8.7**
Boone, KY	17.3	6.5	4.3	12.4	**7.2**
Dearborn, IN	27.0	5.7	2.8	2.0	**6.2**
Brown, OH	0.5	7.4	3.6	1.4	**5.8**
Kenton, KY	4.0	5.7	5.3	5.4	**5.5**
Grant, KY	1.4	5.3	1.6	3.1	**4.1**
Campbell, KY	2.7	4.3	2.9	3.4	**3.9**
Pendleton, KY	2.2	5.1	0.9	0.6	**3.7**
Bracken, KY	0.2	4.6	0.5	1.3	**2.9**
Gallatin, KY	1.5	3.3	0.9	1.2	**2.4**
Ohio. IN	0.0	2.6	0.4	0.4	**1.8**
Union, IN	0.0	2.6	0.5	2.7	**1.8**

Table 5
NOx Emissions as % of Total NOx Emissions
Cincinnati, OH-KY-IN CBSA

County	Point	Non Point	On-Road	Non-Road	Total MSA
Hamilton, OH	22.9	32.0	38.4	35.1	**31.4**
Clermont, OH	38.0	5.0	8.7	9.3	**19.1**
Butler, OH	9.5	16.5	14.2	17.5	**12.8**
Dearborn, IN	15.5	2.5	3.2	2.2	**7.6**
Boone, KY	8.5	6.7	6.9	7.6	**7.5**
Warren, OH	1.4	6.7	9.5	13.3	**6.4**
Kenton, KY	0.4	6.9	6.9	5.8	**4.3**
Campbell, KY	0.2	5.6	3.2	2.8	**2.3**
Grant, KY	3.1	4.3	3.2	1.1	**1.9**
Brown, OH	0.0	3.2	2.6	2.8	**1.7**
Gallatin, KY	1.4	3.0	1.7	0.5	**1.6**
Pendleton, KY	2.3	3.0	0.8	0.9	**1.5**
Bracken, KY	0.0	4.0	0.5	0.8	**0.7**
Union, IN	0.0	0.8	1.5	1.5	**0.5**
Ohio. IN	0.0	0.6	0.3	0.3	**0.2**

Point Sources

Table 2 indicates 2011 point source emissions of VOC in Bracken County were 13.41 tpy. Total VOC point source emissions from the Cincinnati, OH-KY-IN CBSA were 5,890.78 tpy. Bracken County only accounts for approximately 0.2% of the total VOC point source emissions in the CBSA. Table 4 shows the percentages of VOC emissions for point sources in the CBSA, by county.

As seen in Table 3, point source emissions of NO_x in Bracken County were estimated to be 3.72 tpy in 2011, which represents 0.01% of the total 42,133.86 tpy of the overall NO_x point source emissions from the Cincinnati, OH-KY-IN CBSA. Table 5 shows the percentages of NO_x emissions for point sources in the CBSA, by county.

Non-Point (Area) Emissions

Table 2 shows that non-point (or "area") VOC emissions in Bracken County were estimated to be 2,604.87 tpy for 2011, which represents approximately 4.6% of the total 57,249.08 tpy of the overall VOC non-point source emissions from the Cincinnati, OH-KY-IN CBSA. Table 4 shows the percentages of VOC emissions for non-point sources in the CBSA, by county.

As seen in Table 3, non-point NOx emissions from Bracken County were estimated at 469.43 tpy in 2011, which represents approximately 4.0% of the total 11,884.21 tpy of the overall NOx non-point source emissions from the Cincinnati, OH-KY-IN CBSA. Table 5 shows the percentages of NOx emissions for non-point sources in the CBSA, by county.

On-Road Mobile

As indicated in Table 2, on-road mobile source VOC emissions from Bracken County were estimated to be 143.77 tpy in 2011, which represents approximately 0.5% of the total 26,648.08 tpy of the overall VOC on-road mobile source emissions from the Cincinnati, OH-KY-IN CBSA. Table 4 shows the percentages of VOC emissions for on-road mobile sources in the CBSA, by county.

As seen in Table 3, on-road mobile source NO_x emissions from Bracken County were estimated at 267.93 tpy in 2011, which represents approximately 0.5% of the total 50,087.92 tpy of the overall NO_x on-road mobile source emissions from the Cincinnati, OH-KY-IN CBSA. Table 5 shows the percentages of NO_x emissions for on-road mobile sources in the CBSA, by county.

Based on 2014 information obtained from the U.S Census Website, http://onthemap.ces.gov, the commuting traffic from other counties into Bracken County is 49.7%, while the commuting traffic from Bracken County into other counties is 72.6%.

Table 6 below provides Vehicle Miles Travelled (VMT) for all areas within the Cincinnati, OH-KY-IN CBSA for the year 2011. The counties within the Ohio portion of the CBSA contribute to the majority of VMT within the CBSA. Bracken County's VMT is significantly lower compared to other counties within the CBSA.

Table 6
2011 VMT Totals, Cincinnati, OH-KY-IN CBSA

	2011 VMT Totals
Kentucky	
Boone County	**1,558,794,112**
Bracken County	**104,160,119**
Campbell County	**1,010,009,434**
Gallatin County	**245,765,593**
Grant County	**529,145,674**
Kenton County	**1,720,886,038**
Pendleton County	**184,074,537**
KY Total	**5,352,835,507**
Ohio	
Brown County	**468,171,663**
Butler County	**3,099,030,997**
Clermont County	**1,951,343,156**
Hamilton County	**9,004,357,566**
Warren County	**2,139,774,797**
OH Total	**16,662,678,179**
Indiana	
Dearborn County	**690,348,611**
Ohio County	**71,591,617**
Union County	**105,444,221**
IN Total	**867,384,449**
Total VMT for CBSA	**22,882,898,135**

Non-Road Mobile Sources

As listed in Table 2, non-road mobile source VOC emissions from Bracken County were estimated at 98.86 tpy in 2011, which represents approximately 1.3% of the total 7,755.55 tpy of the overall VOC non-road mobile source emissions from the Cincinnati, OH-KY-IN CBSA. Table 4 shows the percentages of VOC emissions for non-road mobile sources in the CBSA, by county.

As seen in Table 3, non-road mobile source NO_x emissions from Bracken County were estimated at 72.38 tpy in 2011, which represents approximately 0.8% of the total 8,957.71 tpy of the overall NO_x non-road mobile source emissions from the Cincinnati, OH-KY-IN CBSA. Table 5 shows the percentages of NO_x emissions for non-road mobile sources in the CBSA, by county.

Comparison of Total Emissions

A comparison of total emissions across the entire Cincinnati, OH-KY-IN CBSA was performed using data from the EPA Ozone Designations Mapping Tool. The percentages shown in last column in both Tables 4 and 5 demonstrate that the majority of VOC and NOx emissions within the Cincinnati, OH-KY-IN CBSA come from the Ohio portion of the CBSA.

Population

Based on U.S. Census Bureau estimates for 2015, there are 8,321 persons living in Bracken County (Refer to Table 7). This represents approximately 40.99 persons per square mile. The population of Bracken County is approximately 100% rural with few people living in incorporated areas. The largest cities in Bracken County are Augusta and Brooksville.

Bracken County's population from 2010 to 2015 *decreased* by 2.0% (8,488 to 8,321). For the entire Cincinnati, OH-KY-IN CBSA, Bracken County represents approximately 0.4% of the total population in the CBSA and 1.9% of the Kentucky portion of the CBSA (Refer to table 8).

Table 7
Northern Kentucky Area Population
Growth Data

County	Census 2010	2015*	%Growth 2010 - 2015
Boone	118,811	127,712	7.5%
Bracken	8,488	8,321	-2.0%
Campbell	90,336	92,066	1.9%
Gallatin	8,589	8,636	0.5%
Grant	24,662	24,757	0.4%
Kenton	159,720	165,012	3.3%
Pendleton	14,877	14,408	-3.1%

*U.S. Census Bureau estimates.

Table 8
2015 Population
Cincinnati, OH-KY-IN CBSA

CBSA Estimated Population	2015*	2015 Population Density (1,000 per square mile)	% of Total	
Kentucky			**of KY Portion**	**of CBSA**
Boone County	**127,712**	**0.52**	**29.0%**	**5.9%**
Bracken County	**8,321**	**0.04**	**1.9%**	**0.5%**
Campbell County	**92,066**	**0.61**	**20.9%**	**4.3%**
Gallatin County	**8,636**	**0.09**	**2.0%**	**0.4%**
Grant County	**24,757**	**0.10**	**5.6%**	**1.2%**
Kenton County	**165,012**	**1.03**	**37.4%**	**7.6%**
Pendleton County	**14,408**	**0.05**	**3.3%**	**0.7%**
KY Total	**440,912**	**--**	**100%**	**20.6%**
Ohio			**of OH Portion**	
Brown County	**43,839**	**0.09**	**2.7%**	**2.0%**
Butler	**376,353**	**0.81**	**22.8%**	**17.4%**
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IN Total	**62,575**	**--**	**100%**	**2.9%**
Total Estimated Population	**2,157,719**	**--**	**100%**	**100%**

*U.S. Census Bureau estimates.

Areas of dense population and high VMT can display elevated nonpoint and on-road source emissions. As seen in Tables 2 and 3, two of the sectors with the highest emission contribution are from nonpoint for both VOC and NOx. However, Bracken County emissions are significantly lower compared to other areas within the CBSA.

Meteorological Information

Wind speed and wind direction data collected at the Cincinnati-Northern Kentucky Airport (NWS Station 93814) for the period 2013-2015 shows that the majority of the time the wind in the area came from the southwest and typically from 2.1-3.6 miles per hour (Refer to figure 1). According to Kentucky Mesonet (http://www.kymesonet.org/), the average high temperature for July for the period 2013-2015 was 91.9º F and the average low temperature for July was 55.5º F. The average July precipitation for the same period (2013-2015) was 4.65 inches.

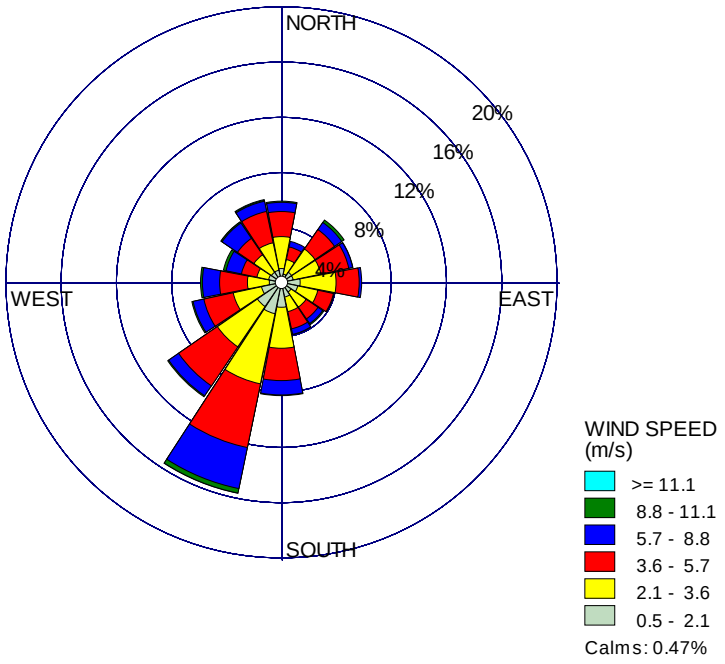

Figure 1: Wind Rose Average 2013-2015 March 1st - October 31st

Several 48-hour back trajectory HYSPLITS for Kentucky have been included in Section 8 for days in 2013-2015 when the 8-hour ambient monitoring concentration for ozone had their highest readings. As seen in the HYSPLITS, the position of Bracken County relative to Campbell County, along with predominant winds being from the southwest, show that Bracken County is not impacting the violating monitor in Campbell County.

Geography and Topography

Bracken County is part of the Cincinnati, OH-KY-IN CBSA and has a land area of 203 square miles. Located on the banks of the Ohio River, Bracken County lies to the east of Pendleton County, west of Mason County, north of Robertson County, and south of Clermont County, Ohio. The lowest point in Bracken County is 455 feet. Floodplains along the river are narrow to nonexistent with elevations

ranging from 490 to 510 feet. The highest elevations (940 to 980) in the county are found along the drainage divide between Licking River and the small creeks that flow directly into the Ohio River.

Figure 2 shows the topography of Bracken County. Bracken County does not have any geographical or topographical distinctions that interfere with air pollution transport. Therefore, this factor is not a significant part of the overall analysis.

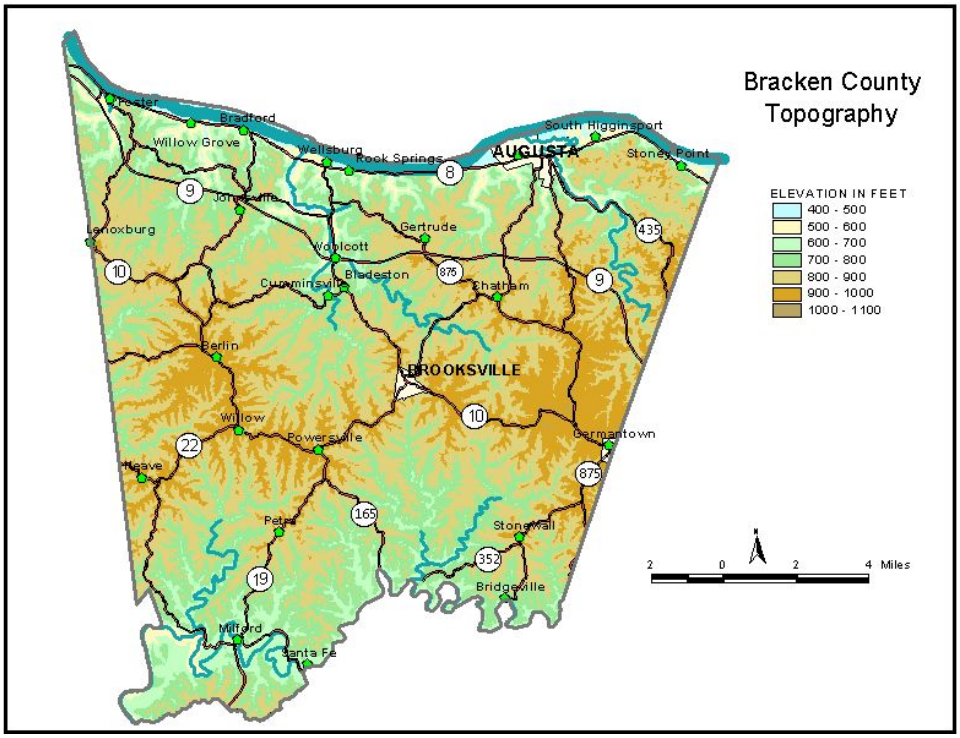

Figure 2: Bracken County Topography

Jurisdictional Boundaries

The authority for air quality planning in the Bracken County area resides with the Kentucky Energy and Environment Cabinet. Transportation planning for Bracken County is performed by the Kentucky Transportation Cabinet. Historically, portions of Boone, Campbell, and Kenton counties have been designated as nonattainment. These Kentucky counties along with Butler, Clermont, Clinton, Hamilton, Warren, Ohio and Dearborn, Indiana were designated nonattainment for the 1997 and 2008 ozone standards. The 2008 ozone standard nonattainment area was confined to specific census tracts in the northern part of Boone, Campbell and Kenton counties.

Conclusion and Recommendation

There were no ozone monitors located in Bracken County for the 2013-2015 monitoring period.

As seen in Table 9, Bracken County's VOC and NOx emissions are minimal, especially when compared to other counties located within the Cincinnati, OH-KY-IN CBSA. Bracken County contributes approximately:

- 2.9% of the total VOC emissions
- 0.7% of the total NO_x emissions

The emissions from Bracken are negligible and do not significantly contribute to the 8-hour ozone standard in the Cincinnati, OH-KY-IN CBSA.

Table 9
VOC and NO_x Percentages for
Cincinnati, OH-KY-IN CBSA (2011 NEI)

County	VOC %	NO_X %
KENTUCKY		
Boone	7.1	7.5
Bracken	2.9	0.7
Campbell	3.8	2.3
Gallatin	2.3	1.6
Grant	4.0	1.9
Kenton	5.3	4.3
Pendleton	3.6	1.6
KY Total	**29.0%**	**19.9%**
OHIO		
Brown	5.7	1.7
Butler	12.9	12.9
Clermont	9.1	19.2
Hamilton	25.0	31.6
Warren	8.6	6.4
OH Total	**61.3%**	**71.8**
INDIANA		
Dearborn	6.1	7.6
Ohio	1.8	0.2
Union	1.8	0.5
IN Total	**9.7%**	**8.3%**
Total Emissions %	**100.0%**	**100.0%**

Data gathered for Bracken County and reviewed using EPA's five factor analysis demonstrates that Bracken County is not contributing to the violating monitor in Campbell County. Therefore, Kentucky recommends that Bracken County be designated as "unclassifiable/attainment" for the 2015 8-hour ozone NAAQS.

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Campbell County, KY

Air Quality

Pursuant to 40 CFR 50:19 (b) and (d) the 8-hour primary and secondary NAAQS are met at an ambient air quality monitoring site when the 3-year average of the annual fourth-highest daily maximum 8-hour average ozone concentration is less than or equal to 0.070 ppm, as determined in accordance with Appendix U of Part 50. The ozone monitor for Campbell County (AQS ID: 21-037-3002) recorded a 3-year average from 2013-2015 of 0.071 ppm. The 8-Hour Ozone National Ambient Air Quality Standard (NAAQS) is set at a level of 0.070 ppm, showing this county is in violation of the standard.

Table 1 provides a summary of the annual fourth-highest daily maximum 8-hour average ozone concentrations recorded at monitors located in the Cincinnati, OH-KY-IN Core Based Statistical Area (CBSA), for 2013-2015. Not all counties in the Cincinnati, OH-KY-IN CBSA have monitors for ozone. Monitor values included in Table 1 only reflect those monitors that were operational during the 2013 to 2015 design value period. Only the monitor in Campbell County, KY indicates a design value above the revised ozone NAAQS for the CBSA.

Table 1
Cincinnati, OH-KY-IN CBSA
3-year Average* of Annual 8-hour concentration for Ozone

County/Site	AQS Code	Annual 4th High (ppm)			Design Value (ppm)
		2013	2014	2015	
Kentucky					
Boone	21-015-0003	0.059	0.062	0.062	0.061
Campbell	21-037-3002	0.072	0.071	0.071	0.071
Ohio					
Butler	39-017-0004	0.068	0.070	0.070	0.069
Butler	39-017-0018	0.068	0.069	0.070	0.069
Butler	39-017-9991	0.069	0.069	0.068	0.068
Clermont	39-025-0022	0.066	0.068	0.070	0.068
Hamilton	39-061-0006	0.069	0.070	0.072	0.070
Hamilton	39-061-0010	0.064	0.073	0.070	0.069
Hamilton	39-061-0040	0.069	0.069	0.071	0.069
Warren	39-165-0007	0.067	0.071	0.071	0.069

*NAAQS 8-hour (3 year average of the 4th max value). 0.070ppm
n/a indicates no monitor data for that county.

Emissions and Emissions-Related Data

The U.S. EPA requires an emissions inventory to be developed in order to identify the level of emissions in a specific area and adjacent regions that may have contributed to an ozone violation. The EPA Ozone Designations Mapping Tool was used to obtain 2011 NEI v2 emissions inventory data. The 2011 NEI v2 is the latest available national emissions inventory data and is the source of the point, non-point, on-road, non-road and event emissions, and was used to evaluate Campbell County's impact on the violating monitor. VOC and NOx emissions, by category, are provided in Tables 2 and 3.

Table 2
2011 NEI VOC Emissions (tpy)
Cincinnati, OH-KY-IN CBSA

County	VOC					
	Point	Non-point	On-road	Non-road	Event	Total
KENTUCKY						
Boone	1019.03	3708.82	1156.27	960.74	210.59	**7055.45**
Bracken	13.41	2604.87	143.77	98.86	0.0	**2860.91**
Campbell	160.58	2658.31	785.96	260.64	0.0	**3865.49**
Gallatin	87.39	1872.80	230.24	95.01	49.75	**2335.19**
Grant	79.78	3246.13	422.24	239.93	2.86	**3990.94**
Kenton	232.80	3289.76	1405.33	418.90	0.0	**5346.79**
Pendleton	127.59	3137.17	227.50	44.20	80.48	**3616.94**
KY Total	**1720.58**	**20517.86**	**4371.31**	**2118.28**	**343.68**	**29071.71**
INDIANA						
Dearborn	1573.32	3500.17	752.90	152.55	144.58	**6123.52**
Ohio	0.01	1571.07	111.12	30.63	46.31	**1759.14**
Union	0.00	1500.88	127.38	218.28	0.00	**1846.54**
IN Total	**1573.33**	**6572.12**	**991.40**	**401.46**	**190.89**	**9729.20**
OHIO						
Brown	28.90	4558.87	969.87	111.49	24.69	**5693.82**
Butler	1146.62	6081.24	4556.78	1076.33	0.0	**12860.97**
Clermont	180.86	5500.53	2654.57	719.53	0.0	**9055.49**
Hamilton	978.46	10759.16	10490.15	2734.21	0.0	**24961.98**
Warren	262.03	4760.18	2741.38	812.53	0.0	**8576.12**
OH Total	**2596.87**	**31659.98**	**21412.75**	**5454.09**	**24.69**	**61148.38**
Total Emissions	**5890.78**	**58749.96**	**26775.46**	**7973.83**	**559.26**	**99949.29**

Table 3
2011 NEI NO_x Emissions (tpy)
Cincinnati, OH-KY-IN CBSA

County	NOx					
	Point	Non-point	On-road	Non-road	Event	Total
KENTUCKY						
Boone	3569.19	801.83	3455.45	682.30	21.32	**8530.09**
Bracken	3.72	469.43	267.93	72.38	0.0	**813.46**
Campbell	82.95	666.79	1583.28	247.83	0.0	**2580.85**
Gallatin	609.76	357.34	832.85	42.53	5.00	**1847.48**
Grant	13.00	510.39	1590.13	96.12	0.28	**2209.92**
Kenton	147.17	818.13	3449.61	521.34	0.0	**4936.25**
Pendleton	949.22	350.98	385.47	77.48	7.90	**1771.05**
KY Total	**5375.01**	**3974.89**	**11564.72**	**1739.98**	**34.50**	**22689.10**
INDIANA						
Dearborn	6530.65	296.72	1610.93	196.33	6.62	**8641.25**
Ohio	0.00	76.65	164.59	28.77	2.75	**272.76**
Union	0.00	190.63	226.35	135.37	0.00	**552.35**
IN Total	**6530.65**	**564.00**	**2001.87**	**360.47**	**9.37**	**9466.36**
OHIO						
Brown	4.40	383.53	1288.36	254.07	2.39	**1932.75**
Butler	3989.32	1962.75	7108.70	1569.52	0.0	**14630.29**
Clermont	16000.81	592.15	4374.25	833.68	0.0	**21800.89**
Hamilton	9664.54	3798.10	19232.85	3145.46	0.0	**35840.95**
Warren	569.13	799.42	4743.52	1189.90	0.0	**7301.97**
OH Total	**30228.20**	**7535.95**	**36747.68**	**6992.63**	**2.39**	**81506.85**
Total Emissions	**42133.86**	**23980.5**	**50314.27**	**9093.08**	**46.26**	**113662.31**

Table 4
VOC Emissions as % of Total VOC Emissions
Cincinnati, OH-KY-IN CBSA

County	Point	Non Point	On-Road	Non-Road	Total MSA
Hamilton, OH	16.6	17.5	39.4	35.3	**25.4**
Butler, OH	19.5	9.9	17.1	13.9	**13.1**
Clermont, OH	3.1	8.9	10.0	9.3	**9.2**
Warren, OH	4.4	7.7	10.3	10.5	**8.7**
Boone, KY	17.3	6.5	4.3	12.4	**7.2**
Dearborn, IN	27.0	5.7	2.8	2.0	**6.2**
Brown, OH	0.5	7.4	3.6	1.4	**5.8**
Kenton, KY	4.0	5.7	5.3	5.4	**5.5**
Grant, KY	1.4	5.3	1.6	3.1	**4.1**
Campbell, KY	2.7	4.3	2.9	3.4	**3.9**
Pendleton, KY	2.2	5.1	0.9	0.6	**3.7**
Bracken, KY	0.2	4.6	0.5	1.3	**2.9**
Gallatin, KY	1.5	3.3	0.9	1.2	**2.4**
Ohio. IN	0.0	2.6	0.4	0.4	**1.8**
Union, IN	0.0	2.6	0.5	2.7	**1.8**

Table 5
NOx Emissions as % of Total NOx Emissions
Cincinnati, OH-KY-IN CBSA

County	Point	Non Point	On-Road	Non-Road	Total MSA
Hamilton, OH	22.9	32.0	38.4	35.1	**31.4**
Clermont, OH	38.0	5.0	8.7	9.3	**19.1**
Butler, OH	9.5	16.5	14.2	17.5	**12.8**
Dearborn, IN	15.5	2.5	3.2	2.2	**7.6**
Boone, KY	8.5	6.7	6.9	7.6	**7.5**
Warren, OH	1.4	6.7	9.5	13.3	**6.4**
Kenton, KY	0.4	6.9	6.9	5.8	**4.3**
Campbell, KY	0.2	5.6	3.2	2.8	**2.3**
Grant, KY	3.1	4.3	3.2	1.1	**1.9**
Brown, OH	0.0	3.2	2.6	2.8	**1.7**
Gallatin, KY	1.4	3.0	1.7	0.5	**1.6**
Pendleton, KY	2.3	3.0	0.8	0.9	**1.5**
Bracken, KY	0.0	4.0	0.5	0.8	**0.7**
Union, IN	0.0	0.8	1.5	1.5	**0.5**
Ohio. IN	0.0	0.6	0.3	0.3	**0.2**

Point Sources

Table 2 indicates 2011 point source emissions of VOC in Campbell County were 160.58 tpy. Total VOC point source emissions from the Cincinnati, OH-KY-IN CBSA were 5,890.78 tpy. Campbell County only accounts for approximately 2.7% of the total VOC point source emissions in the CBSA. Table 4 shows the percentages of VOC emissions for point sources in the CBSA, by county.

As seen in Table 3, point source emissions of NO_x in Campbell County were estimated to be 82.95 tpy in 2011, which represents 0.2% of the total 42,133.86 tpy of the overall NO_x point source emissions from the Cincinnati, OH-KY-IN CBSA. Table 5 shows the percentages of NO_x emissions for point sources in the CBSA, by county.

Non-Point (Area) Emissions

Table 2 shows that non-point (or "area") VOC emissions in Campbell County were estimated to be 2,658.31 tpy for 2011, which represents approximately 4.6% of the total 57,249.08 tpy of the overall VOC non-point source emissions from the Cincinnati, OH-KY-IN CBSA. Table 4 shows the percentages of VOC emissions for non-point sources in the CBSA, by county.

As seen in Table 3, non-point NOx emissions from Campbell County were estimated at 666.79 tpy in 2011, which represents approximately 5.6% of the total 11,884.21 tpy of the overall NOx non-point source emissions from the Cincinnati, OH-KY-IN CBSA. Table 5 shows the percentages of NOx emissions for non-point sources in the CBSA, by county.

On-Road Mobile

As indicated in Table 2, on-road mobile source VOC emissions from Campbell County were estimated to be 785.96 tpy in 2011, which represents approximately 2.9% of the total 26,648.08 tpy of the overall VOC on-road mobile source emissions from the Cincinnati, OH-KY-IN CBSA. Table 4 shows the percentages of VOC emissions for on-road mobile sources in the CBSA, by county.

As seen in Table 3, on-road mobile source NO_x emissions from Campbell County were estimated at 1,583.28 tpy in 2011, which represents approximately 3.2% of the total 50,087.92 tpy of the overall NO_x on-road mobile source emissions from the Cincinnati, OH-KY-IN CBSA. Table 5 shows the percentages of NO_x emissions for on-road mobile sources in the CBSA, by county.

Based on 2014 information obtained from the U.S. Census website, http://onthemap.ces.census.gov/, the commuting traffic from other counties into Campbell County is 65.9% while the commuting traffic from Campbell County into other counties is 78.0%.

Table 6 below provides Vehicle Miles Travelled (VMT) for all areas within the Cincinnati, OH-KY-IN CBSA for the year 2011. The counties within the Ohio portion of the CBSA contribute to the majority of VMT within the CBSA. Although Campbell County is not the main contributor to VMT, it does

contribute a significant number of VMT within the CBSA. High VMT is associated with urban areas and linked with motor vehicle emissions that may contribute to ozone formation.

Table 6
2011 VMT Totals, Cincinnati, OH-KY-IN CBSA

	2011 VMT Totals
Kentucky	
Boone County	**1,558,794,112**
Bracken County	**104,160,119**
Campbell County	**1,010,009,434**
Gallatin County	**245,765,593**
Grant County	**529,145,674**
Kenton County	**1,720,886,038**
Pendleton County	**184,074,537**
KY Total	**5,352,835,507**
Ohio	
Brown County	**468,171,663**
Butler County	**3,099,030,997**
Clermont County	**1,951,343,156**
Hamilton County	**9,004,357,566**
Warren County	**2,139,774,797**
OH Total	**16,662,678,179**
Indiana	
Dearborn County	**690,348,611**
Ohio County	**71,591,617**
Union County	**105,444,221**
IN Total	**867,384,449**
Total VMT for CBSA	**22,882,898,135**

Non-Road Mobile Sources

As listed in Table 2, non-road mobile source VOC emissions from Campbell County were estimated at 260.64 tpy in 2011, which represents approximately 3.4% of the total 7,755.55 tpy of the overall VOC non-road mobile source emissions from the Cincinnati, OH-KY-IN CBSA. Table 4 shows the percentages of VOC emissions for non-road mobile sources in the CBSA, by county.

As seen in Table 3, non-road mobile source NO_x emissions from Campbell County were estimated at 247.83 tpy in 2011, which represents approximately 2.8% of the total 8,957.71 tpy of the overall NO_x non-road mobile source emissions from the Cincinnati, OH-KY-IN CBSA. Table 5 shows the percentages of NO_x emissions for non-road mobile sources in the CBSA, by county.

Comparison of Total Emissions

A comparison of total emissions across the entire Cincinnati, OH-KY-IN CBSA was performed using data from the Ozone Designations Mapping Tool. The percentages shown in last column in both Tables 4 and 5 demonstrate that the majority of VOC and NOx emissions within the Cincinnati, OH-KY-IN CBSA come from the Ohio portion of the CBSA.

Population

Based on U.S. Census Bureau estimates for 2015, there are 92,066 persons living in Campbell County (Refer to Table 7). This represents approximately 597 persons per square mile. The population of Campbell County is approximately 15.3% rural with the remaining 84.7% living in incorporated areas. The largest cities in Campbell County are Newport and Ft. Thomas.

Campbell County's population from 2010 to 2015 *increased* by 1.9% (90,336 to 92,066). For the entire Cincinnati, OH-KY-IN CBSA, Campbell County represents approximately 4.2% of the total population in the CBSA and 20.9% of the Kentucky portion of the CBSA (Refer to Table 8).

Table 7
Northern Kentucky Area Population
Growth Data

County	Census 2010	2015*	%Growth 2010 - 2015
Boone	118,811	127,712	7.5%
Bracken	8,488	8,321	-2.0%
Campbell	90,336	92,066	1.9%
Gallatin	8,589	8,636	0.5%
Grant	24,662	24,757	0.4%
Kenton	159,720	165,012	3.3%
Pendleton	14,877	14,408	-3.1%

*U.S. Census Bureau estimates.

Table 8
2015 Population
Cincinnati, OH-KY-IN CBSA

CBSA Estimated Population	2015*	2015 Population Density (1,000 per square mile)	% of Total	
Kentucky			**of KY Portion**	**of CBSA**
Boone County	**127,712**	**0.52**	**29.0%**	**5.9%**
Bracken County	**8,321**	**0.04**	**1.9%**	**0.5%**
Campbell County	**92,066**	**0.61**	**20.9%**	**4.3%**
Gallatin County	**8,636**	**0.09**	**2.0%**	**0.4%**
Grant County	**24,757**	**0.10**	**5.6%**	**1.2%**
Kenton County	**165,012**	**1.03**	**37.4%**	**7.6%**
Pendleton County	**14,408**	**0.05**	**3.3%**	**0.7%**
KY Total	**440,912**	**--**	**100%**	**20.6%**
Ohio			**of OH Portion**	
Brown County	**43,839**	**0.09**	**2.7%**	**2.0%**
Butler	**376,353**	**0.81**	**22.8%**	**17.4%**
Clermont County	**201,973**	**0.45**	**12.2%**	**9.4%**
Hamilton County	**807,598**	**1.99**	**48.8%**	**37.4%**
Warren County	**224,469**	**0.56**	**13.6%**	**10.4%**
OH Total	**1,654,232**	**--**	**100%**	**76.7%**
Indiana			**of IN Portion**	
Dearborn County	**49,455**	**0.16**	**79.0%**	**2.3%**
Ohio County	**5,938**	**0.07**	**9.5%**	**0.3%**
Union County	**7,182**	**0.04**	**11.5%**	**0.3%**
IN Total	**62,575**	**--**	**100%**	**2.9%**
Total Estimated Population	**2,157,719**	**--**	**100%**	**100%**

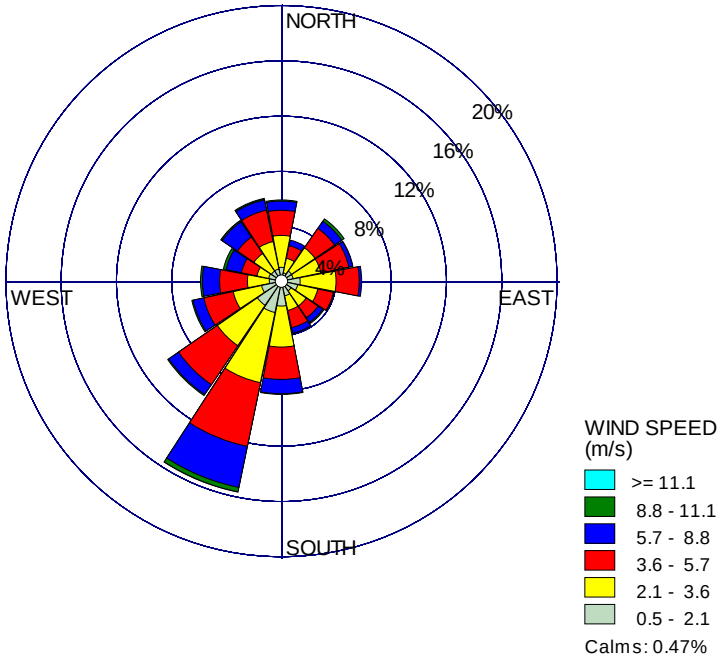
*U.S. Census Bureau estimates.

Areas of dense population and high VMT can display elevated nonpoint and on-road source emissions. As seen in Tables 2 and 3, two of the sectors with the highest emission contribution are from nonpoint (VOC) and on-road (NOx). This correlation indicates that VMT and population density within Campbell County may be contributing to violating monitors within the CBSA.

Meteorological Information

Wind speed and wind direction data collected at the Cincinnati-Northern Kentucky Airport (NWS Station 93814) for the period 2013-2015 shows that the majority of the time the wind in the area came from the southwest and typically from 2.1-3.6 miles per hour (Refer to Figure 1). According to Kentucky Mesonet (http://www.kymesonet.org/), the average high temperature for July for the period 2013-2015 was 91.9º F and the average low temperature for July was 55.5º F. The average July precipitation for the same period (2013-2015) was 4.7 inches.

Figure 1: Wind Rose Average 2013-2015 March 1st - October 31st



Several 48-hour back trajectory HYSPLITS for Kentucky have been included in section 8 for days in 2013-2015 when the 8-hour ambient monitoring concentration for ozone had their highest readings. These HYSPLITS show which direction the air column is coming from for the majority of the time and what areas may be affecting the violating monitor within Campbell County.

Geography and Topography

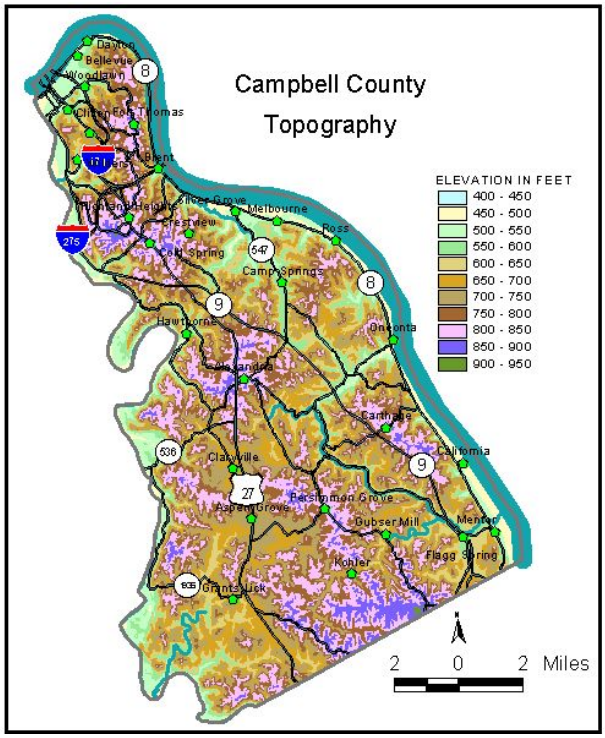
Campbell County is part of the Cincinnati, OH-KY-IN Metropolitan Statistical Area (CBSA) and has a land area of 151 square miles. Located on the banks of the Ohio River, Campbell County lies to the east of Kenton County, Kentucky, to the north of Pendleton County, Kentucky and to the southeast of Cincinnati, Ohio.

The area is bound by the Ohio River to the east and north and the Licking River to the west. Flat areas are small and relatively scarce. The community elevations are as follows: Alexandria is the county seat

at 823 feet; Bellevue, 545 feet; Dayton, 515 feet; Fort Thomas, 810 feet and Newport, 514 feet. The highest elevation in the county is 920 feet, located at a ridge that sits on the divide of the Ohio and Licking Rivers at the county's southern boundary. The lowest elevation is 455 feet, where the Ohio and Licking Rivers are conjunct.

Campbell County does not have any geographical or topographical distinctions that interfere with air pollution transport. Therefore, this factor is not a significant part of the overall analysis.

Figure 2: Campbell County Topography Map



Jurisdictional Boundaries

The authority for air quality planning in the Campbell County area resides with the Kentucky Energy and Environment Cabinet. Transportation planning for Campbell County is performed by the Ohio, Kentucky, and Indiana Regional Council of Governments (OKI). Historically, portions of Boone, Campbell, and Kenton counties have been designated as nonattainment. These Kentucky counties along with Butler, Clermont, Clinton, Hamilton, Warren, Ohio, and Dearborn, Indiana were designated nonattainment for the 1997 and 2008 ozone standards. The 2008 ozone standard nonattainment area was confined to specific census tracts in the northern part of Boone, Campbell and Kenton counties.

Conclusion and Recommendation

A three-year-average (2013-2015) of 0.071 parts per million shows Campbell County is in violation of the 8-hour ozone standard.

As seen in Table 9, Campbell County's VOC and NOx emissions are relatively less than other counties located within the Cincinnati, OH-KY-IN CBSA. Campbell County contributes approximately:

- 3.9% of the total VOC emissions
- 2.3% of the total NO_x emissions

The emissions from Campbell do not significantly contribute to the ozone violations of the 8-hour standard in the Cincinnati, OH-KY-IN CBSA.

Table 9
VOC and NO_x Percentages for
Cincinnati, OH-KY-IN CBSA (2011 NEI)

County	VOC %	NO_X %
KENTUCKY		
Boone	7.1	7.5
Bracken	2.9	0.7
Campbell	3.8	2.3
Gallatin	2.3	1.6
Grant	4.0	1.9
Kenton	5.3	4.3
Pendleton	3.6	1.6
KY Total	**29.0%**	**19.9%**
OHIO		
Brown	5.7	1.7
Butler	12.9	12.9
Clermont	9.1	19.2
Hamilton	25.0	31.6
Warren	8.6	6.4
OH Total	**61.3%**	**71.8**
INDIANA		
Dearborn	6.1	7.6
Ohio	1.8	0.2
Union	1.8	0.5
IN Total	**9.7%**	**8.3%**
Total Emissions %	**100.0%**	**100.0%**

There are no distinguishable geographical or topographical elements that would affect VOC or NOx levels. The emission contributions in Campbell County are not as significant as other areas within the CBSA. Figure 3a shows 2010 Census Tracts For the northern portion of Campbell County. Figure 3b shows the southern portion of Campbell County, with the 2010 Census Tracts identified, as well. The EPA Ozone Mapping Tool map was used to analyze which portions of Campbell County could be contributing to the violating monitor based on high population areas. Although Campbell County does not have the highest population within the CBSA, the significant VMT levels along with commuting patterns suggest that there is a large urban population that leads to increased on-road and nonpoint source emissions. It is suggested that a portion of Campbell County be designated as "nonattainment" for the 2015 8-hour ozone NAAQS. Specifically, the following census tracts within Campbell County should be designated as nonattainment: 501, 502, 503, 504, 505, 506, 511.01, 511.02, 512, 513, 519.01, 519.03, 519.04, 521, 522, 523.01, 523.02, 524, 525, 526, 528, 529, 530, and 531.

Figure 3a: 2010 Census Tracts for northern Campbell County

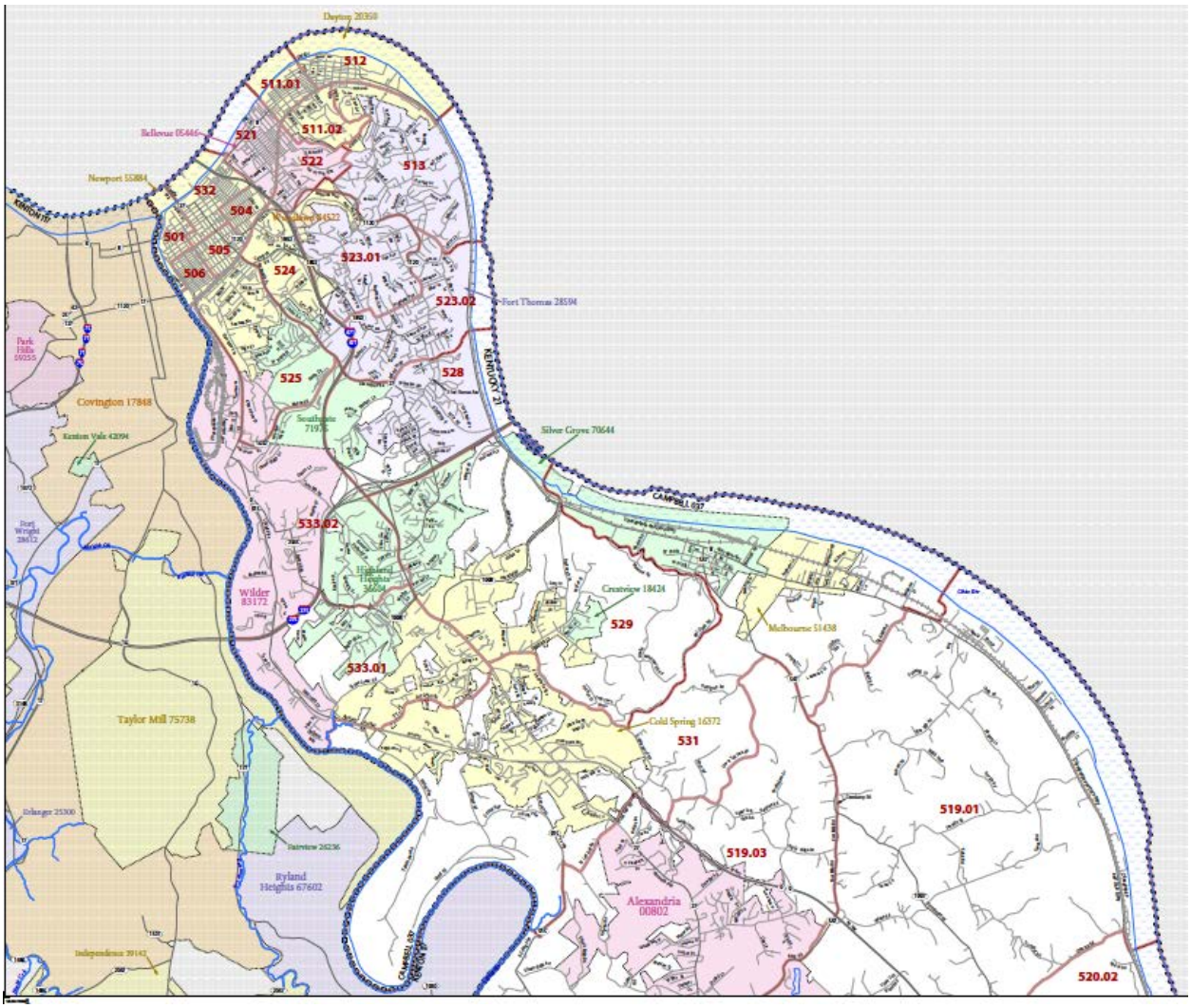
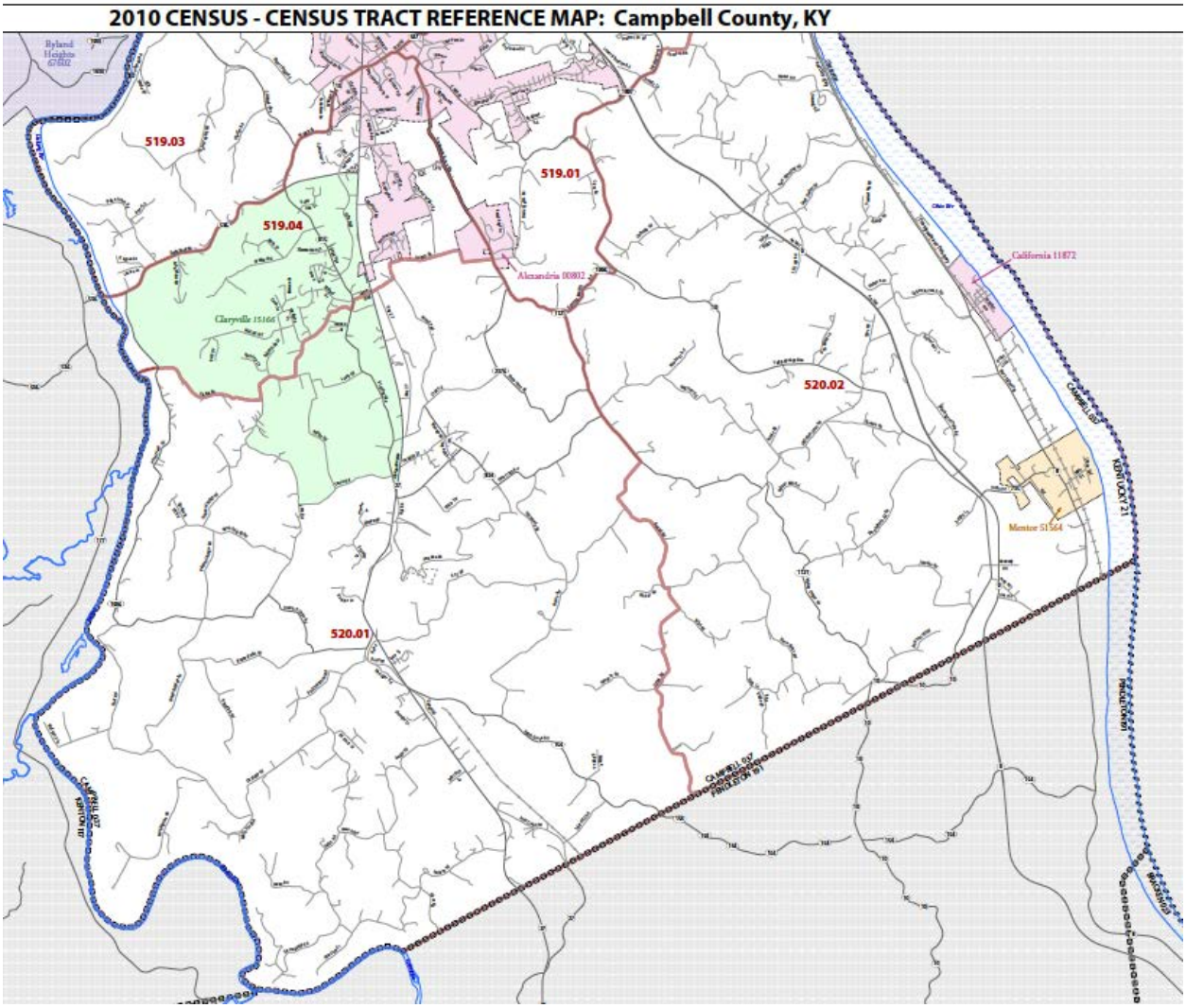


Figure 3b: 2010 Census Tracts for southern Campbell County



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Gallatin County, KY

Air Quality

Pursuant to 40 CFR 50:19 (b) and (d) the 8-hour primary and secondary NAAQS are met at an ambient air quality monitoring site when the 3-year average of the annual fourth-highest daily maximum 8-hour average ozone concentration is less than or equal to 0.070 ppm, as determined in accordance with Appendix U of Part 50. For the 2013-2015 monitoring period, there were no ozone monitors located in Gallatin County.

Table 1 provides a summary of the annual fourth-highest daily maximum 8-hour average ozone concentrations recorded at monitors located in the Cincinnati, OH-KY-IN Core Based Statistical Area (CBSA), for 2013-2015. Not all counties in the Cincinnati, OH-KY-IN CBSA have monitors for ozone. Monitor values included in Table 1 only reflect those monitors that were operational during the 2013 to 2015 design value period. Only the monitor in Campbell County, KY indicates a design value above the revised ozone NAAQS for the CBSA.

Table 1
Cincinnati, OH-KY-IN CBSA
3-year Average* of Annual 8-hour concentrations for Ozone

County/Site	AQS Code	Annual 4th High (ppm)			Design Value (ppm)
		2013	2014	2015	
Kentucky					
Boone	21-015-0003	0.059	0.062	0.062	0.061
Campbell	21-037-3002	0.072	0.071	0.071	0.071
Ohio					
Butler	39-017-0004	0.068	0.070	0.070	0.069
Butler	39-017-0018	0.068	0.069	0.070	0.069
Butler	39-017-9991	0.069	0.069	0.068	0.068
Clermont	39-025-0022	0.066	0.068	0.070	0.068
Hamilton	39-061-0006	0.069	0.070	0.072	0.070
Hamilton	39-061-0010	0.064	0.073	0.070	0.069
Hamilton	39-061-0040	0.069	0.069	0.071	0.069
Warren	39-165-0007	0.067	0.071	0.071	0.069

*NAAQS 8-hour (3 year average of the 4th max value). 0.070ppm
n/a indicates no monitor data for that county.

Emissions and Emissions-Related Data

The U.S. EPA requires an emissions inventory to be developed in order to identify the level of emissions in a specific area and adjacent regions that may have contributed to an ozone violation. The EPA Ozone Designations Mapping Tool was used to obtain 2011 NEI v2 emissions inventory data. The 2011 NEI v2 is the latest available national emissions inventory data and is the source of the point, non-point, on-road, non-road and event emissions, and was used to evaluate Gallatin County's impact on the violating monitor. VOC and NOx emissions, by category, are provided in Tables 2 and 3.

Table 2
2011 NEI VOC Emissions (tpy)
Cincinnati, OH-KY-IN CBSA

County	VOC					
	Point	Non-point	On-road	Non-road	Event	Total
KENTUCKY						
Boone	1019.03	3708.82	1156.27	960.74	210.59	**7055.45**
Bracken	13.41	2604.87	143.77	98.86	0.0	**2860.91**
Campbell	160.58	2658.31	785.96	260.64	0.0	**3865.49**
Gallatin	87.39	1872.80	230.24	95.01	49.75	**2335.19**
Grant	79.78	3246.13	422.24	239.93	2.86	**3990.94**
Kenton	232.80	3289.76	1405.33	418.90	0.0	**5346.79**
Pendleton	127.59	3137.17	227.50	44.20	80.48	**3616.94**
KY Total	**1720.58**	**20517.86**	**4371.31**	**2118.28**	**343.68**	**29071.71**
INDIANA						
Dearborn	1573.32	3500.17	752.90	152.55	144.58	**6123.52**
Ohio	0.01	1571.07	111.12	30.63	46.31	**1759.14**
Union	0.00	1500.88	127.38	218.28	0.00	**1846.54**
IN Total	**1573.33**	**6572.12**	**991.40**	**401.46**	**190.89**	**9729.20**
OHIO						
Brown	28.90	4558.87	969.87	111.49	24.69	**5693.82**
Butler	1146.62	6081.24	4556.78	1076.33	0.0	**12860.97**
Clermont	180.86	5500.53	2654.57	719.53	0.0	**9055.49**
Hamilton	978.46	10759.16	10490.15	2734.21	0.0	**24961.98**
Warren	262.03	4760.18	2741.38	812.53	0.0	**8576.12**
OH Total	**2596.87**	**31659.98**	**21412.75**	**5454.09**	**24.69**	**61148.38**
Total Emissions	**5890.78**	**58749.96**	**26775.46**	**7973.83**	**559.26**	**99949.29**

Table 3
2011 NEI NO_x Emissions (tpy)
Cincinnati, OH-KY-IN CBSA

County	NOx					
	Point	Non-point	On-road	Non-road	Event	Total
KENTUCKY						
Boone	3569.19	801.83	3455.45	682.30	21.32	**8530.09**
Bracken	3.72	469.43	267.93	72.38	0.0	**813.46**
Campbell	82.95	666.79	1583.28	247.83	0.0	**2580.85**
Gallatin	609.76	357.34	832.85	42.53	5.00	**1847.48**
Grant	13.00	510.39	1590.13	96.12	0.28	**2209.92**
Kenton	147.17	818.13	3449.61	521.34	0.0	**4936.25**
Pendleton	949.22	350.98	385.47	77.48	7.90	**1771.05**
KY Total	**5375.01**	**3974.89**	**11564.72**	**1739.98**	**34.50**	**22689.10**
INDIANA						
Dearborn	6530.65	296.72	1610.93	196.33	6.62	**8641.25**
Ohio	0.00	76.65	164.59	28.77	2.75	**272.76**
Union	0.00	190.63	226.35	135.37	0.00	**552.35**
IN Total	**6530.65**	**564.00**	**2001.87**	**360.47**	**9.37**	**9466.36**
OHIO						
Brown	4.40	383.53	1288.36	254.07	2.39	**1932.75**
Butler	3989.32	1962.75	7108.70	1569.52	0.0	**14630.29**
Clermont	16000.81	592.15	4374.25	833.68	0.0	**21800.89**
Hamilton	9664.54	3798.10	19232.85	3145.46	0.0	**35840.95**
Warren	569.13	799.42	4743.52	1189.90	0.0	**7301.97**
OH Total	**30228.20**	**7535.95**	**36747.68**	**6992.63**	**2.39**	**81506.85**
Total Emissions	**42133.86**	**23980.5**	**50314.27**	**9093.08**	**46.26**	**113662.31**

Table 4
VOC Emissions as % of Total VOC Emissions
Cincinnati, OH-KY-IN CBSA

County	Point	Non Point	On-Road	Non-Road	Total MSA
Hamilton, OH	16.6	17.5	39.4	35.3	**25.4**
Butler, OH	19.5	9.9	17.1	13.9	**13.1**
Clermont, OH	3.1	8.9	10.0	9.3	**9.2**
Warren, OH	4.4	7.7	10.3	10.5	**8.7**
Boone, KY	17.3	6.5	4.3	12.4	**7.2**
Dearborn, IN	27.0	5.7	2.8	2.0	**6.2**
Brown, OH	0.5	7.4	3.6	1.4	**5.8**
Kenton, KY	4.0	5.7	5.3	5.4	**5.5**
Grant, KY	1.4	5.3	1.6	3.1	**4.1**
Campbell, KY	2.7	4.3	2.9	3.4	**3.9**
Pendleton, KY	2.2	5.1	0.9	0.6	**3.7**
Bracken, KY	0.2	4.6	0.5	1.3	**2.9**
Gallatin, KY	1.5	3.3	0.9	1.2	**2.4**
Ohio. IN	0.0	2.6	0.4	0.4	**1.8**
Union, IN	0.0	2.6	0.5	2.7	**1.8**

Table 5
NOx Emissions as % of Total NOx Emissions
Cincinnati, OH-KY-IN CBSA

County	Point	Non Point	On-Road	Non-Road	Total MSA
Hamilton, OH	22.9	32.0	38.4	35.1	**31.4**
Clermont, OH	38.0	5.0	8.7	9.3	**19.1**
Butler, OH	9.5	16.5	14.2	17.5	**12.8**
Dearborn, IN	15.5	2.5	3.2	2.2	**7.6**
Boone, KY	8.5	6.7	6.9	7.6	**7.5**
Warren, OH	1.4	6.7	9.5	13.3	**6.4**
Kenton, KY	0.4	6.9	6.9	5.8	**4.3**
Campbell, KY	0.2	5.6	3.2	2.8	**2.3**
Grant, KY	3.1	4.3	3.2	1.1	**1.9**
Brown, OH	0.0	3.2	2.6	2.8	**1.7**
Gallatin, KY	1.4	3.0	1.7	0.5	**1.6**
Pendleton, KY	2.3	3.0	0.8	0.9	**1.5**
Bracken, KY	0.0	4.0	0.5	0.8	**0.7**
Union, IN	0.0	0.8	1.5	1.5	**0.5**
Ohio. IN	0.0	0.6	0.3	0.3	**0.2**

Point Sources

Table 2 indicates 2011 point source emissions of VOC in Gallatin County were 87.39 tpy. Total VOC point source emissions from the Cincinnati, OH-KY-IN CBSA were 5,890.78 tpy. Gallatin County only accounts for approximately 1.5% of the total VOC point source emissions in the CBSA. Table 4 shows the percentages of VOC emissions for point sources in the CBSA, by county.

As seen in Table 3, point source emissions of NO_x in Gallatin County were estimated to be 609.76 tpy in 2011, which 1.4% of the total 42,133.86 tpy of the overall NO_x point source emissions from the Cincinnati, OH-KY-IN CBSA. Table 5 shows the percentages of NO_x emissions for point sources in the CBSA, by county.

Non-Point (Area) Emissions

Table 2 shows that non-point (or "area") VOC emissions in Gallatin County were estimated to be 1,872.80 tpy for 2011, which represents approximately 3.3% of the total 57,249.08 tpy of the overall VOC non-point source emissions from the Cincinnati, OH-KY-IN CBSA. Table 4 shows the percentages of VOC emissions for non-point sources in the CBSA, by county.

As seen in Table 3, non-point NOx emissions from Gallatin County were estimated at 357.34 tpy in 2011, which represents approximately 3.0% of the total 11,884.21 tpy of the overall NOx non-point source emissions from the Cincinnati, OH-KY-IN CBSA. Table 5 shows the percentages of NOx emissions for non-point sources in the CBSA, by county.

On-Road Mobile

As indicated in Table 2, on-road mobile source VOC emissions from Gallatin County were estimated to be 230.24 tpy in 2011, which represents approximately 0.9% of the total 26,648.08 tpy of the overall VOC on-road mobile source emissions from the Cincinnati, OH-KY-IN CBSA. Table 4 shows the percentages of VOC emissions for on-road mobile sources in the CBSA, by county.

As seen in Table 3, on-road mobile source NO_x emissions from Gallatin County were estimated at 832.85 tpy in 2011, which represents approximately 1.7% of the total 50,087.92 tpy of the overall NO_x on-road mobile source emissions from the Cincinnati, OH-KY-IN CBSA. Table 5 shows the percentages of NO_x emissions for on-road mobile sources in the CBSA, by county.

Based on 2014 information obtained from the U.S Census Website, http://onthemap.ces.gov, the commuting traffic from other counties into Gallatin County is 70.5% while the commuting traffic from Gallatin County into other counties is 80.0%.

Table 6 below provides Vehicle Miles Travelled (VMT) for all areas within the Cincinnati, OH-KY-IN CBSA for the year 2011. The counties within the Ohio portion of the CBSA contribute to the majority of VMT within the CBSA. Gallatin County's VMT is significantly lower compared to other counties within the CBSA.

Table 6
2011 VMT Totals, Cincinnati, OH-KY-IN CBSA

	2011 VMT Totals
Kentucky	
Boone County	**1,558,794,112**
Bracken County	**104,160,119**
Campbell County	**1,010,009,434**
Gallatin County	**245,765,593**
Grant County	**529,145,674**
Kenton County	**1,720,886,038**
Pendleton County	**184,074,537**
KY Total	**5,352,835,507**
Ohio	
Brown County	**468,171,663**
Butler County	**3,099,030,997**
Clermont County	**1,951,343,156**
Hamilton County	**9,004,357,566**
Warren County	**2,139,774,797**
OH Total	**16,662,678,179**
Indiana	
Dearborn County	**690,348,611**
Ohio County	**71,591,617**
Union County	**105,444,221**
IN Total	**867,384,449**
Total VMT for CBSA	**22,882,898,135**

Non-Road Mobile Sources

As listed in Table 2, non-road mobile source VOC emissions from Gallatin County were estimated at 95.01 tpy in 2011, which represents approximately 1.2% of the total 7,755.55 tpy of the overall VOC non-road mobile source emissions from the Cincinnati, OH-KY-IN CBSA. Table 4 shows the percentages of VOC emissions for non-road mobile sources in the CBSA, by county.

As seen in Table 3, non-road mobile source NO_x emissions from Gallatin County were estimated at 42.53 tpy in 2011, which represents approximately 0.5% of the total 8,957.71 tpy of the overall NO_x non-road mobile source emissions from the Cincinnati, OH-KY-IN CBSA. Table 5 shows the percentages of NO_x emissions for non-road mobile sources in the CBSA, by county.

Comparison of Total Emissions

A comparison of total emissions across the entire Cincinnati, OH-KY-IN CBSA was performed using data from the Ozone Designations Mapping Tool. The percentages shown in last column in both Tables 4 and 5 demonstrate that the majority of VOC and NOx emissions within the Cincinnati, OH-KY-IN CBSA come from the Ohio portion of the CBSA

Population

Based on U.S. Census Bureau estimates for 2015, there are 8,636 persons living in Gallatin County (Refer to table 7). This represents approximately 88.1 persons per square mile. The population of Gallatin County is approximately 100% rural with few people living in incorporated areas. The largest cities in Gallatin County are Warsaw and Glencoe.

Gallatin County's population from 2010 to 2015 *increased* by approximately 0.5% (8,589 to 8,636). For the entire Cincinnati, OH-KY-IN CBSA, Gallatin County represents less than 0.4% of the total population in the CBSA and 2.0% of the Kentucky portion of the CBSA. (Refer to Table 8)

Table 7
Northern Kentucky Area Population
Growth Data

County	Census 2010	2015*	%Growth 2010 - 2015
Boone	118,811	127,712	7.5%
Bracken	8,488	8,321	-2.0%
Campbell	90,336	92,066	1.9%
Gallatin	8,589	8,636	0.5%
Grant	24,662	24,757	0.4%
Kenton	159,720	165,012	3.3%
Pendleton	14,877	14,408	-3.1%

*U.S. Census Bureau estimates.

Table 8
2015 Population
Cincinnati, OH-KY-IN CBSA

CBSA Estimated Population	2015*	2015 Population Density (1,000 per square mile)	% of Total	
Kentucky			**of KY Portion**	**of CBSA**
Boone County	**127,712**	**0.52**	**29.0%**	**5.9%**
Bracken County	**8,321**	**0.04**	**1.9%**	**0.5%**
Campbell County	**92,066**	**0.61**	**20.9%**	**4.3%**
Gallatin County	**8,636**	**0.09**	**2.0%**	**0.4%**
Grant County	**24,757**	**0.10**	**5.6%**	**1.2%**
Kenton County	**165,012**	**1.03**	**37.4%**	**7.6%**
Pendleton County	**14,408**	**0.05**	**3.3%**	**0.7%**
KY Total	**440,912**	**--**	**100%**	**20.6%**
Ohio			**of OH Portion**	
Brown County	**43,839**	**0.09**	**2.7%**	**2.0%**
Butler	**376,353**	**0.81**	**22.8%**	**17.4%**
Clermont County	**201,973**	**0.45**	**12.2%**	**9.4%**
Hamilton County	**807,598**	**1.99**	**48.8%**	**37.4%**
Warren County	**224,469**	**0.56**	**13.6%**	**10.4%**
OH Total	**1,654,232**	**--**	**100%**	**76.7%**
Indiana			**of IN Portion**	
Dearborn County	**49,455**	**0.16**	**79.0%**	**2.3%**
Ohio County	**5,938**	**0.07**	**9.5%**	**0.3%**
Union County	**7,182**	**0.04**	**11.5%**	**0.3%**
IN Total	**62,575**	**--**	**100%**	**2.9%**
Total Estimated Population	**2,157,719**	**--**	**100%**	**100%**

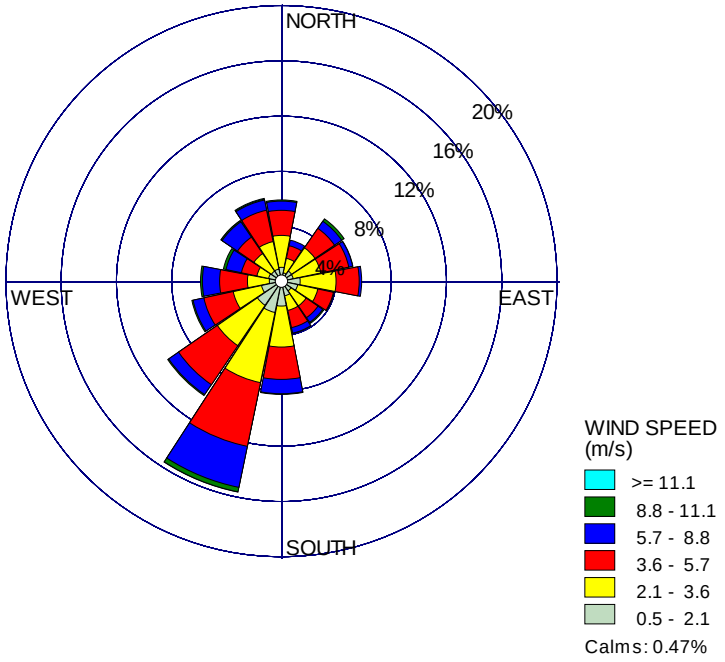
*U.S. Census Bureau estimates.

Areas of dense population and high VMT can display elevated nonpoint and on-road source emissions. As seen in Tables 2 and 3, two of the sectors with the highest emission contribution are from nonpoint for both VOC and NOx. However, Gallatin County emissions are low compared to other areas within the CBSA.

Meteorological Information

Wind speed and wind direction data collected at the Cincinnati-Northern Kentucky Airport (NWS Station 93814) for the period 2013-2015 shows that the majority of the time the wind in the area came from the southwest and typically from 2.1-3.6 miles per hour (Refer to figure 1). According to Kentucky Mesonet (http://www.kymesonet.org/), the average high temperature for July for the period 2013-2015 was 91.9º F and the average low temperature for July was 55.5º F. The average July precipitation for the same period (2013-2015) was 4.65 inches.

Figure 1: Wind Rose Average 2013-2015 March 1st - October 31st



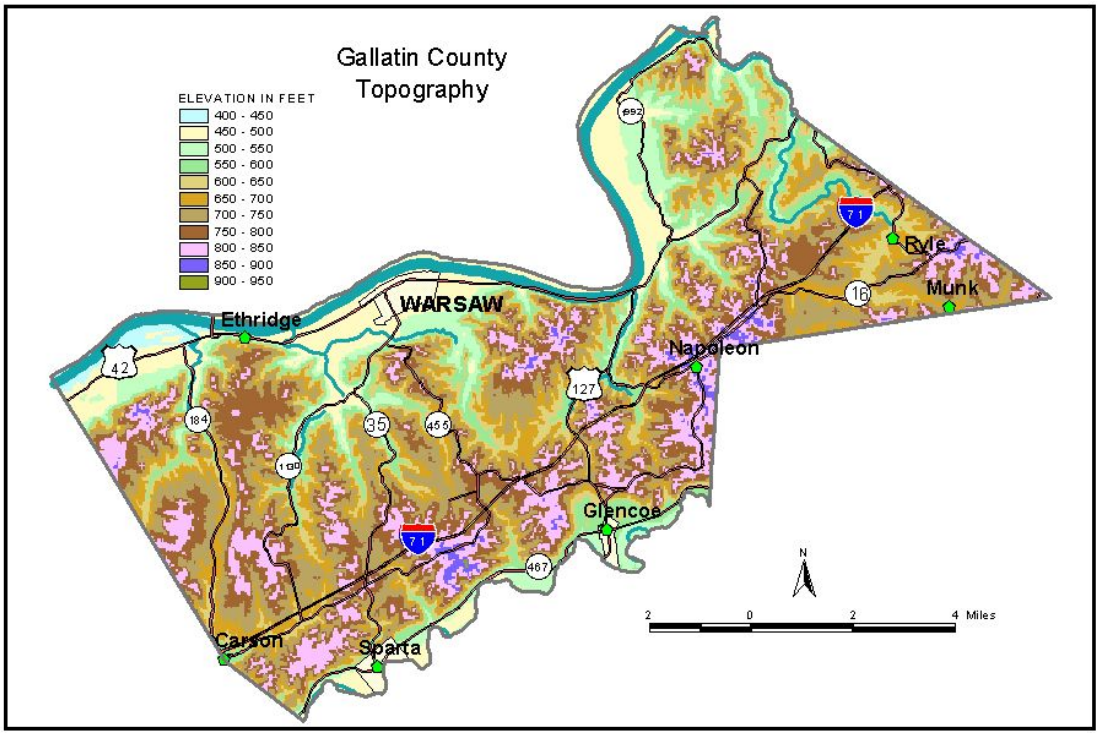
Several 48-hour back trajectory HYSPLITS for Kentucky have been included in Section 8 for days in 2013-2015 when the 8-hour ambient monitoring concentration for ozone had their highest readings. The HYSPLITS show that there is potential for Gallatin County to affect the violating monitor in Campbell County. However, Gallatin County's emissions are so low that there is no significant impact.

Geography and Topography

Gallatin County is part of the Cincinnati, OH-KY-IN Metropolitan Statistical Area (CBSA) and has a land area of 98 square miles. Located on the banks of the Ohio River, Gallatin County lies to the southwest of Boone County, northeast of Carroll County, and to the north of Owen County. The lowest elevations (420 to 520 feet) in the county are found along the Ohio River and the highest elevations (750-920 feet) are found in the southwestern corner of the county.

Gallatin County does not have any geographical or topographical distinctions that interfere with air pollution transport. Therefore, this factor is not a significant part of the overall analysis.

Figure 2: Gallatin County Topography Map



Jurisdictional Boundaries

The authority for air quality planning in the Gallatin County area resides with the Kentucky Energy and Environment Cabinet. Transportation planning for Gallatin County is performed by the Kentucky Transportation Cabinet. Historically, portions of Boone, Campbell, and Kenton counties have been designated as nonattainment. These Kentucky counties along with Butler, Clermont, Clinton, Hamilton, Warren, Ohio, and Dearborn, Indiana were designated nonattainment for the 1997 and 2008 ozone standards. The 2008 ozone standard nonattainment area was confined to specific census tracts in the northern part of Boone, Campbell and Kenton counties.

Conclusion and Recommendation

There were no ozone monitors located in Gallatin County for the 2013-2015 monitoring period.

As seen in Table 9, Gallatin County's VOC and NOx emissions are insignificant when compared to other counties located within the Cincinnati, OH-KY-IN CBSA. Gallatin County contributes approximately:

- 2.4% of the total VOC emissions
- 1.6% of the total NO_x emissions

The emissions from Gallatin are negligible and do not contribute to the ozone violations of the 8-hour standard in the Cincinnati, OH-KY-IN CBSA.

Table 9
VOC and NO_x Percentages for
Cincinnati, OH-KY-IN CBSA (2011 NEI)

County	VOC %	NO_X %
KENTUCKY		
Boone	7.1	7.5
Bracken	2.9	0.7
Campbell	3.8	2.3
Gallatin	2.3	1.6
Grant	4.0	1.9
Kenton	5.3	4.3
Pendleton	3.6	1.6
KY Total	**29.0%**	**19.9%**
OHIO		
Brown	5.7	1.7
Butler	12.9	12.9
Clermont	9.1	19.2
Hamilton	25.0	31.6
Warren	8.6	6.4
OH Total	**61.3%**	**71.8**
INDIANA		
Dearborn	6.1	7.6
Ohio	1.8	0.2
Union	1.8	0.5
IN Total	**9.7%**	**8.3%**
Total Emissions %	**100.0%**	**100.0%**

Data gathered for Gallatin County and reviewed using EPA's five factor analysis demonstrates that Gallatin County is not contributing to the violating monitor in Campbell County. Therefore, Kentucky recommends that Gallatin County be designated as "unclassifiable/attainment" for the revised 2015 8-hour ozone NAAQS.

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Grant County, KY

Air Quality

Pursuant to 40 CFR 50:19 (b) and (d) the 8-hour primary and secondary NAAQS are met at an ambient air quality monitoring site when the 3-year average of the annual fourth-highest daily maximum 8-hour average ozone concentration is less than or equal to 0.070 ppm, as determined in accordance with Appendix U of Part 50. Currently, there is no ozone monitor located in Grant County.

Table 1 provides a summary of the annual fourth-highest daily maximum 8-hour average ozone concentrations recorded at monitors located in the Cincinnati, OH-KY-IN Metropolitan Statistical Area (MSA), for 2013-2015. Not all counties in the Cincinnati, OH-KY-IN MSA have monitors for ozone. Monitor values included in Table 1 only reflect those monitors that were operational during the 2013 to 2015 design value period. Only the monitor in Campbell County, KY indicates a design value above the revised ozone NAAQS for the MSA.

Table 1
Cincinnati, OH-KY-IN MSA
3-year Average* of Annual 8-hour concentrations for Ozone

County/Site	AQS Code	Annual 4th High (ppm)			Design Value (ppm)
		2013	2014	2015	
Kentucky					
Boone	21-015-0003	0.059	0.062	0.062	0.061
Campbell	21-037-3002	0.072	0.071	0.071	0.071
Ohio					
Butler	39-017-0004	0.068	0.070	0.070	0.069
Butler	39-017-0018	0.068	0.069	0.070	0.069
Butler	39-017-9991	0.069	0.069	0.068	0.068
Clermont	39-025-0022	0.066	0.068	0.070	0.068
Hamilton	39-061-0006	0.069	0.070	0.072	0.070
Hamilton	39-061-0010	0.064	0.073	0.070	0.069
Hamilton	39-061-0040	0.069	0.069	0.071	0.069
Warren	39-165-0007	0.067	0.071	0.071	0.069

*NAAQS 8-hour (3 year average of the 4th max value). 0.070ppm
N/A indicates no monitor data for that county.

Emissions and Emissions Related Data

The U.S. EPA requires an emissions inventory to be developed in order to identify the level of emissions in a specific area and adjacent regions that may have contributed to an ozone violation. The EPA Ozone Designations Mapping Tool was used to obtain 2011 NEI v2 emissions inventory data. The 2011 NEI v2 is the latest available national emissions inventory data and is the source of the point, non-point, on-road, non-road and event emissions, and was used to evaluate Bracken County's impact on the violating monitor. VOC and NOx emissions, by category, are provided in Tables 2 and 3.

Table 2
2011 NEI VOC Emissions (tpy)
Cincinnati, OH-KY-IN MSA

County	VOC (tons per year)					
	Point	Non-point	On-road	Non-road	Event	Total
KENTUCKY						
Boone	1019.03	3708.82	1156.27	960.74	210.59	**7055.45**
Bracken	13.41	2604.87	143.77	98.86	0.0	**2860.91**
Campbell	160.58	2658.31	785.96	260.64	0.0	**3865.49**
Gallatin	87.39	1872.80	230.24	95.01	49.75	**2335.19**
Grant	79.78	3246.13	422.24	239.93	2.86	**3990.94**
Kenton	232.80	3289.76	1405.33	418.90	0.0	**5346.79**
Pendleton	127.59	3137.17	227.50	44.20	80.48	**3616.94**
KY Total	**1720.58**	**20517.86**	**4371.31**	**2118.28**	**343.68**	**29071.71**
INDIANA						
Dearborn	1573.32	3500.17	752.90	152.55	144.58	**6123.52**
Ohio	0.01	1571.07	111.12	30.63	46.31	**1759.14**
Union	0.00	1500.88	127.38	218.28	0.00	**1846.54**
IN Total	**1573.33**	**6572.12**	**991.40**	**401.46**	**190.89**	**9729.20**
OHIO						
Brown	28.90	4558.87	969.87	111.49	24.69	**5693.82**
Butler	1146.62	6081.24	4556.78	1076.33	0.0	**12860.97**
Clermont	180.86	5500.53	2654.57	719.53	0.0	**9055.49**
Hamilton	978.46	10759.16	10490.15	2734.21	0.0	**24961.98**
Warren	262.03	4760.18	2741.38	812.53	0.0	**8576.12**
OH Total	**2596.87**	**31659.98**	**21412.75**	**5454.09**	**24.69**	**61148.38**
Total Emissions	**5890.78**	**58749.96**	**26775.46**	**7973.83**	**559.26**	**99949.29**

Table 3
2011 NEI NO_x Emissions (tpy)
Cincinnati, OH-KY-IN MSA

County	NOx (tons per year)					
	Point	Non-point	On-road	Non-road	Event	Total
KENTUCKY						
Boone	3569.19	801.83	3455.45	682.30	21.32	**8530.09**
Bracken	3.72	469.43	267.93	72.38	0.0	**813.46**
Campbell	82.95	666.79	1583.28	247.83	0.0	**2580.85**
Gallatin	609.76	357.34	832.85	42.53	5.00	**1847.48**
Grant	13.00	510.39	1590.13	96.12	0.28	**2209.92**
Kenton	147.17	818.13	3449.61	521.34	0.0	**4936.25**
Pendleton	949.22	350.98	385.47	77.48	7.90	**1771.05**
KY Total	**5375.01**	**3974.89**	**11564.72**	**1739.98**	**34.50**	**22689.10**
INDIANA						
Dearborn	6530.65	296.72	1610.93	196.33	6.62	**8641.25**
Ohio	0.00	76.65	164.59	28.77	2.75	**272.76**
Union	0.00	190.63	226.35	135.37	0.00	**552.35**
IN Total	**6530.65**	**564.00**	**2001.87**	**360.47**	**9.37**	**9466.36**
OHIO						
Brown	4.40	383.53	1288.36	254.07	2.39	**1932.75**
Butler	3989.32	1962.75	7108.70	1569.52	0.0	**14630.29**
Clermont	16000.81	592.15	4374.25	833.68	0.0	**21800.89**
Hamilton	9664.54	3798.10	19232.85	3145.46	0.0	**35840.95**
Warren	569.13	799.42	4743.52	1189.90	0.0	**7301.97**
OH Total	**30228.20**	**7535.95**	**36747.68**	**6992.63**	**2.39**	**81506.85**
Total Emissions	**42133.86**	**23980.5**	**50314.27**	**9093.08**	**46.26**	**113662.31**

Table 4
VOC Emissions as % of Total VOC Emissions
Cincinnati, OH-KY-IN MSA

County	Point	Non Point	On-Road	Non-Road	Total MSA
Hamilton, OH	16.6	17.5	39.4	35.3	**25.4**
Butler, OH	19.5	9.9	17.1	13.9	**13.1**
Clermont, OH	3.1	8.9	10.0	9.3	**9.2**
Warren, OH	4.4	7.7	10.3	10.5	**8.7**
Boone, KY	17.3	6.5	4.3	12.4	**7.2**
Dearborn, IN	27.0	5.7	2.8	2.0	**6.2**
Brown, OH	0.5	7.4	3.6	1.4	**5.8**
Kenton, KY	4.0	5.7	5.3	5.4	**5.5**
Grant, KY	1.4	5.3	1.6	3.1	**4.1**
Campbell, KY	2.7	4.3	2.9	3.4	**3.9**
Pendleton, KY	2.2	5.1	0.9	0.6	**3.7**
Bracken, KY	0.2	4.6	0.5	1.3	**2.9**
Gallatin, KY	1.5	3.3	0.9	1.2	**2.4**
Ohio. IN	0.0	2.6	0.4	0.4	**1.8**
Union, IN	0.0	2.6	0.5	2.7	**1.8**

Table 5
NOx Emissions as % of Total NOx Emissions
Cincinnati, OH-KY-IN MSA

County	Point	Non Point	On-Road	Non-Road	Total MSA
Hamilton, OH	22.9	32.0	38.4	35.1	**31.4**
Clermont, OH	38.0	5.0	8.7	9.3	**19.1**
Butler, OH	9.5	16.5	14.2	17.5	**12.8**
Dearborn, IN	15.5	2.5	3.2	2.2	**7.6**
Boone, KY	8.5	6.7	6.9	7.6	**7.5**
Warren, OH	1.4	6.7	9.5	13.3	**6.4**
Kenton, KY	0.4	6.9	6.9	5.8	**4.3**
Campbell, KY	0.2	5.6	3.2	2.8	**2.3**
Grant, KY	3.1	4.3	3.2	1.1	**1.9**
Brown, OH	0.0	3.2	2.6	2.8	**1.7**
Gallatin, KY	1.4	3.0	1.7	0.5	**1.6**
Pendleton, KY	2.3	3.0	0.8	0.9	**1.5**
Bracken, KY	0.0	4.0	0.5	0.8	**0.7**
Union, IN	0.0	0.8	1.5	1.5	**0.5**
Ohio. IN	0.0	0.6	0.3	0.3	**0.2**

Point Sources

Table 2 indicates 2011 point source emissions of VOC in Grant County were 79.78 tpy in 2011. Total VOC point source emissions from the Cincinnati, OH-KY-IN MSA were 5,890.78 tpy. Grant County only accounts for approximately 1.4% of the total VOC point source emissions in the MSA. Table 4 shows the percentages of VOC emissions for point sources in the MSA, by county.

As seen in Table 3, point source emissions of NO_x in Grant County were estimated to be 13.00 tpy in 2011, which represents 0.03% of the total 42,133.86 tpy of the overall NO_x point source emissions from the Cincinnati, OH-KY-IN MSA. Table 5 shows the percentages of NO_x emissions for point sources in the MSA, by county.

Non-Point (Area) Emissions

Table 2 shows that non-point (or "area") VOC emissions in Grant County were estimated at 3,246.13 tpy in 2011, which represents approximately 5.7% of the total 57,249.08 tpy of the overall VOC area source emissions from the Cincinnati, OH-KY-IN MSA. Table 4 shows the percentages of VOC emissions for non-point sources in the MSA, by county.

As seen in Table 3, non-point NOx emissions from Grant County were estimated at 510.39 tpy in 2011, which represents approximately 4.3% of the total 11,884.21 tpy of the overall NO_x non-point source emissions from the Cincinnati, OH-KY-IN MSA. Table 5 shows the percentages of NOx emissions for non-point sources in the MSA, by county.

On-Road Mobile

As indicated in Table 2, on-road mobile source VOC emissions from Grant County were estimated to be 422.24 tpy in 2011, which represents approximately 1.6% of the total 26,648.08 tpy of the overall VOC on-road mobile source emissions from the Cincinnati, OH-KY-IN MSA. Table 4 shows the percentages of VOC emissions for on-road mobile sources in the MSA, by county.

As seen in Table 3, on-road mobile source NO_x emissions from Grant County were estimated at 1,590.13 tpy in 2011, which represents approximately 3.2% of the total 50,087.92 tpy of the overall NO_x on-road mobile source emissions from the Cincinnati, OH-KY-IN MSA. Table 5 shows the percentages of NO_x emissions for on-road mobile sources in the MSA, by county.

Based on 2014 information obtained from the U.S. Census website, http://onthemap.ces.census.gov/, the commuting traffic from other counties into Grant County is 54.4% while the commuting traffic from Grant County into other counties is 79.2%.

Table 6 below provides Vehicle Miles Travelled (VMT) for all areas within the Cincinnati, OH-KY-IN MSA for the year 2011. The counties within the Ohio portion of the MSA contribute to the majority of VMT within the MSA. Grant County's VMT is low compared to other counties within the MSA.

Table 6
2011 VMT Totals, Cincinnati, OH-KY-IN MSA

	2011 VMT Totals
Kentucky	
Boone County	**1,558,794,112**
Bracken County	**104,160,119**
Campbell County	**1,010,009,434**
Gallatin County	**245,765,593**
Grant County	**529,145,674**
Kenton County	**1,720,886,038**
Pendleton County	**184,074,537**
KY Total	**5,352,835,507**
Ohio	
Brown County	**468,171,663**
Butler County	**3,099,030,997**
Clermont County	**1,951,343,156**
Hamilton County	**9,004,357,566**
Warren County	**2,139,774,797**
OH Total	**16,662,678,179**
Indiana	
Dearborn County	**690,348,611**
Ohio County	**71,591,617**
Union County	**105,444,221**
IN Total	**867,384,449**
Total VMT for MSA	**22,882,898,135**

Non-Road Mobile Sources

As seen in Table 2, non-road mobile source VOC emissions from Grant County were estimated at 239.93 tpy in 2011, which represents approximately 3.1% of the total 7,755.55 tpy of the overall VOC non-road mobile source emissions from the Cincinnati, OH-KY-IN MSA. Table 4 shows the percentages of VOC emissions for non-road mobile sources in the MSA, by county.

As seen in Table 3, non-road mobile source NO_x emissions from Grant County were estimated at 96.12 tpy in 2011, which represents approximately 1.1% of the total 8,957.71 tpy of the overall NO_x non-road mobile source emissions from the Cincinnati, OH-KY-IN MSA. Table 5 shows the percentages of NO_x emissions for non-road mobile sources in the MSA, by county.

Comparison of Total Emissions

A comparison of total emissions across the entire Cincinnati, OH-KY-IN MSA was performed using data from the EPA Ozone Designations Mapping Tool. The percentages shown in last column in both Tables 4 and 5 demonstrate that the majority of VOC and NOx emissions within the Cincinnati, OH-KY-IN MSA come from the Ohio portion of the MSA.

Population

Based on U.S. Census Bureau estimates for 2015, there are 24,757 persons living in Grant County (Refer to table 7). This represents approximately 95.6 persons per square mile. The population of Grant County is approximately 65.0% rural with the remaining 35.0% living in incorporated areas. The largest cities in Grant County are Williamstown and Crittenden.

Grant County's population from 2010-2015 *increased* by approximately 0.4%. For the entire Cincinnati, OH-KY-IN MSA, Grant County represents approximately 1.2% of the total population in the MSA and 6% of the Kentucky portion of the MSA. (Refer to table 8)

Table 7
Northern Kentucky Area Population
Growth Data

County	Census 2010	2015*	%Growth 2010 - 2015
Boone	118,811	127,712	7.5%
Bracken	8,488	8,321	-2.0%
Campbell	90,336	92,066	1.9%
Gallatin	8,589	8,636	0.5%
Grant	24,662	24,757	0.4%
Kenton	159,720	165,012	3.3%
Pendleton	14,877	14,408	-3.1%

*U.S. Census Bureau estimates.

Table 8
2015 Population
Cincinnati, OH-KY-IN MSA

MSA Estimated Population	2015*	2015 Population Density (1,000 per square mile)	% of Total	
Kentucky			**of KY Portion**	**of MSA**
Boone County	**127,712**	**0.52**	**29.0%**	**5.9%**
Bracken County	**8,321**	**0.04**	**1.9%**	**0.5%**
Campbell County	**92,066**	**0.61**	**20.9%**	**4.3%**
Gallatin County	**8,636**	**0.09**	**2.0%**	**0.4%**
Grant County	**24,757**	**0.10**	**5.6%**	**1.2%**
Kenton County	**165,012**	**1.03**	**37.4%**	**7.6%**
Pendleton County	**14,408**	**0.05**	**3.3%**	**0.7%**
KY Total	**440,912**	**--**	**100%**	**20.6%**
Ohio			**of OH Portion**	
Brown County	**43,839**	**0.09**	**2.7%**	**2.0%**
Butler	**376,353**	**0.81**	**22.8%**	**17.4%**
Clermont County	**201,973**	**0.45**	**12.2%**	**9.4%**
Hamilton County	**807,598**	**1.99**	**48.8%**	**37.4%**
Warren County	**224,469**	**0.56**	**13.6%**	**10.4%**
OH Total	**1,654,232**	**--**	**100%**	**76.7%**
Indiana			**of IN Portion**	
Dearborn County	**49,455**	**0.16**	**79.0%**	**2.3%**
Ohio County	**5,938**	**0.07**	**9.5%**	**0.3%**
Union County	**7,182**	**0.04**	**11.5%**	**0.3%**
IN Total	**62,575**	**--**	**100%**	**2.9%**
Total Estimated Population	**2,157,719**	**--**	**100%**	**100%**

*U.S. Census Bureau estimates.

Areas of dense population and high VMT can display elevated nonpoint and on-road source emissions. As seen in Tables 2 and 3, two of the sectors with the highest emission contribution are from nonpoint for both VOC and NOx. However, Grant County emissions are low compared to other areas within the MSA.

Meteorology

Wind speed and wind direction data collected at Cincinnati-Northern Kentucky Airport (NWS Station 93814) for the period 2013-2015 shows that the majority of the time the wind in the area came from the southwest and typically from 2.1-3.6 miles per hour (Refer to figure 12). According to Kentucky Mesonet (http://www.kymesonet.org/), the average high temperature for July for the area from 2013 through 2015 was 91.9°F; the average low was 55.5°F. The average precipitation for the same period was 4.65 inches.

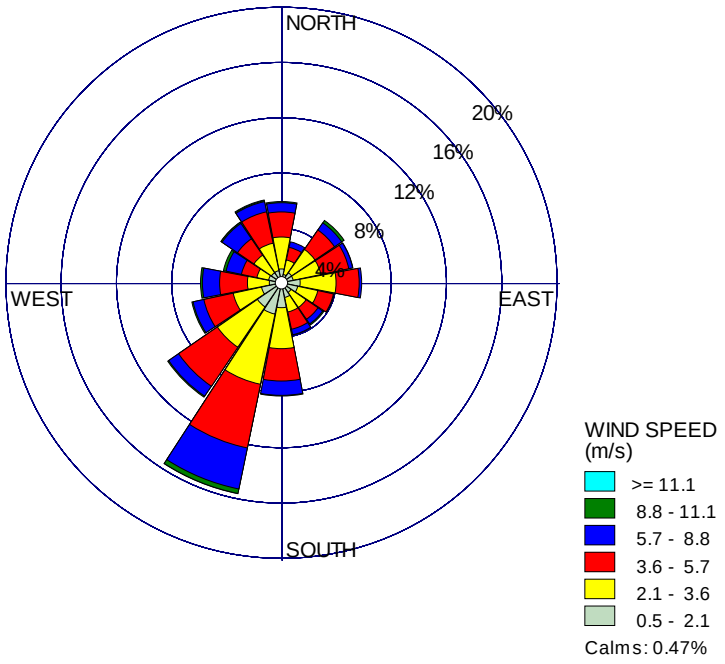

Figure 1: Wind Rose Average 2013-2015 March 1st - October 31st

Several 48-hour back trajectory HYSPLITS for Kentucky have been included in Section 8 for days in 2013-2015 when the 8-hour ambient monitoring concentration for ozone had their highest readings. The HYSPLITS show that there is potential for Grant County to affect the violating monitor in Campbell County. However, Grant County's emissions are so low that there is no significant impact.

Geography and Topography

Grant County is part of the Cincinnati, OH-KY-IN MSA and has a land area of 259 square miles. Located in the central part of Northern Kentucky, Gallatin County lies to the west of Pendleton County, north of Scott County, northeast of Owen County and south of Boone County. Elevations above 900 feet are common. The highest elevation is recorded at 1,000 feet, where Eagle and Three Forks Creeks have a drainage divide. The lowest elevation is 530 feet, where Eagle Creek, the largest stream in the county, exits the county. The community elevations are as follows: Williamstown, the county seat, is

974 feet; Corinth, 980 feet; Crittenden, 920 feet; Dry Ridge, 958 feet, Jonesville, 914 feet; Mount Zion, 925 feet.

Figure 2 shows the topography of Grant county. Grant County does not have any geographical or topographical distinctions that interfere with air pollution transport. Therefore, this factor is not a significant part of the overall analysis.

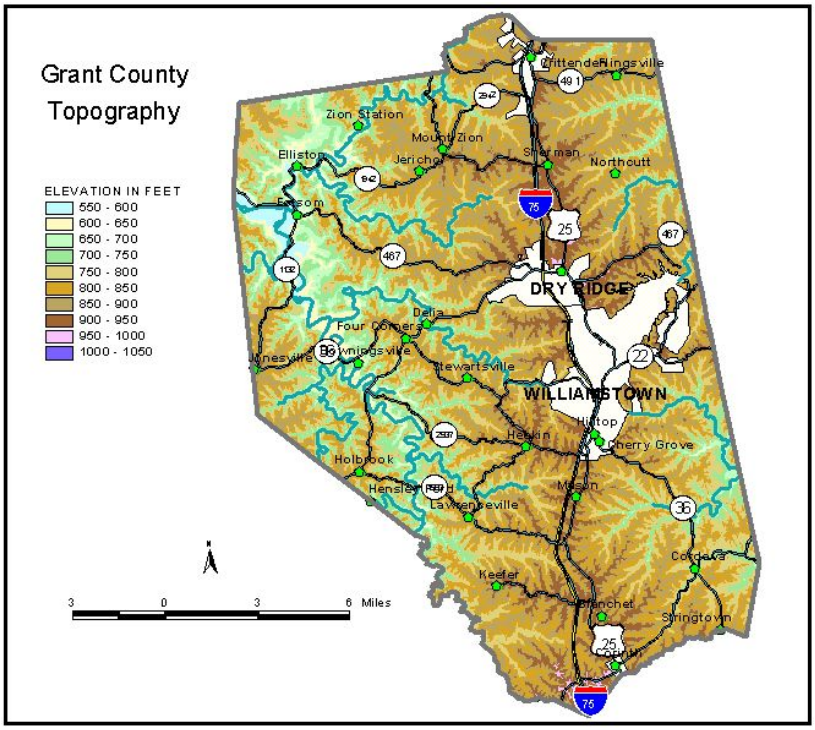

Figure 2: Grant County Topographic Map

Jurisdictional Boundaries

The authority for air quality planning in the Grant County area resides with the Kentucky Energy and Environment Cabinet. Transportation planning for Grant County is performed by the Kentucky Transportation Cabinet. Historically, portions of Boone, Campbell, and Kenton counties have been designated as nonattainment. These Kentucky counties along with Butler, Clermont, Clinton, Hamilton, Warren, Ohio, and Dearborn, Indiana were designated nonattainment for the 1997 and 2008 ozone standards. The 2008 ozone standard nonattainment area was confined to specific census tracts in the northern part of Boone, Campbell and Kenton counties.

Conclusion and Recommendation

There were no ozone monitors located in Grant County for the 2013-2015 monitoring period.

As seen in Table 9 below, Grant County's VOC and NOx emissions are insignificant when compared to other counties located within the Cincinnati, OH-KY-IN MSA. Grant County contributes approximately:

- 4.1% of the total VOC emissions
- 1.9% of the total NO_x emissions

The emissions from Grant do not contribute to the ozone violation of the 8-hour standard in the Cincinnati, OH-KY-IN MSA.

Table 7: VOC and NO_x Percentages for Cincinnati, OH-KY-IN MSA (2011 NEI)

County	VOC %	NO_X %
KENTUCKY		
Boone	7.1	7.5
Bracken	2.9	0.7
Campbell	3.8	2.3
Gallatin	2.3	1.6
Grant	4.0	1.9
Kenton	5.3	4.3
Pendleton	3.6	1.6
KY Total	**29.0%**	**19.9%**
OHIO		
Brown	5.7	1.7
Butler	12.9	12.9
Clermont	9.1	19.2
Hamilton	25.0	31.6
Warren	8.6	6.4
OH Total	**61.3%**	**71.8**
INDIANA		
Dearborn	6.1	7.6
Ohio	1.8	0.2
Union	1.8	0.5
IN Total	**9.7%**	**8.3%**
Total Emissions %	**100.0%**	**100.0%**

Data gathered for Grant County and reviewed using EPA's five factor analysis demonstrates that Grant County is not contributing to the violating monitor in Campbell County. Therefore, Kentucky recommends that Grant County be designated as "unclassifiable/attainment" for the 2015 8-hour ozone NAAQS.

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Kenton County, KY

Air Quality

Pursuant to 40 CFR 50:19 (b) and (d) the 8-hour primary and secondary NAAQS are met at an ambient air quality monitoring site when the 3-year average of the annual fourth-highest daily maximum 8-hour average ozone concentration is less than or equal to 0.070 ppm, as determined in accordance with Appendix U of Part 50. For the 2013-2015 monitoring period, there were no ozone monitors located in Kenton County.

Ozone air monitoring data and design values for 2013-2015, for the Cincinnati, OH-KY-IN Core Based Statistical Area (CBSA), were retrieved from https://www.epa.gov/air-trends/air-quality-design-values#report. Per the EPA website, "The design values shown here are computed using Federal Reference Method or equivalent data reported by State, Tribal, and Local monitoring agencies to EPA's Air Quality System (AQS) as of June 24, 2016." Table 1 provides a summary of both the 2013-2015 design values and the annual fourth-highest daily maximum 8-hour average ozone concentrations recorded at monitors located in the Cincinnati, OH-KY-IN CBSA for 2013-2015. Not all counties in the Cincinnati, OH-KY-IN CBSA have monitors for ozone. Monitor values included in Table 1 only reflect those monitors that were operational during the 2013 to 2015 design value period. Only the monitor in Campbell County, KY indicates a design value above the revised ozone NAAQS for the CBSA.

Table 1
Cincinnati, OH-KY-IN CBSA
3-year Average* of Annual 8-hour concentrations for Ozone

County/Site	AQS Code	Annual 4th High (ppm)			Design Value (ppm)
		2013	2014	2015	
Kentucky					
Boone	21-015-0003	0.059	0.062	0.062	0.061
Campbell	21-037-3002	0.072	0.071	0.071	0.071
Ohio					
Butler	39-017-0004	0.068	0.070	0.070	0.069
Butler	39-017-0018	0.068	0.069	0.070	0.069
Butler	39-017-9991	0.069	0.069	0.068	0.068
Clermont	39-025-0022	0.066	0.068	0.070	0.068
Hamilton	39-061-0006	0.069	0.070	0.072	0.070
Hamilton	39-061-0010	0.064	0.073	0.070	0.069
Hamilton	39-061-0040	0.069	0.069	0.071	0.069
Warren	39-165-0007	0.067	0.071	0.071	0.069

*NAAQS 8-hour (3 year average of the 4th max value). 0.070ppm
n/a indicates no monitor data for that county.

Emissions and Emissions-Related Data

The U.S. EPA requires an emissions inventory to be developed in order to identify the level of emissions in a specific area and adjacent regions that may have contributed to an ozone violation. The EPA Ozone Designations Mapping Tool was used to obtain 2011 NEI v2 emissions inventory data. The 2011 NEI v2 is the latest available national emissions inventory data and is the source of the point, non-point, on-road, non-road and event emissions, and was used to evaluate Kenton County's impact on the violating monitor. VOC and NOx emissions, by category, are provided in Tables 2 and 3.

Table 2
2011 NEI VOC Emissions (tpy)
Cincinnati, OH-KY-IN CBSA

County	VOC (tons per year)					
	Point	Non-point	On-road	Non-road	Event	Total
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OHIO						
Brown	28.90	4558.87	969.87	111.49	24.69	**5693.82**
Butler	1146.62	6081.24	4556.78	1076.33	0.0	**12860.97**
Clermont	180.86	5500.53	2654.57	719.53	0.0	**9055.49**
Hamilton	978.46	10759.16	10490.15	2734.21	0.0	**24961.98**
Warren	262.03	4760.18	2741.38	812.53	0.0	**8576.12**
OH Total	**2596.87**	**31659.98**	**21412.75**	**5454.09**	**24.69**	**61148.38**
Total Emissions	**5890.78**	**58749.96**	**26775.46**	**7973.83**	**559.26**	**99949.29**

Table 3
2011 NEI NO_x Emissions (tpy)
Cincinnati, OH-KY-IN CBSA

County	NOx (tons per year)					
	Point	Non-point	On-road	Non-road	Event	Total
KENTUCKY						
Boone	3569.19	801.83	3455.45	682.30	21.32	**8530.09**
Bracken	3.72	469.43	267.93	72.38	0.0	**813.46**
Campbell	82.95	666.79	1583.28	247.83	0.0	**2580.85**
Gallatin	609.76	357.34	832.85	42.53	5.00	**1847.48**
Grant	13.00	510.39	1590.13	96.12	0.28	**2209.92**
Kenton	147.17	818.13	3449.61	521.34	0.0	**4936.25**
Pendleton	949.22	350.98	385.47	77.48	7.90	**1771.05**
KY Total	**5375.01**	**3974.89**	**11564.72**	**1739.98**	**34.50**	**22689.10**
INDIANA						
Dearborn	6530.65	296.72	1610.93	196.33	6.62	**8641.25**
Ohio	0.00	76.65	164.59	28.77	2.75	**272.76**
Union	0.00	190.63	226.35	135.37	0.00	**552.35**
IN Total	**6530.65**	**564.00**	**2001.87**	**360.47**	**9.37**	**9466.36**
OHIO						
Brown	4.40	383.53	1288.36	254.07	2.39	**1932.75**
Butler	3989.32	1962.75	7108.70	1569.52	0.0	**14630.29**
Clermont	16000.81	592.15	4374.25	833.68	0.0	**21800.89**
Hamilton	9664.54	3798.10	19232.85	3145.46	0.0	**35840.95**
Warren	569.13	799.42	4743.52	1189.90	0.0	**7301.97**
OH Total	**30228.20**	**7535.95**	**36747.68**	**6992.63**	**2.39**	**81506.85**
Total Emissions	**42133.86**	**12074.84**	**50314.27**	**9093.08**	**46.26**	**113662.31**

Table 4
VOC Emissions as % of Total VOC Emissions
Cincinnati, OH-KY-IN CBSA

County	Point	Non Point	On-Road	Non-Road	Total MSA
Hamilton, OH	16.6	17.5	39.4	35.3	**25.4**
Butler, OH	19.5	9.9	17.1	13.9	**13.1**
Clermont, OH	3.1	8.9	10.0	9.3	**9.2**
Warren, OH	4.4	7.7	10.3	10.5	**8.7**
Boone, KY	17.3	6.5	4.3	12.4	**7.2**
Dearborn, IN	27.0	5.7	2.8	2.0	**6.2**
Brown, OH	0.5	7.4	3.6	1.4	**5.8**
Kenton, KY	4.0	5.7	5.3	5.4	**5.5**
Grant, KY	1.4	5.3	1.6	3.1	**4.1**
Campbell, KY	2.7	4.3	2.9	3.4	**3.9**
Pendleton, KY	2.2	5.1	0.9	0.6	**3.7**
Bracken, KY	0.2	4.6	0.5	1.3	**2.9**
Gallatin, KY	1.5	3.3	0.9	1.2	**2.4**
Ohio. IN	0.0	2.6	0.4	0.4	**1.8**
Union, IN	0.0	2.6	0.5	2.7	**1.8**

Table 5
NOx Emissions as % of Total NOx Emissions
Cincinnati, OH-KY-IN CBSA

County	Point	Non Point	On-Road	Non-Road	Total MSA
Hamilton, OH	22.9	32.0	38.4	35.1	**31.4**
Clermont, OH	38.0	5.0	8.7	9.3	**19.1**
Butler, OH	9.5	16.5	14.2	17.5	**12.8**
Dearborn, IN	15.5	2.5	3.2	2.2	**7.6**
Boone, KY	8.5	6.7	6.9	7.6	**7.5**
Warren, OH	1.4	6.7	9.5	13.3	**6.4**
Kenton, KY	0.4	6.9	6.9	5.8	**4.3**
Campbell, KY	0.2	5.6	3.2	2.8	**2.3**
Grant, KY	3.1	4.3	3.2	1.1	**1.9**
Brown, OH	0.0	3.2	2.6	2.8	**1.7**
Gallatin, KY	1.4	3.0	1.7	0.5	**1.6**
Pendleton, KY	2.3	3.0	0.8	0.9	**1.5**
Bracken, KY	0.0	4.0	0.5	0.8	**0.7**
Union, IN	0.0	0.8	1.5	1.5	**0.5**
Ohio. IN	0.0	0.6	0.3	0.3	**0.2**

Point Source

Table 2 indicates 2011 point source emissions of VOC in Kenton County were estimated at 232.80 tpy in 2011. Total VOC point source emissions from the Cincinnati, OH-KY-IN CBSA were 5,890.78 tpy. Kenton County accounts for approximately 4.0% of the total 5 VOC point source emissions in the CBSA. Table 4 shows the percentages of VOC emissions for point sources in the CBSA, by county.

As seen in Table 3, point source NO_x emissions from Kenton County were estimated at 147.17 tpy in 2011, which represents approximately 0.4% of the total 42,133.86 tpy of the overall NO_x point source emissions from the Cincinnati, OH-KY-IN CBSA. Table 5 shows the percentages of NO_x emissions for point sources in the CBSA, by county.

Non-Point (Area) Emissions

Table 2 shows that non-point (or "area") VOC emissions in Kenton County were estimated at 3,289.76 tpy in 2011, which represents approximately 5.7% of the total 57,249.08 tpy of the overall VOC non-point source emissions from the Cincinnati, OH-KY-IN CBSA. Table 4 shows the percentages of VOC emissions for non-point sources in the CBSA, by county.

As seen in Table 3, non-point NO_x emissions from Kenton County were estimated at 818.13 tpy in 2011, which represents approximately 6.9% of the total 11,884.21 tpy of the overall NO_x non-point source emissions from the Cincinnati, OH-KY-IN CBSA. Table 5 shows the percentages of NOx emissions for non-point sources in the CBSA, by county.

On-Road Sources

As indicated in Table 2, on-road mobile source VOC emissions from Kenton County were estimated at 1,405.33 tpy in 2011, which represents approximately 5.3% of the total 26,648.08 tpy of the overall VOC on-road mobile source emissions from the Cincinnati, OH-KY-IN CBSA.

As seen in Table 3, on-road mobile source NO_x emissions from Kenton County were estimated at 3,449.61 tpy in 2011, which represents approximately 6.9% of the total 50,087.92 tpy of the overall NO_x on-road mobile source emissions from the Cincinnati, OH-KY-IN CBSA. Table 5 shows the percentages of NO_x emissions for on-road mobile sources in the CBSA, by county.

Based on 2014 information obtained from the U.S Census Website, http://onthemap.ces.gov, the commuting traffic from other counties into Kenton County is 64.1% while the commuting traffic from Kenton County into other counties is 72.3%.

Table 6 below provides Vehicle Miles Travelled (VMT) for all areas within the Cincinnati, OH-KY-IN CBSA for the year 2011. The counties within the Ohio portion of the CBSA contribute to the majority of VMT. Although Kenton County is not the main contributor to VMT, it does contribute a significant number of VMT within the CBSA. High VMT is associated with urban areas and linked with motor vehicle emissions that may contribute to ozone formation.

Table 6
2011 VMT Totals, Cincinnati, OH-KY-IN CBSA

	2011 VMT Totals
Kentucky	
Boone County	**1,558,794,112**
Bracken County	**104,160,119**
Campbell County	**1,010,009,434**
Gallatin County	**245,765,593**
Grant County	**529,145,674**
Kenton County	**1,720,886,038**
Pendleton County	**184,074,537**
KY Total	**5,352,835,507**
Ohio	
Brown County	**468,171,663**
Butler County	**3,099,030,997**
Clermont County	**1,951,343,156**
Hamilton County	**9,004,357,566**
Warren County	**2,139,774,797**
OH Total	**16,662,678,179**
Indiana	
Dearborn County	**690,348,611**
Ohio County	**71,591,617**
Union County	**105,444,221**
IN Total	**867,384,449**
Total VMT for CBSA	**22,882,898,135**

Non-Road Mobile Sources

As seen in Table 2, non-road mobile source VOC emissions from Kenton County were estimated at 418.90 tpy in 2011, which represents approximately 5.4% of the total 7,755.55 tpy of the overall VOC non-road mobile source emissions from the Cincinnati, OH-KY-IN CBSA. Table 4 shows the percentages of VOC emissions for non-road mobile sources in the CBSA, by county.

As shown in Table 3, non-road mobile source NO_x emissions from Kenton County were estimated at 521.34 tpy in 2011, which represents approximately 5.8% of the total 8,957.71 tpy of the overall NO_x non-road mobile source emissions from the Cincinnati, OH-KY-IN CBSA. Table 5 shows the percentages of NO_x emissions for non-road mobile sources in the CBSA, by county.

Comparison of Total Emissions

A comparison of total emissions across the entire Cincinnati, OH-KY-IN CBSA was performed using data from the EPA Ozone Designations Mapping Tool. The percentages shown in last column in both Tables 4 and 5 demonstrate that the majority of VOC and NOx emissions within the Cincinnati, OH-KY-IN CBSA come from the Ohio portion of the CBSA.

Population

Based on 2015 from the U.S. Census Bureau, there are 165,012 persons living in Kenton County. (Refer to table 7) This represents approximately 1,018.6 persons per square mile. The population of Kenton County is approximately 7% rural with the remaining 93% living in incorporated areas. The largest cities in Kenton County are Covington and Independence.

Kenton County's population from 2010-2015 *increased* approximately 3.3%. For the entire Cincinnati, OH-KY-IN CBSA, Kenton County represents approximately 7.6% of the total population in the CBSA and 37.4% of the Kentucky portion of the CBSA. (Refer to table 8)

Table 7
Northern Kentucky Area Population
Growth Data

County	Census 2010	2015*	%Growth 2010 - 2015
Boone	118,811	127,712	7.5%
Bracken	8,488	8,321	-2.0%
Campbell	90,336	92,066	1.9%
Gallatin	8,589	8,636	0.5%
Grant	24,662	24,757	0.4%
Kenton	159,720	165,012	3.3%
Pendleton	14,877	14,408	-3.1%

*U.S. Census Bureau estimates.

Table 8
2015 Population
Cincinnati, OH-KY-IN CBSA

CBSA Estimated Population	2015*	2015 Population Density (1,000 per square mile)	% of Total	
Kentucky			**of KY Portion**	**of CBSA**
Boone County	**127,712**	**0.52**	**29.0%**	**5.9%**
Bracken County	**8,321**	**0.04**	**1.9%**	**0.5%**
Campbell County	**92,066**	**0.61**	**20.9%**	**4.3%**
Gallatin County	**8,636**	**0.09**	**2.0%**	**0.4%**
Grant County	**24,757**	**0.10**	**5.6%**	**1.2%**
Kenton County	**165,012**	**1.03**	**37.4%**	**7.6%**
Pendleton County	**14,408**	**0.05**	**3.3%**	**0.7%**
KY Total	**440,912**	**--**	**100%**	**20.6%**
Ohio			**of OH Portion**	
Brown County	**43,839**	**0.09**	**2.7%**	**2.0%**
Butler	**376,353**	**0.81**	**22.8%**	**17.4%**
Clermont County	**201,973**	**0.45**	**12.2%**	**9.4%**
Hamilton County	**807,598**	**1.99**	**48.8%**	**37.4%**
Warren County	**224,469**	**0.56**	**13.6%**	**10.4%**
OH Total	**1,654,232**	**--**	**100%**	**76.7%**
Indiana			**of IN Portion**	
Dearborn County	**49,455**	**0.16**	**79.0%**	**2.3%**
Ohio County	**5,938**	**0.07**	**9.5%**	**0.3%**
Union County	**7,182**	**0.04**	**11.5%**	**0.3%**
IN Total	**62,575**	**--**	**100%**	**2.9%**
Total Estimated Population	**2,157,719**	**--**	**100%**	**100%**

*U.S. Census Bureau estimates.

Areas of dense population and high VMT can display elevated nonpoint and on-road source emissions. As seen in Tables 2 and 3, two of the sectors with the highest emission contribution are from nonpoint (VOC) and on-road (NOx). This correlation indicates that VMT and population density within Kenton County may be contributing to the violating monitor within the CBSA.

Meteorological Information

Wind speed and wind direction data collected at the Cincinnati-Northern Kentucky Airport (NWS Station 93814) for the period 2013-2015 shows that the majority of the time the wind in the area came from the southwest and typically from 2.1-3.6 miles per hour (Refer to figure 1). According to Kentucky Mesonet (http://www.kymesonet.org/), the average high temperature for July for the period 2013-2015 was 90.1º F and the average low temperature for July was 53.7º F. The average July precipitation for the same period (2013-2015) was 4.63 inches.

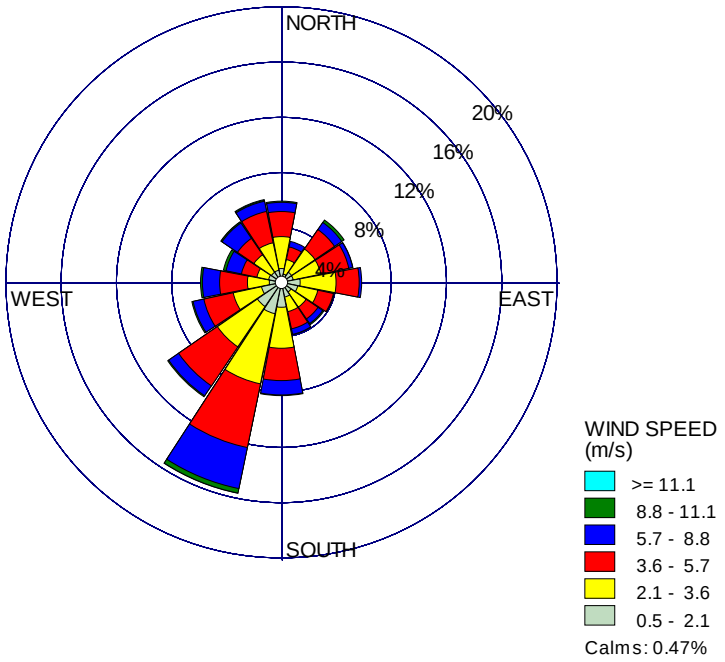

Figure 1: Wind Rose Average 2013-2015 March 1st - October 31st

Several 48-hour back trajectory HYSPLITS for Ohio and Kentucky have been included in Section 8 for days in 2013-2015 when the 8-hour ambient monitoring concentration for ozone had their highest readings. These HYSPLITS show that, for the majority of the time, the air column does come from the south-southwest. Therefore, the low emission levels from Kenton County do not affect the violating monitor located in Campbell County.

Geography and Topography

Kenton County is part of the Cincinnati, OH-KY-IN CBSA and has a land area of 162 square miles. Located on the banks of the Ohio River, Kenton County lies west of Campbell County, east of Boone County, and to the south of Cincinnati, Ohio. Kenton County is well dissected by numerous small streams that flow into the Licking and Ohio Rivers. Hilly terrain predominates and few flat areas are

present. The highest elevation is 960 feet, located on the divide between Banklick and Cruises Creeks near the Kenton-Boone County line.

Kenton County does not have any geographical or topographical distinctions that interfere with air pollution transport. Therefore, this factor is not a significant part of the overall analysis.

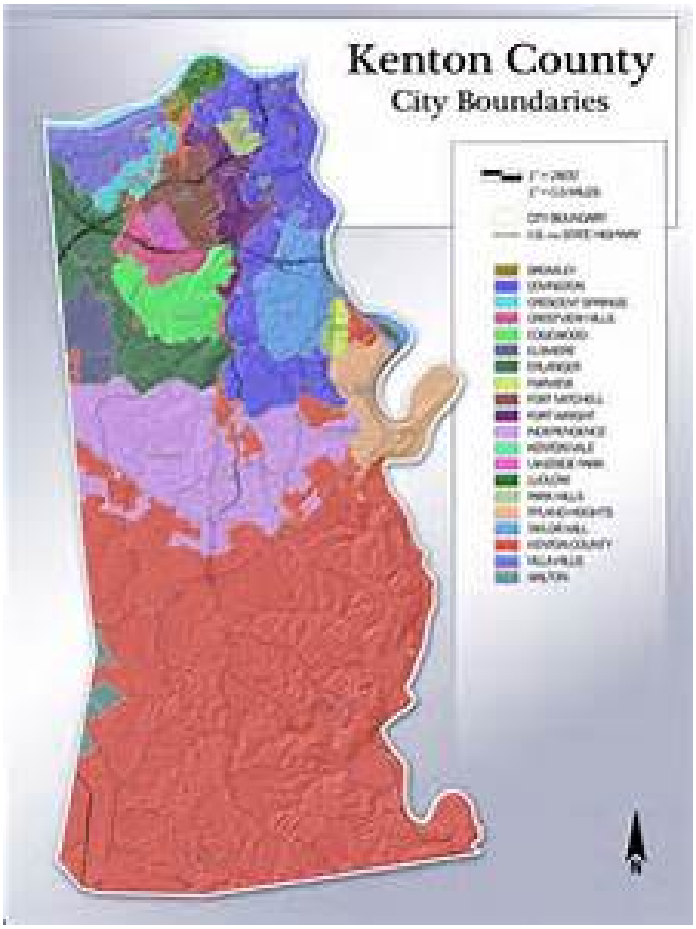

Figure 2: Kenton County Topography Map

Jurisdictional Boundaries

The authority for air quality planning in the Kenton County area resides with the Kentucky Energy and Environment Cabinet. Transportation planning for Kenton County is performed by the Ohio, Kentucky, and Indiana Regional Council of Governments (OKI). Historically, portions of Boone, Campbell, and Kenton counties have been designated as nonattainment. These Kentucky counties along with Butler, Clermont, Clinton, Hamilton, Warren, Ohio and Dearborn, Indiana, were designated nonattainment for the 1997 and 2008 ozone standards. The 2008 ozone standard nonattainment area was confined to specific census tracts in the northern part of Boone, Campbell and Kenton counties.

Conclusion and Recommendation

For the 2013-2015 monitoring period, there were no ozone monitors located in Kenton County.

As seen in Table 9 below, Kenton County's VOC and NOx emissions are relatively less than other counties located within the Cincinnati, OH-KY-IN CBSA. Kenton County contributes approximately:

- 5.5% of the total VOC emissions
- 4.4% of the total NO_x emissions

Table 9
VOC and NO_x Percentages for
Cincinnati, OH-KY-IN CBSA (2011 NEI)

County	VOC %	NO_X %
KENTUCKY		
Boone	7.1	7.5
Bracken	2.9	0.7
Campbell	3.8	2.3
Gallatin	2.3	1.6
Grant	4.0	1.9
Kenton	5.3	4.3
Pendleton	3.6	1.6
KY Total	**29.0%**	**19.9%**
OHIO		
Brown	5.7	1.7
Butler	12.9	12.9
Clermont	9.1	19.2
Hamilton	25.0	31.6
Warren	8.6	6.4
OH Total	**61.3%**	**71.8**
INDIANA		
Dearborn	6.1	7.6
Ohio	1.8	0.2
Union	1.8	0.5
IN Total	**9.7%**	**8.3%**
Total Emissions %	**100.0%**	**100.0%**

There are no distinguishable geographical or topographical elements that would affect VOC or NOx levels in Kenton County. The emission contributions from Kenton County are not as significant as other areas within the CBSA. The dominating factors that influence Kenton County's contribution to the violating monitor within the area involve population, VMT and commuting traffic.

2010 Census Tract data gathered from EPA's Ozone Mapping Tool was used to analyze which portion of Kenton County could be contributing to the violating monitor in Campbell County based on high population areas. Although Kenton County does not have the highest population within the CBSA, the significant VMT levels along with commuting patterns suggest that there is a large urban population that leads to increased on-road and nonpoint source emissions. Additionally, due to winds from the southwest the majority of the time, the emissions from Kenton may be contributing to the violating monitor in Campbell County, KY.

Based on all available data, Kentucky recommends that the northern portion of Kenton County be designated as nonattainment for the 2015 8-hour ozone NAAQS. Specifically, the following census tracts within Kenton County should be designated as nonattainment: 603, 607, 609, 610, 611, 612, 613, 614, 616, 636.03, 636.04, 636.05, 636.06, 638, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655.01, 655.02, 656, 657, 658, 659, 668, 669, 670, and 671.

Figures 3a and 3b contain the census tracts listed above for the partial area of Kenton County recommended for "nonattainment" designation.

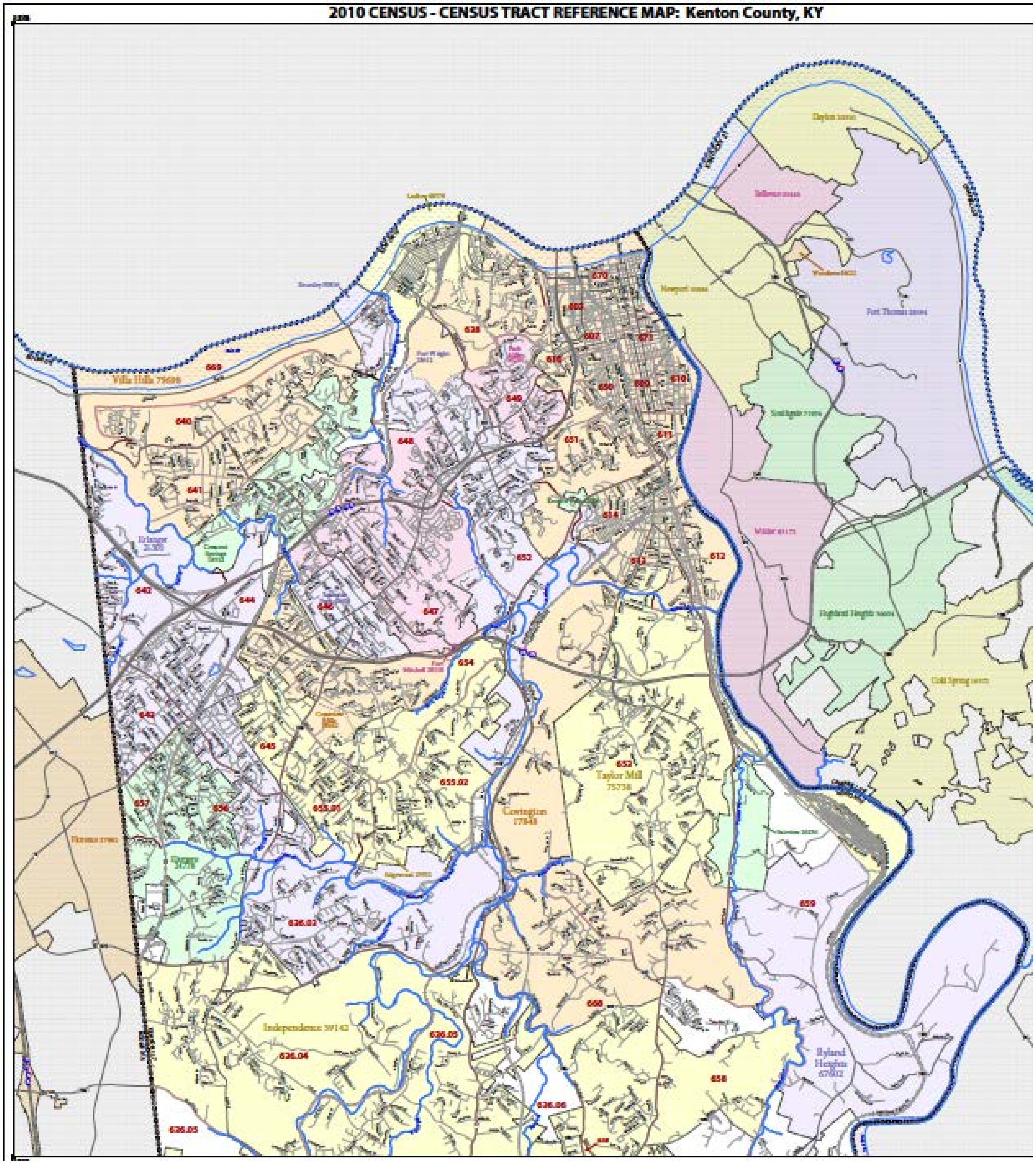

Figure 3a: Northern portion of Kenton County, KY

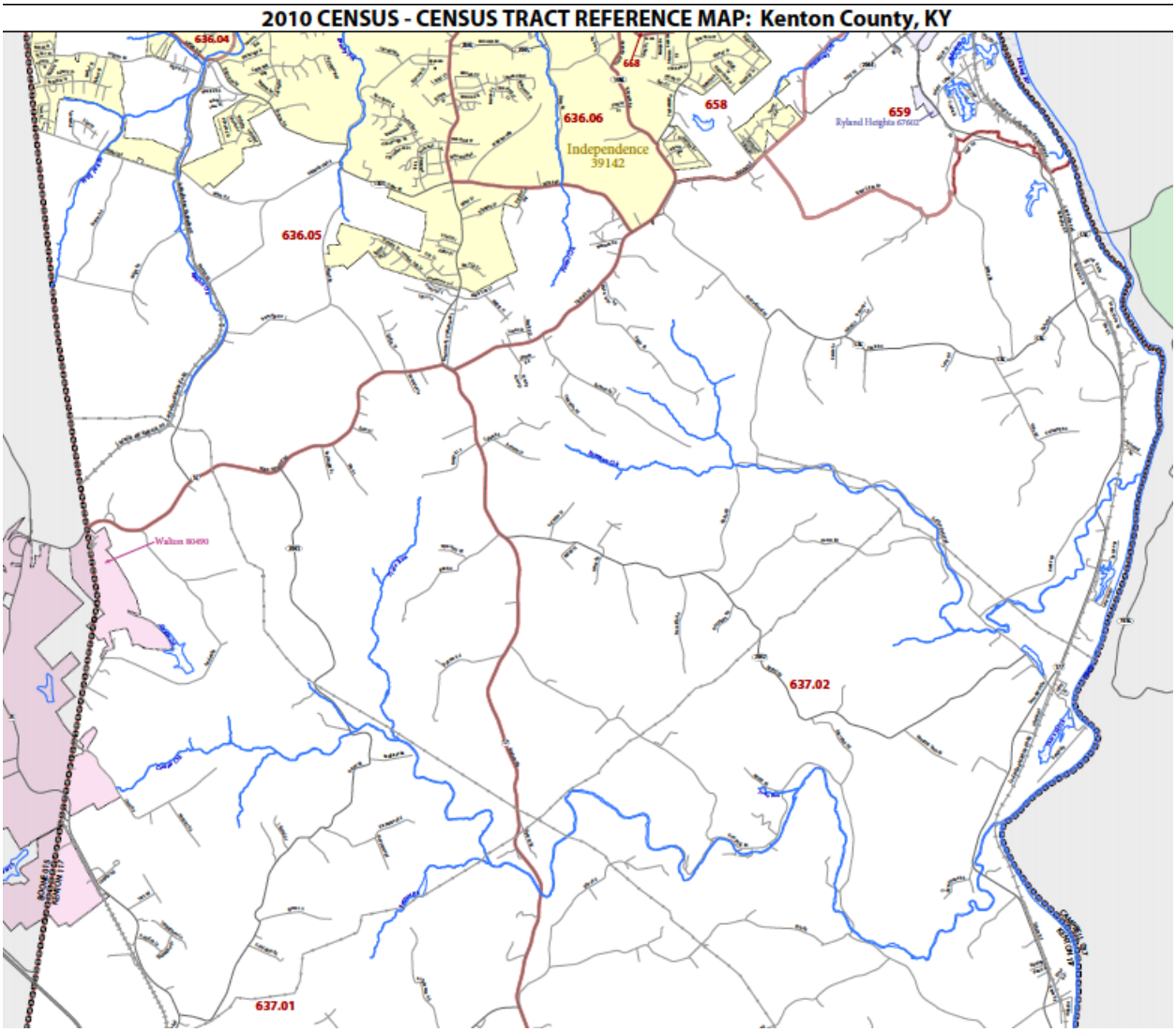

Figure 3b: Southern portion of Kenton County, KY

Pendleton County, KY

Air Quality

Pursuant to 40 CFR 50:19 (b) and (d) the 8-hour primary and secondary NAAQS are met at an ambient air quality monitoring site when the 3-year average of the annual fourth-highest daily maximum 8-hour average ozone concentration is less than or equal to 0.070 ppm, as determined in accordance with Appendix U of Part 50. Currently, there is no ozone monitor located in Pendleton County.

Ozone air monitoring data and design values for 2013-2015 for the Cincinnati, OH-KY-IN Core Based Statistical Area (CBSA) were retrieved from https://www.epa.gov/air-trends/air-quality-design-values#report. Per the EPA website, "The design values shown here are computed using Federal Reference Method or equivalent data reported by State, Tribal, and Local monitoring agencies to EPA's Air Quality System (AQS) as of June 24, 2016." Table 1 provides a summary of the annual fourth-highest daily maximum 8-hour average ozone concentrations recorded at monitors located in the Cincinnati, OH-KY-IN Core Based Statistical Area (CBSA), for 2013-2015. Not all counties in the Cincinnati, OH-KY-IN CBSA have monitors for ozone. Monitor values included in Table 1 only reflect those monitors that were operational during the 2013 to 2015 design value period. Only the monitor in Campbell County, KY indicates a design value above the revised ozone NAAQS for the CBSA.

Table 1
Cincinnati, OH-KY-IN CBSA
3-year Average* of Annual 8-hour concentrations for Ozone

County/Site	AQS Code	Annual 4th High (ppm)			Design Value (ppm)
		2013	2014	2015	
Kentucky					
Boone	21-015-0003	0.059	0.062	0.062	0.061
Campbell	21-037-3002	0.072	0.071	0.071	0.071
Ohio					
Butler	39-017-0004	0.068	0.070	0.070	0.069
Butler	39-017-0018	0.068	0.069	0.070	0.069
Butler	39-017-9991	0.069	0.069	0.068	0.068
Clermont	39-025-0022	0.066	0.068	0.070	0.068
Hamilton	39-061-0006	0.069	0.070	0.072	0.070
Hamilton	39-061-0010	0.064	0.073	0.070	0.069
Hamilton	39-061-0040	0.069	0.069	0.071	0.069
Warren	39-165-0007	0.067	0.071	0.071	0.069

*NAAQS 8-hour (3 year average of the 4th max value). 0.070ppm
n/a indicates no monitor data for that county.

Emissions and Emissions-Related Data

The U.S. EPA requires an emissions inventory to be developed in order to identify the level of emissions in a specific area and adjacent regions that may have contributed to an ozone violation. The EPA Ozone Designations Mapping Tool was used to obtain 2011 NEI v2 emissions inventory data. The 2011 NEI v2 is the latest available national emissions inventory data and is the source of the point, non-point, on-road, non-road and event emissions, and was used to evaluate Pendleton County's impact on the violating monitor. VOC and NOx emissions, by category, are provided in Tables 2 and 3.

Table 2
2011 NEI VOC Emissions (tpy)
Cincinnati, OH-KY-IN CBSA

County	VOC (tons per year)					
	Point	Non-point	On-road	Non-road	Event	Total
KENTUCKY						
Boone	1019.03	3708.82	1156.27	960.74	210.59	**7055.45**
Bracken	13.41	2604.87	143.77	98.86	0.0	**2860.91**
Campbell	160.58	2658.31	785.96	260.64	0.0	**3865.49**
Gallatin	87.39	1872.80	230.24	95.01	49.75	**2335.19**
Grant	79.78	3246.13	422.24	239.93	2.86	**3990.94**
Kenton	232.80	3289.76	1405.33	418.90	0.0	**5346.79**
Pendleton	127.59	3137.17	227.50	44.20	80.48	**3616.94**
KY Total	**1720.58**	**20517.86**	**4371.31**	**2118.28**	**343.68**	**29071.71**
INDIANA						
Dearborn	1573.32	3500.17	752.90	152.55	144.58	**6123.52**
Ohio	0.01	1571.07	111.12	30.63	46.31	**1759.14**
Union	0.00	1500.88	127.38	218.28	0.00	**1846.54**
IN Total	**1573.33**	**6572.12**	**991.40**	**401.46**	**190.89**	**9729.20**
OHIO						
Brown	28.90	4558.87	969.87	111.49	24.69	**5693.82**
Butler	1146.62	6081.24	4556.78	1076.33	0.0	**12860.97**
Clermont	180.86	5500.53	2654.57	719.53	0.0	**9055.49**
Hamilton	978.46	10759.16	10490.15	2734.21	0.0	**24961.98**
Warren	262.03	4760.18	2741.38	812.53	0.0	**8576.12**
OH Total	**2596.87**	**31659.98**	**21412.75**	**5454.09**	**24.69**	**61148.38**
Total Emissions	**5890.78**	**58749.96**	**26775.46**	**7973.83**	**559.26**	**99949.29**

Table 3
2011 NEI NO_x Emissions (tpy)
Cincinnati, OH-KY-IN CBSA

County	NOx (tons per year)					
	Point	Non-point	On-road	Non-road	Event	Total
KENTUCKY						
Boone	3569.19	801.83	3455.45	682.30	21.32	**8530.09**
Bracken	3.72	469.43	267.93	72.38	0.0	**813.46**
Campbell	82.95	666.79	1583.28	247.83	0.0	**2580.85**
Gallatin	609.76	357.34	832.85	42.53	5.00	**1847.48**
Grant	13.00	510.39	1590.13	96.12	0.28	**2209.92**
Kenton	147.17	818.13	3449.61	521.34	0.0	**4936.25**
Pendleton	949.22	350.98	385.47	77.48	7.90	**1771.05**
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Warren	569.13	799.42	4743.52	1189.90	0.0	**7301.97**
OH Total	**30228.20**	**7535.95**	**36747.68**	**6992.63**	**2.39**	**81506.85**
Total Emissions	**42133.86**	**12074.84**	**50314.27**	**9093.08**	**46.26**	**113662.31**

Table 4
VOC Emissions as % of Total VOC Emissions
Cincinnati, OH-KY-IN CBSA

County	Point	Non Point	On-Road	Non-Road	Total MSA
Hamilton, OH	16.6	17.5	39.4	35.3	**25.4**
Butler, OH	19.5	9.9	17.1	13.9	**13.1**
Clermont, OH	3.1	8.9	10.0	9.3	**9.2**
Warren, OH	4.4	7.7	10.3	10.5	**8.7**
Boone, KY	17.3	6.5	4.3	12.4	**7.2**
Dearborn, IN	27.0	5.7	2.8	2.0	**6.2**
Brown, OH	0.5	7.4	3.6	1.4	**5.8**
Kenton, KY	4.0	5.7	5.3	5.4	**5.5**
Grant, KY	1.4	5.3	1.6	3.1	**4.1**
Campbell, KY	2.7	4.3	2.9	3.4	**3.9**
Pendleton, KY	2.2	5.1	0.9	0.6	**3.7**
Bracken, KY	0.2	4.6	0.5	1.3	**2.9**
Gallatin, KY	1.5	3.3	0.9	1.2	**2.4**
Ohio. IN	0.0	2.6	0.4	0.4	**1.8**
Union, IN	0.0	2.6	0.5	2.7	**1.8**

Table 5
NOx Emissions as % of Total NOx Emissions
Cincinnati, OH-KY-IN CBSA

County	Point	Non Point	On-Road	Non-Road	Total MSA
Hamilton, OH	22.9	32.0	38.4	35.1	**31.4**
Clermont, OH	38.0	5.0	8.7	9.3	**19.1**
Butler, OH	9.5	16.5	14.2	17.5	**12.8**
Dearborn, IN	15.5	2.5	3.2	2.2	**7.6**
Boone, KY	8.5	6.7	6.9	7.6	**7.5**
Warren, OH	1.4	6.7	9.5	13.3	**6.4**
Kenton, KY	0.4	6.9	6.9	5.8	**4.3**
Campbell, KY	0.2	5.6	3.2	2.8	**2.3**
Grant, KY	3.1	4.3	3.2	1.1	**1.9**
Brown, OH	0.0	3.2	2.6	2.8	**1.7**
Gallatin, KY	1.4	3.0	1.7	0.5	**1.6**
Pendleton, KY	2.3	3.0	0.8	0.9	**1.5**
Bracken, KY	0.0	4.0	0.5	0.8	**0.7**
Union, IN	0.0	0.8	1.5	1.5	**0.5**
Ohio. IN	0.0	0.6	0.3	0.3	**0.2**

Point Sources

Table 2 indicates 2011 point source emissions of VOC in Pendleton County were estimated at 127.59 tpy. Total VOC point source emissions from the Cincinnati, OH-KY-IN CBSA were 5,890.78 tpy. Pendleton County represents approximately 2.2% of the total VOC point source emissions in the CBSA. Table 4 shows the percentages of VOC emissions for point sources in the CBSA, by county.

As seen in Table 3, point source NO_x emissions from Pendleton County were estimated at 949.22 tpy in 2011, which represents approximately 2.3% of the total 42,133.86 tpy of the overall NO_x point source emissions from the Cincinnati, OH-KY-IN CBSA. Table 5 shows the percentages of NO_x emissions for point sources in the CBSA, by county.

Non-Point (Area) Emissions

Table 2 shows that non-point (or "area") VOC emissions in Pendleton County were estimated to be 3,137.17 tpy in 2011, which represents approximately 5.5% of the total 57,249.08 tpy of the overall VOC non-point source emissions from the Cincinnati, OH-KY-IN CBSA. Table 4 shows the percentages of VOC emissions for non-point sources in the CBSA, by county.

As seen in Table 3, non-point NO_x emissions from Pendleton County were estimated at 350.98 tpy in 2011, which represents approximately 3.0% of the total 11,884.21 tpy of the overall NO_x non-point source emissions from the Cincinnati, OH-KY-IN CBSA. Table 5 shows the percentages of NOx emissions for non-point sources in the CBSA, by county.

On-Road Mobile

As indicated in Table 2, on-road mobile source VOC emissions from Pendleton County were estimated at 227.50 tpy in 2011, which represents approximately 0.9% of the total 26,648.08 tpy of the overall VOC on-road mobile source emissions from the Cincinnati, OH-KY-IN CBSA. Table 4 shows the percentages of VOC emissions for on-road mobile sources in the CBSA, by county.

As seen in Table 3, on-road mobile source NO_x emissions from Pendleton County were estimated to be 385.47 tpy in 2011, which represents approximately 0.8% of the total 50,087.92 tpy of the overall NO_x on-road mobile source emissions from the Cincinnati, OH-KY-IN CBSA. Table 5 shows the percentages of NO_x emissions for on-road mobile sources in the CBSA, by county.

Based on 2014 information obtained from the U.S. Census website, http://onthemap.ces.census.gov/, the commuting traffic from other counties into Pendleton County is 48.4% while the commuting traffic from Pendleton County into other counties is 81.4%.

Table 6 below provides Vehicle Miles Travelled (VMT) for all areas within the Cincinnati, OH-KY-IN CBSA for the year 2011. The counties within the Ohio portion of the CBSA contribute to the majority of VMT within the CBSA. Pendleton County's VMT is significantly lower compared to other counties within the CBSA.

Table 6
2011 VMT Totals, Cincinnati, OH-KY-IN CBSA

	2011 VMT Totals
Kentucky	
Boone County	**1,558,794,112**
Bracken County	**104,160,119**
Campbell County	**1,010,009,434**
Gallatin County	**245,765,593**
Grant County	**529,145,674**
Kenton County	**1,720,886,038**
Pendleton County	**184,074,537**
KY Total	**5,352,835,507**
Ohio	
Brown County	**468,171,663**
Butler County	**3,099,030,997**
Clermont County	**1,951,343,156**
Hamilton County	**9,004,357,566**
Warren County	**2,139,774,797**
OH Total	**16,662,678,179**
Indiana	
Dearborn County	**690,348,611**
Ohio County	**71,591,617**
Union County	**105,444,221**
IN Total	**867,384,449**
Total VMT for CBSA	**22,882,898,135**

Non-Road Mobile Sources

As listed in Table 2, non-road mobile source VOC emissions from Pendleton County were estimated at 44.20 tpy in 2011, which represents approximately 0.6% of the total 7,755.55 tpy of the overall VOC non-road mobile source emissions from the Cincinnati, OH-KY-IN CBSA. Table 4 shows the percentages of VOC emissions for non-road mobile sources in the CBSA, by county.

As seen in Table 3, non-road mobile source NO_x emissions from Pendleton County were estimated at 77.48 tpy in 2011, which represents approximately 0.9% of the total 8,957.71 tpy of the overall NO_x non-road mobile source emissions from the Cincinnati, OH-KY-IN CBSA. Table 5 shows the percentages of NO_x emissions for non-road mobile sources in the CBSA, by county.

Comparison of Total Emissions

A comparison of total emissions across the entire Ohio, Kentucky, and Indiana CBSA was performed using data from the EPA Ozone Designations Mapping Tool. The percentages shown in last column in both Tables 4 and 5 demonstrate that the majority of VOC and NOx emissions within the Cincinnati, OH-KY-IN CBSA come from the Ohio portion of the CBSA.

Population

Based on U.S. Census Bureau estimates for 2015, there are 14,408 persons living in Pendleton County. (Refer to table 7) This represents approximately 51.5 persons per square mile. The population of Pendleton County is approximately 100% rural with few people living in incorporated areas. The largest cities in Pendleton County are Falmouth and Butler.

Pendleton County's population from 2010 to 2015 *decreased* by approximately -3.1%. For the entire Cincinnati, OH-KY-IN CBSA, Pendleton County represents approximately 0.7% of the total population in the CBSA and 3.5% of the Kentucky portion of the CBSA. (Refer to table 8)

Table 7
Northern Kentucky Area Population
Growth Data

County	Census 2010	2015*	%Growth 2010 - 2015
Boone	118,811	127,712	7.5%
Bracken	8,488	8,321	-2.0%
Campbell	90,336	92,066	1.9%
Gallatin	8,589	8,636	0.5%
Grant	24,662	24,757	0.4%
Kenton	159,720	165,012	3.3%
Pendleton	14,877	14,408	-3.1%

*U.S. Census Bureau estimates.

Table 8
2015 Population
Cincinnati, OH-KY-IN CBSA

CBSA Estimated Population	2015*	2015 Population Density (1,000 per square mile)	% of Total	
Kentucky			**of KY Portion**	**of CBSA**
Boone County	**127,712**	**0.52**	**29.0%**	**5.9%**
Bracken County	**8,321**	**0.04**	**1.9%**	**0.5%**
Campbell County	**92,066**	**0.61**	**20.9%**	**4.3%**
Gallatin County	**8,636**	**0.09**	**2.0%**	**0.4%**
Grant County	**24,757**	**0.10**	**5.6%**	**1.2%**
Kenton County	**165,012**	**1.03**	**37.4%**	**7.6%**
Pendleton County	**14,408**	**0.05**	**3.3%**	**0.7%**
KY Total	**440,912**	**--**	**100%**	**20.6%**
Ohio			**of OH Portion**	
Brown County	**43,839**	**0.09**	**2.7%**	**2.0%**
Butler	**376,353**	**0.81**	**22.8%**	**17.4%**
Clermont County	**201,973**	**0.45**	**12.2%**	**9.4%**
Hamilton County	**807,598**	**1.99**	**48.8%**	**37.4%**
Warren County	**224,469**	**0.56**	**13.6%**	**10.4%**
OH Total	**1,654,232**	**--**	**100%**	**76.7%**
Indiana			**of IN Portion**	
Dearborn County	**49,455**	**0.16**	**79.0%**	**2.3%**
Ohio County	**5,938**	**0.07**	**9.5%**	**0.3%**
Union County	**7,182**	**0.04**	**11.5%**	**0.3%**
IN Total	**62,575**	**--**	**100%**	**2.9%**
Total Estimated Population	**2,157,719**	**--**	**100%**	**100%**

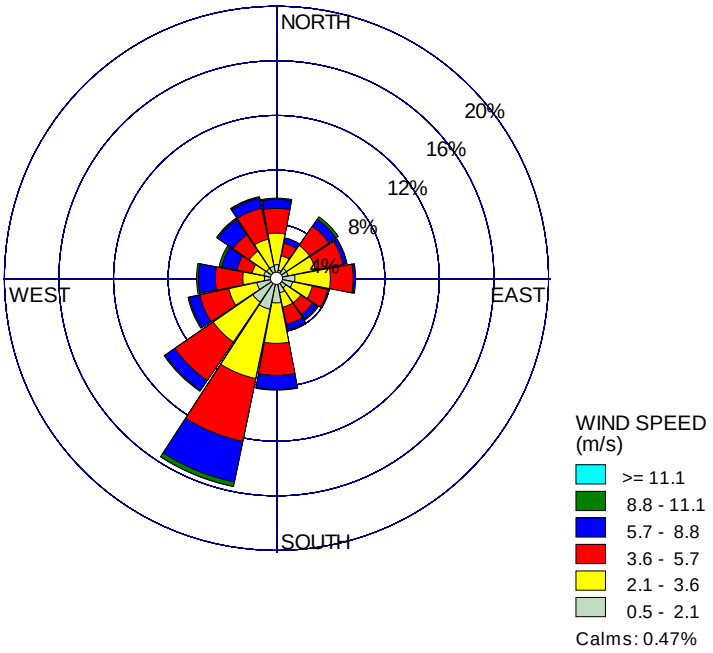
*U.S. Census Bureau estimates.

Areas of dense population and high VMT can display elevated nonpoint and on-road source emissions. As seen in Tables 2 and 3, two of the sectors with the highest emission contribution are from nonpoint for both VOC and NOx. However, Pendleton County emissions are low compared to other areas within the CBSA.

Meteorology

Wind speed and wind direction data collected at the Cincinnati-Northern Kentucky Airport (NWS Station 93814) for the period 2013-2015 shows that the majority of the time the wind in the area came from the southwest and typically from 2.1-3.6 miles per hour (Refer to figure 1). According to Kentucky Mesonet (http://www.kymesonet.org/), the average high temperature for July for the area from 2013 through 2015 was 91.9°F; the average low was 55.5°F. The average precipitation for the same period was 4.65 inches.

Figure 1: Wind Rose Average 2013-2015 March 1st - October 31st



Several 48-hour back trajectory HYSPLITS for Kentucky have been included in Section 8 for days in 2013-2015 when the 8-hour ambient monitoring concentration for ozone had their highest readings. As seen in the HYSPLITS, the position of Pendleton County relative to Campbell County along with predominant winds being from the southwest show that Pendleton County is not impacting the violating monitor in Campbell County.

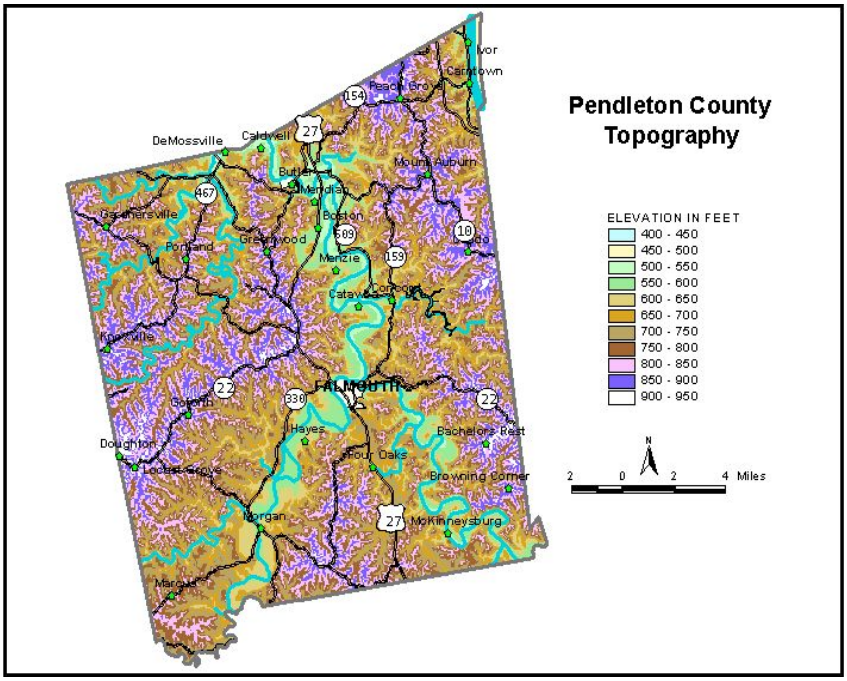
Geography and Topography

Pendleton County is part of the Cincinnati, OH-KY-IN CBSA and has a land area of 280 square miles. Located in the central part of Northern Kentucky, Pendleton County lies directly south of Kenton and Campbell Counties and to the east of Grant County, Kentucky. The terrain is rolling and hilly. The Licking River makes broad loops ranging from 100 to 200 feet below the upland. The valley bottom is mainly where flat areas are found. The highest elevation is 960 feet, at a ridge adjoining Ky. 22 near the Pendleton-Bracken County line. The lowest elevation is 455 feet, in Carntown. Community elevations

are as follows: Falmouth, the county seat, at 558 feet; Butler, 540 feet; DeMossville, 521 feet; Gardnersville, 882 feet.

Figure 2 shows the topography of Pendleton County. Pendleton County does not have any geographical or topographical distinctions that interfere with air pollution transport. Therefore, this factor is not a significant part of the overall analysis.

Figure 2: Pendleton County Topographic Map



Jurisdictional Boundaries

The authority for air quality planning in the Pendleton County area resides with the Kentucky Energy and Environment Cabinet. Transportation planning for Pendleton County is performed by the Kentucky Transportation Cabinet. Historically, portions of Boone, Campbell, and Kenton counties have been designated as nonattainment. These Kentucky counties along with Butler, Clermont, Clinton, Hamilton, Warren, Ohio, and Dearborn, Indiana were designated nonattainment for the 1997 and 2008 ozone standards. The 2008 ozone standard nonattainment area was confined to specific census tracts in the northern part of Boone, Campbell and Kenton counties.

Conclusion and Recommendation

There were no ozone monitors located in Pendleton County for the 2013-2015 monitoring period.

As seen in Table 9 below, Pendleton County's VOC and NOx emissions are insignificant compared to other counties located within the Cincinnati, OH-KY-IN CBSA. Pendleton County contributes approximately:

- 3.6% of the total VOC emissions
- 1.6% of the total NO_x emissions

The emissions from Pendleton are negligible and do not significantly contribute to the 8-hour ozone standard in the Cincinnati, OH-KY-IN CBSA.

Table 9
VOC and NO_x Percentages for
Cincinnati, OH-KY-IN CBSA (2011 NEI)

County	VOC %	NO_X %
KENTUCKY		
Boone	7.1	7.5
Bracken	2.9	0.7
Campbell	3.8	2.3
Gallatin	2.3	1.6
Grant	4.0	1.9
Kenton	5.3	4.3
Pendleton	3.6	1.6
KY Total	**29.0%**	**19.9%**
OHIO		
Brown	5.7	1.7
Butler	12.9	12.9
Clermont	9.1	19.2
Hamilton	25.0	31.6
Warren	8.6	6.4
OH Total	**61.3%**	**71.8**
INDIANA		
Dearborn	6.1	7.6
Ohio	1.8	0.2
Union	1.8	0.5
IN Total	**9.7%**	**8.3%**
Total Emissions %	**100.0%**	**100.0%**

Data gathered for Pendleton County and reviewed using EPA's five factor analysis demonstrates that Pendleton County is not contributing to the violating monitor in Campbell County. Therefore, Kentucky recommends that Pendleton County be designated as "unclassifiable/attainment" for the 2015 8-hour ozone NAAQS.

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Back Trajectory Analysis Prepared by the Kentucky Division for Air Quality

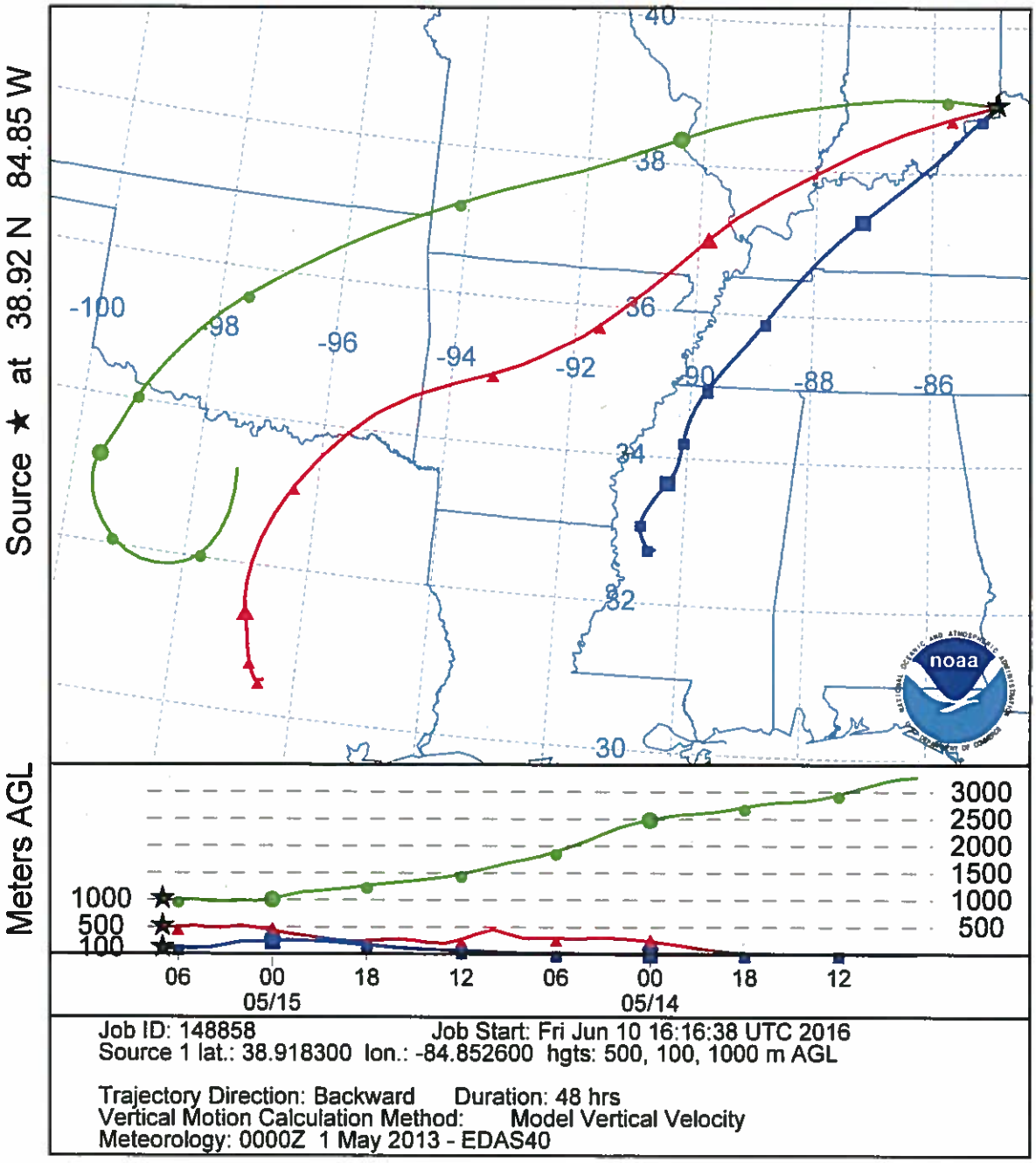
For the Boone County, Kentucky Ozone Monitor

Using NOAA's HYSPLIT Trajectory Model

East Bend (Boone County) Ozone Monitor (AQS: 21-015-0003)
2013 8-Hour Average Top Four Maximum Values

Date	Start Hour (EST)	8-Hour Reading (PPM)	
05/15/2013	11	.071	
08/29/2013	11	.062	
05/14/2013	12	.060	
04/05/2013	11	.059	(4^{th} Max)

NOAA HYSPLIT MODEL
Backward trajectories ending at 0700 UTC 15 May 13
EDAS Meteorological Data



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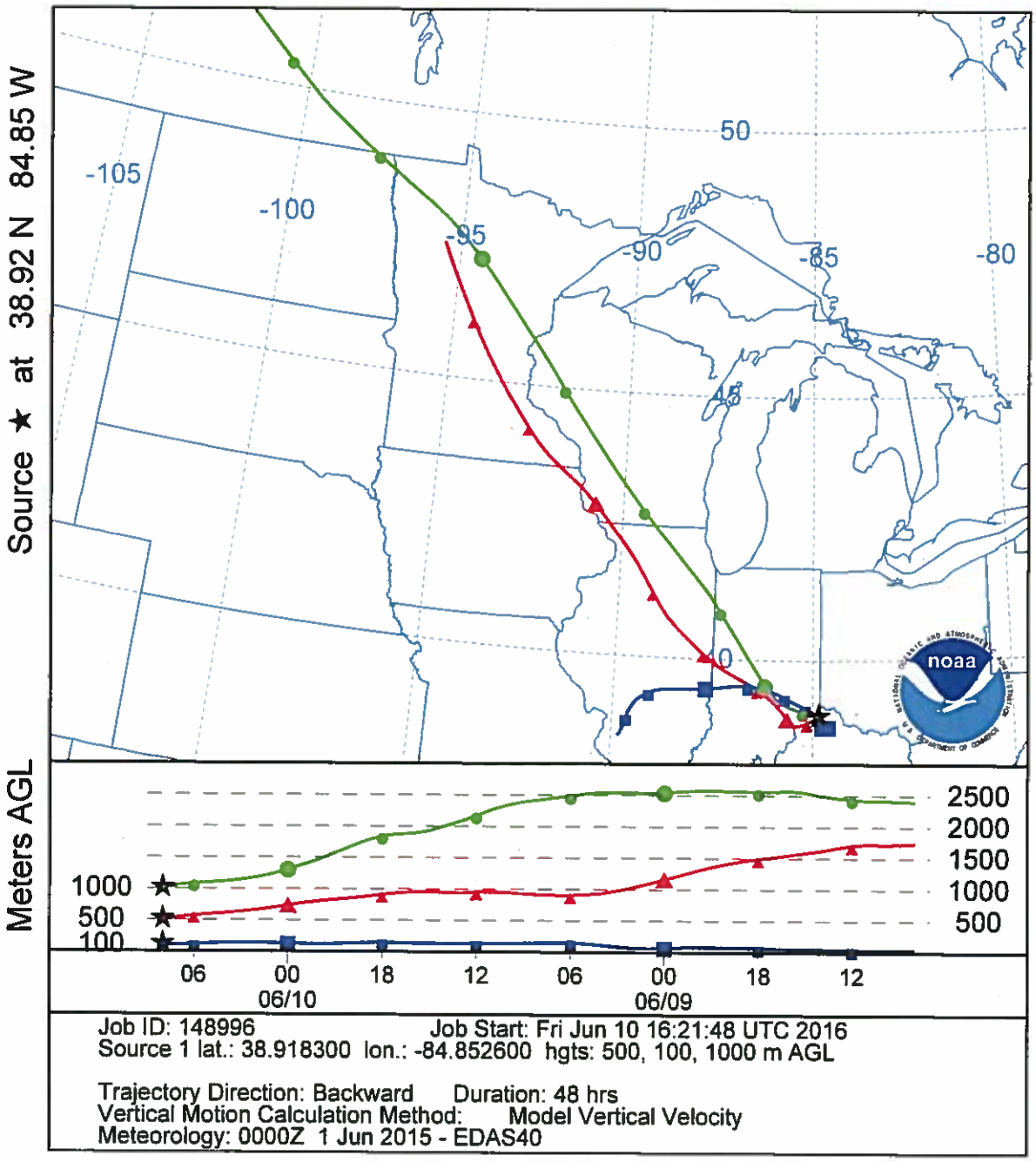
Source 1 lat.: 38.918300 lon.: -84.852600 hgts: 500, 100, 1000 m AGL

Trajectory Direction: Backward Duration: 48 hrs
Vertical Motion Calculation Method: Model Vertical Velocity
Meteorology: 0000Z 1 May 2013 - EDAS40

East Bend (Boone County) Ozone Monitor (AQS: 21-015-0003)
2015 8-Hour Average Top Four Maximum Values

Date	Start Hour (EST)	8-Hour Reading (PPM)	
06/10/2015	12	.071	
05/06/2015	11	.069	
07/25/2015	11	.062	
09/04/2015	11	.062	(4^{th} Max)

NOAA HYSPLIT MODEL
Backward trajectories ending at 0800 UTC 10 Jun 15
EDAS Meteorological Data



Back Trajectory Analysis Prepared by the Kentucky Division for Air Quality

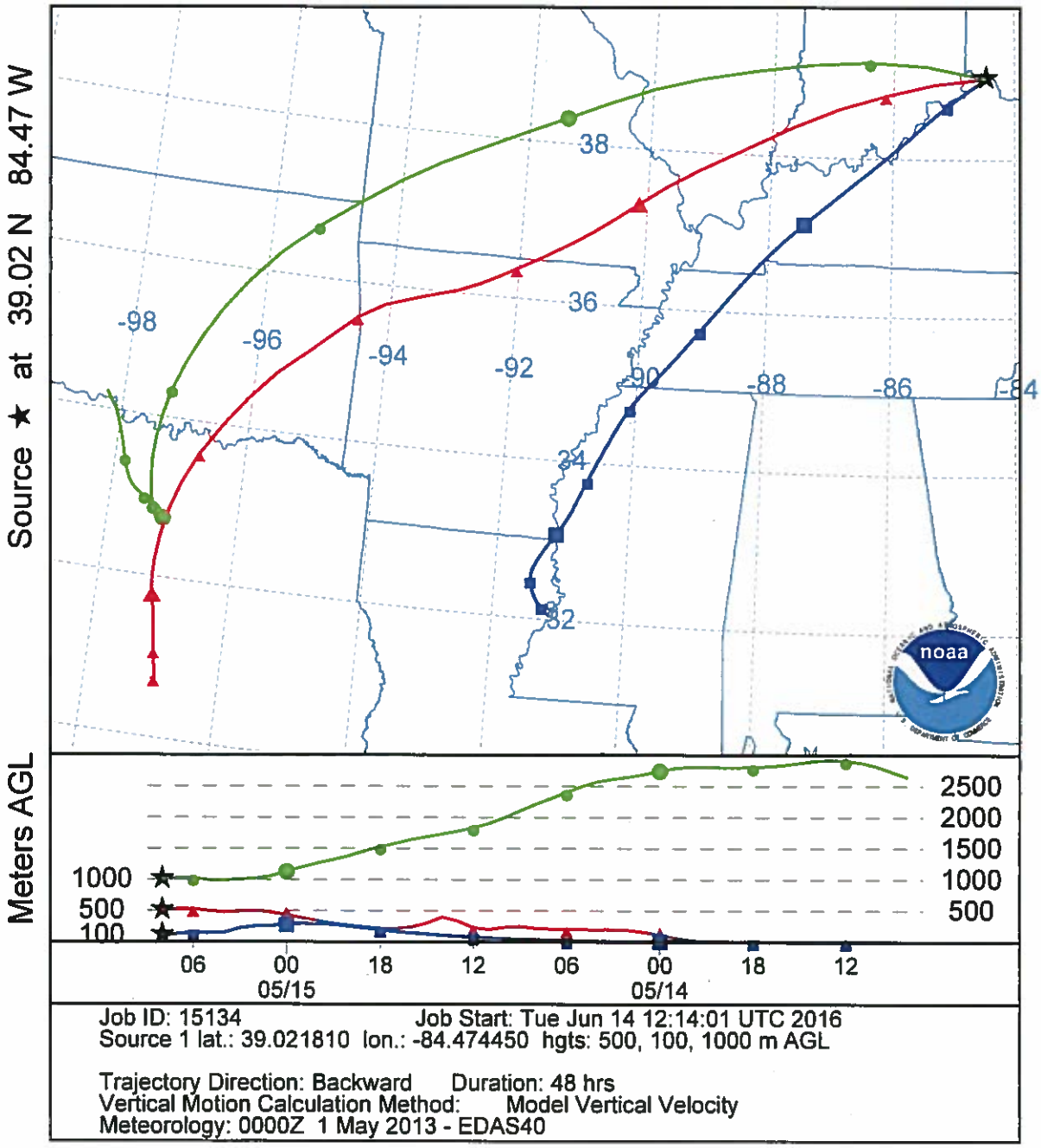
For the Campbell County, Kentucky Ozone Monitor

Using NOAA's HYSPLIT Trajectory Model

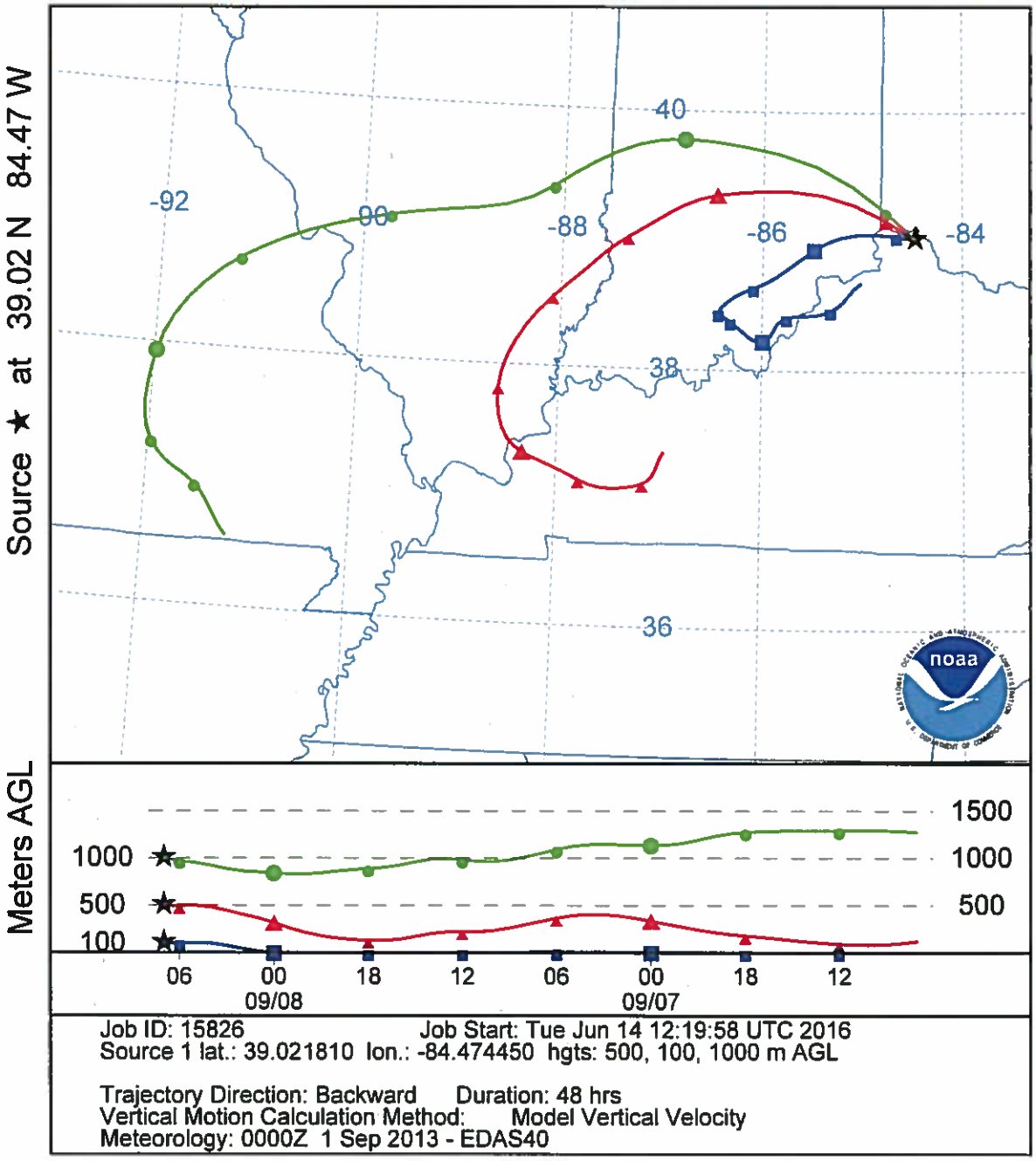
Highland Heights (Campbell County) Ozone Monitor (AQS: 21-037-3002)
2013 8-Hour Average Top Four Maximum Values

Date	Start Hour (EST)	8-Hour Reading (PPM)	
05/15/2013	12	.079	
08/19/2013	12	.076	
09/08/2013	11	.072	
09/11/2013	13	.072	(4^{th} Max)

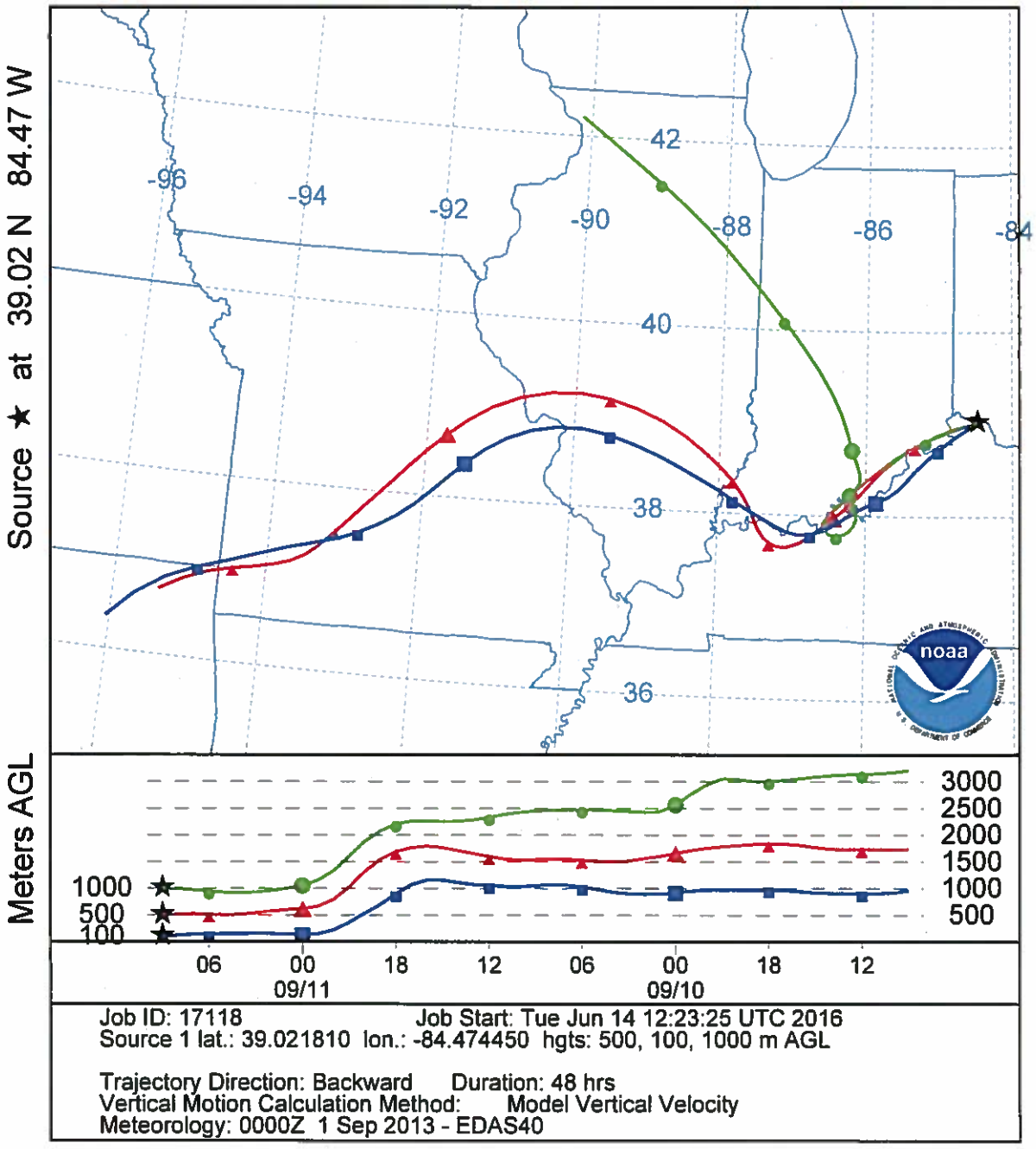
NOAA HYSPLIT MODEL
Backward trajectories ending at 0800 UTC 15 May 13
EDAS Meteorological Data



NOAA HYSPLIT MODEL
Backward trajectories ending at 0700 UTC 08 Sep 13
EDAS Meteorological Data



NOAA HYSPLIT MODEL
Backward trajectories ending at 0900 UTC 11 Sep 13
EDAS Meteorological Data



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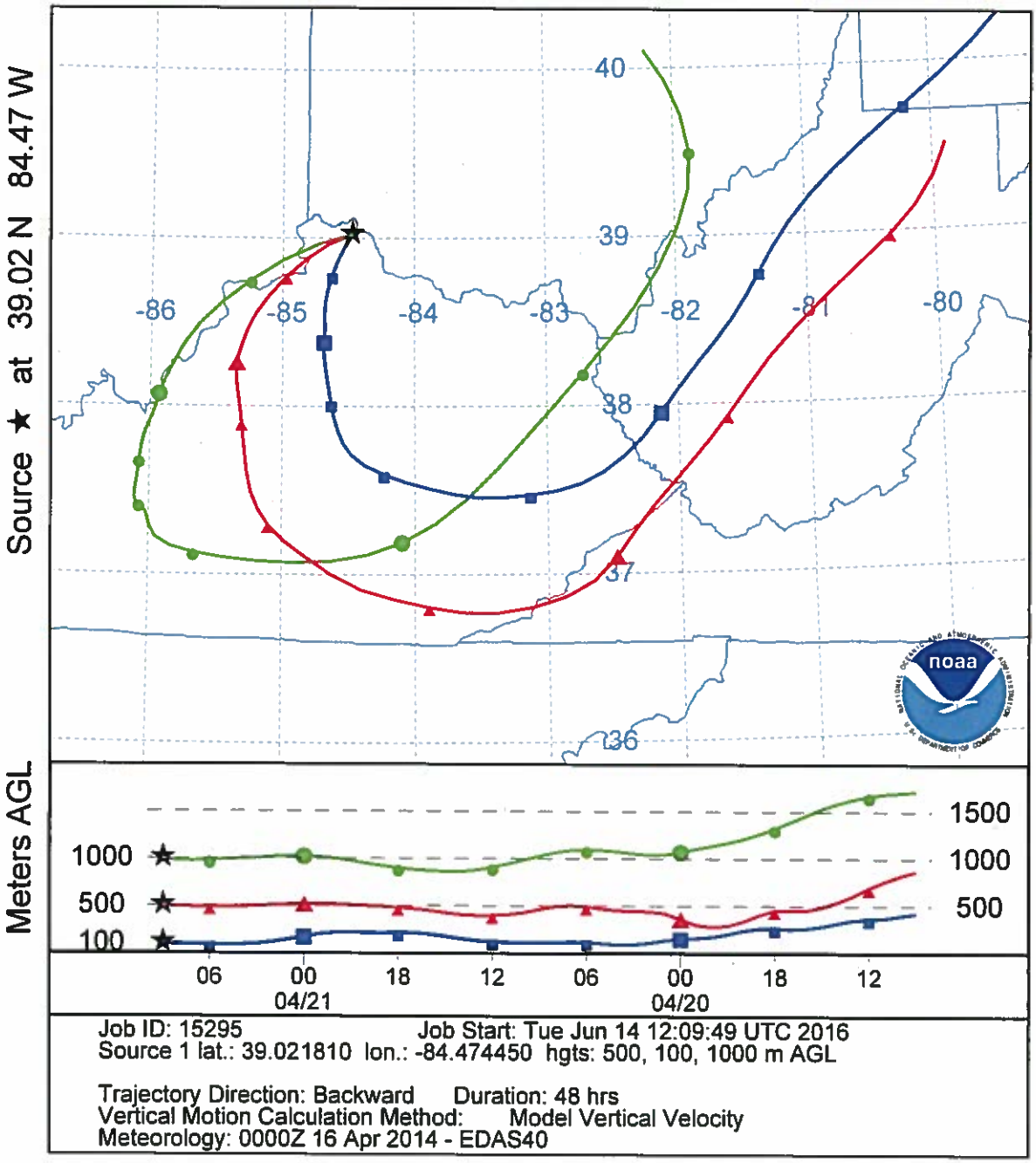
Source 1 lat.: 39.021810 lon.: -84.474450 hgts: 500, 100, 1000 m AGL

Trajectory Direction: Backward Duration: 48 hrs
Vertical Motion Calculation Method: Model Vertical Velocity
Meteorology: 0000Z 1 Sep 2013 - EDAS40

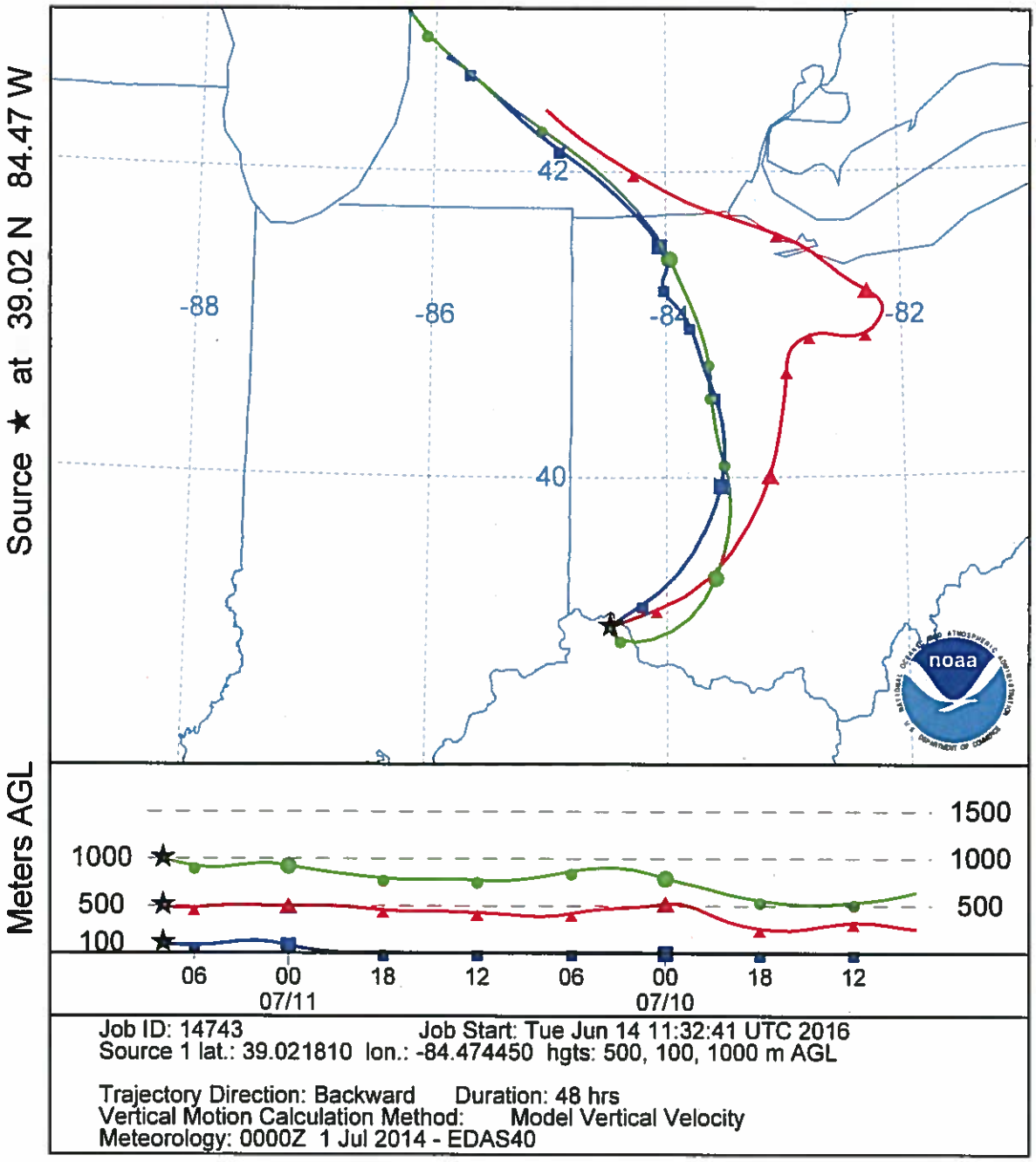
Highland Heights (Campbell County) Ozone Monitor (AQS: 21-037-3002)
2014 8-Hour Average Top Four Maximum Values

Date	Start Hour (EST)	8-Hour Reading (PPM)	
07/11/2014	12	.074	
08/04/2014	11	.074	
07/12/2014	11	.072	
04/21/2014	13	.071	(4^{th} Max)

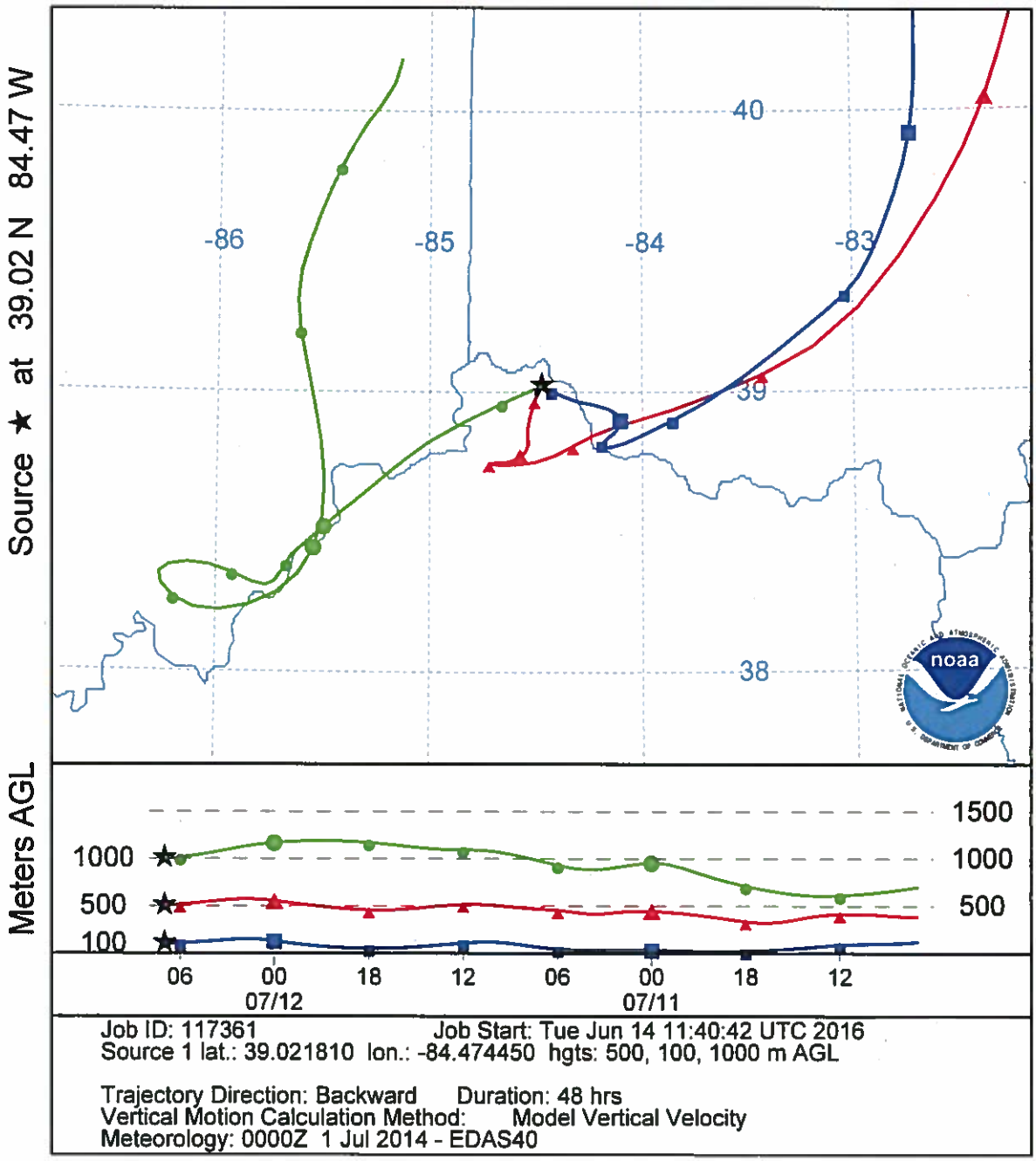
NOAA HYSPLIT MODEL
Backward trajectories ending at 0900 UTC 21 Apr 14
EDAS Meteorological Data



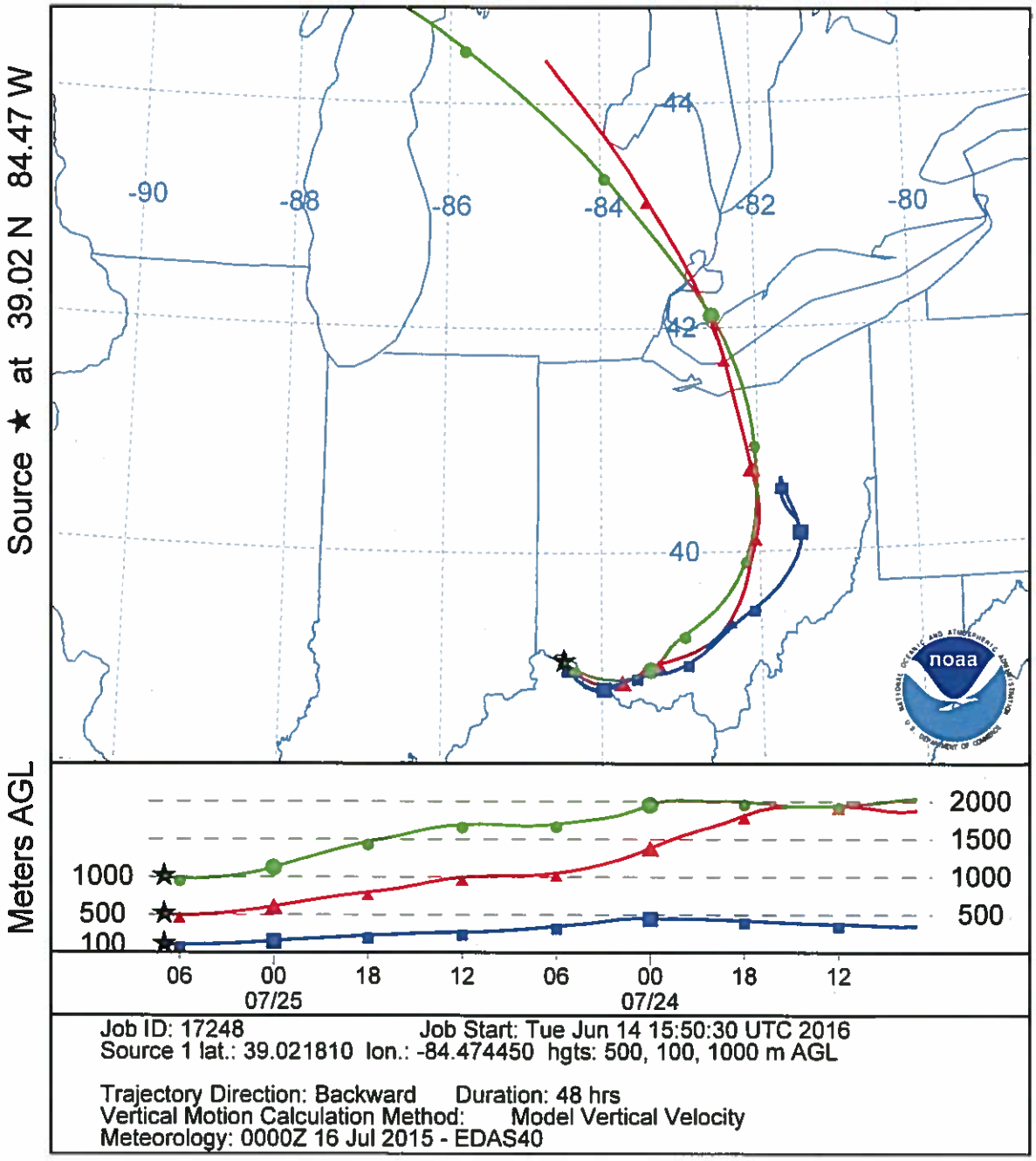
NOAA HYSPLIT MODEL
Backward trajectories ending at 0800 UTC 11 Jul 14
EDAS Meteorological Data



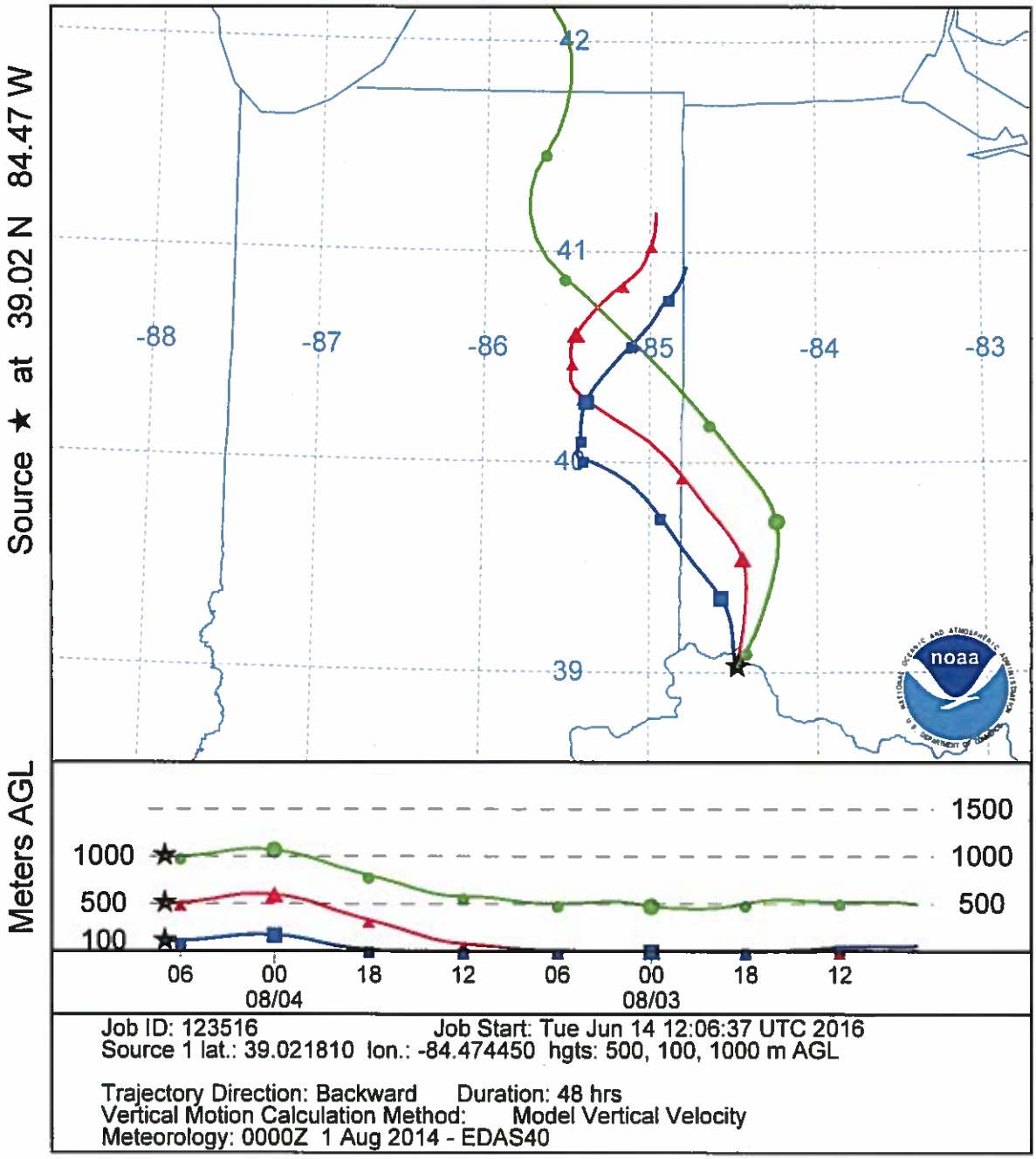
NOAA HYSPLIT MODEL
Backward trajectories ending at 0700 UTC 12 Jul 14
EDAS Meteorological Data



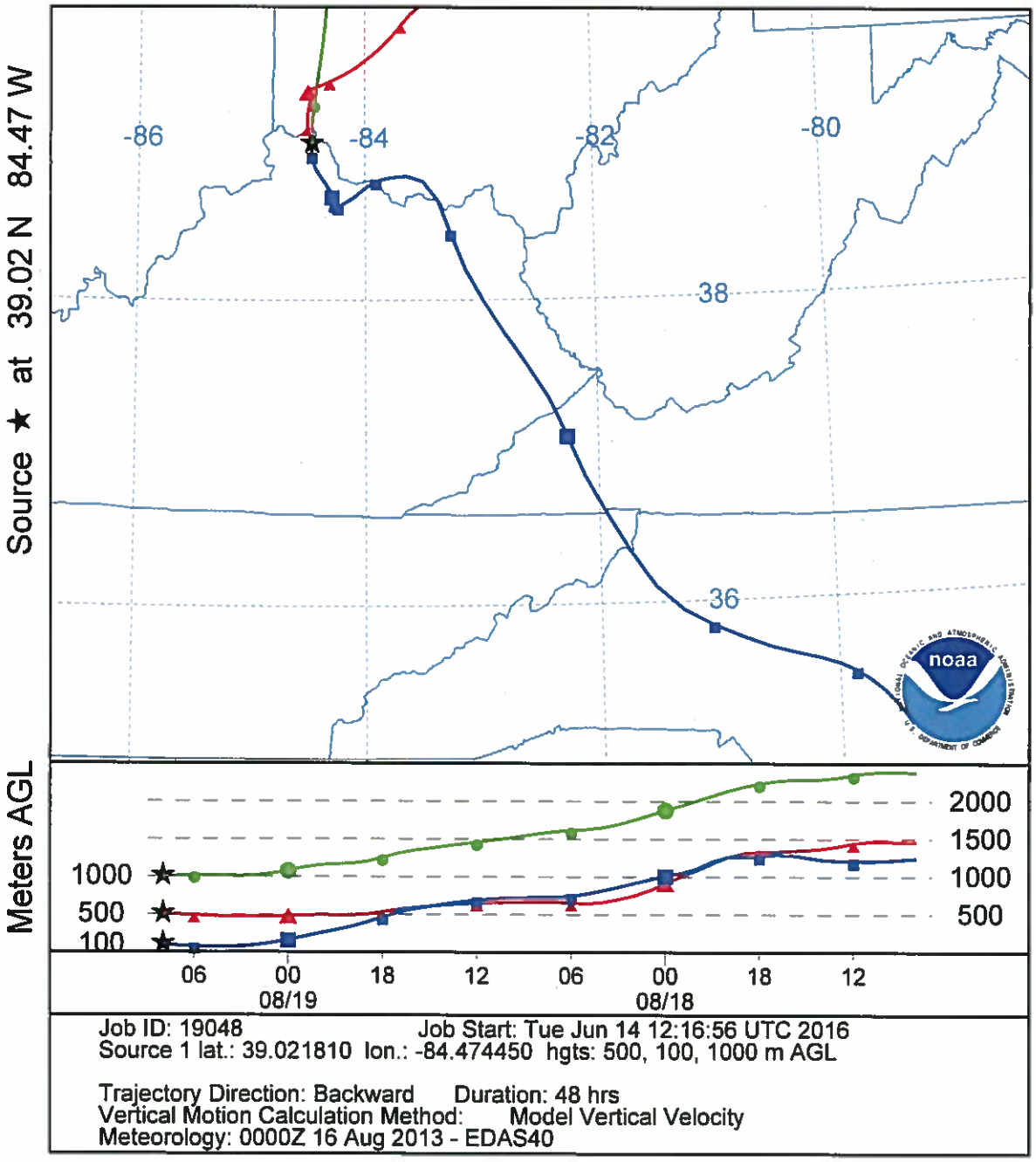
NOAA HYSPLIT MODEL
Backward trajectories ending at 0700 UTC 25 Jul 15
EDAS Meteorological Data



NOAA HYSPLIT MODEL
Backward trajectories ending at 0700 UTC 04 Aug 14
EDAS Meteorological Data



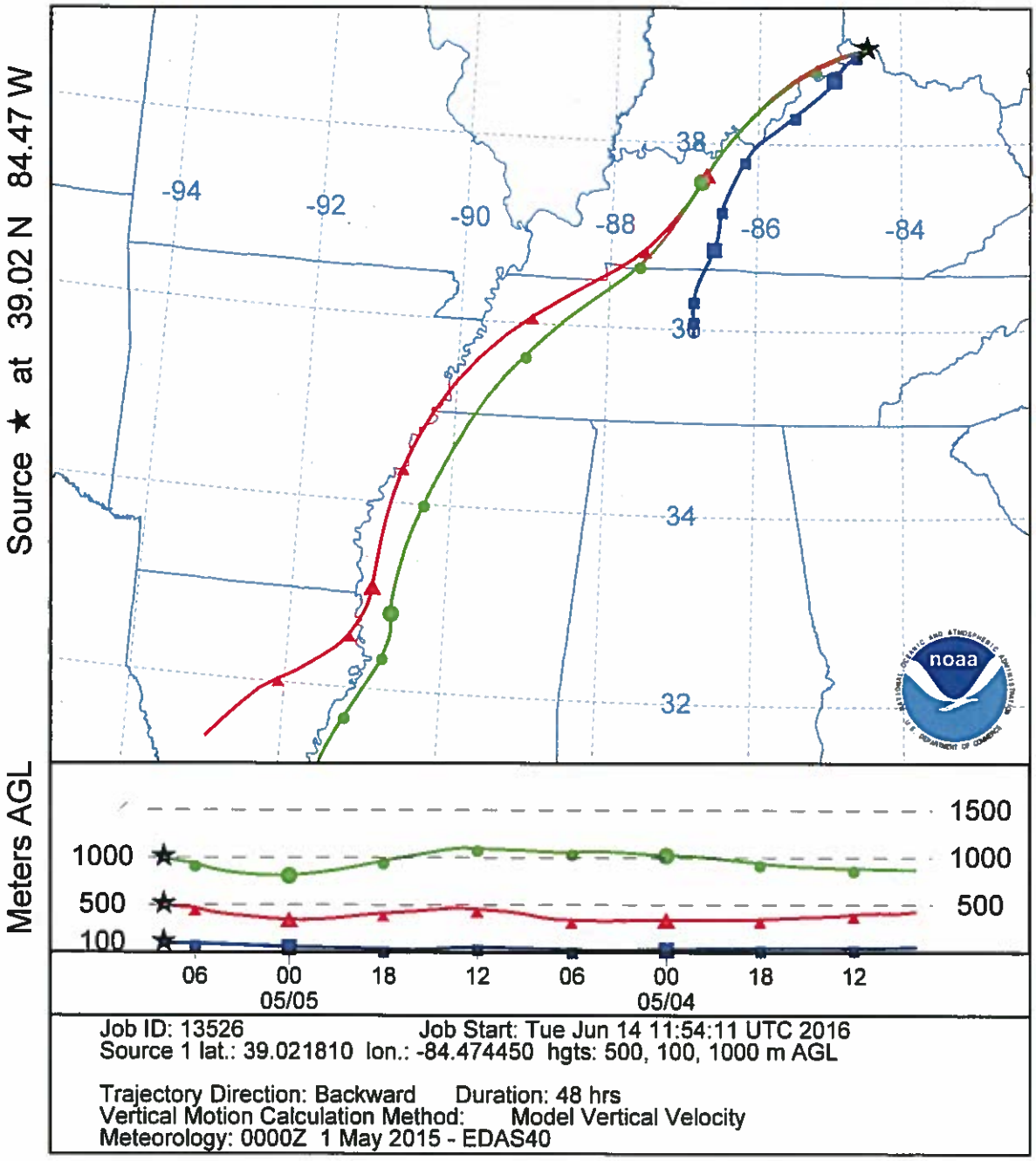
NOAA HYSPLIT MODEL
Backward trajectories ending at 0800 UTC 19 Aug 13
EDAS Meteorological Data



Highland Heights (Campbell County) Ozone Monitor (AQS: 21-037-3002)
2015 8-Hour Average Top Four Maximum Values

Date	Start Hour (EST)	8-Hour Reading (PPM)	
05/06/2015	13	.079	
07/25/2015	11	.078	
06/10/2015	12	.077	
05/05/2015	12	.071	(4^{th} Max)

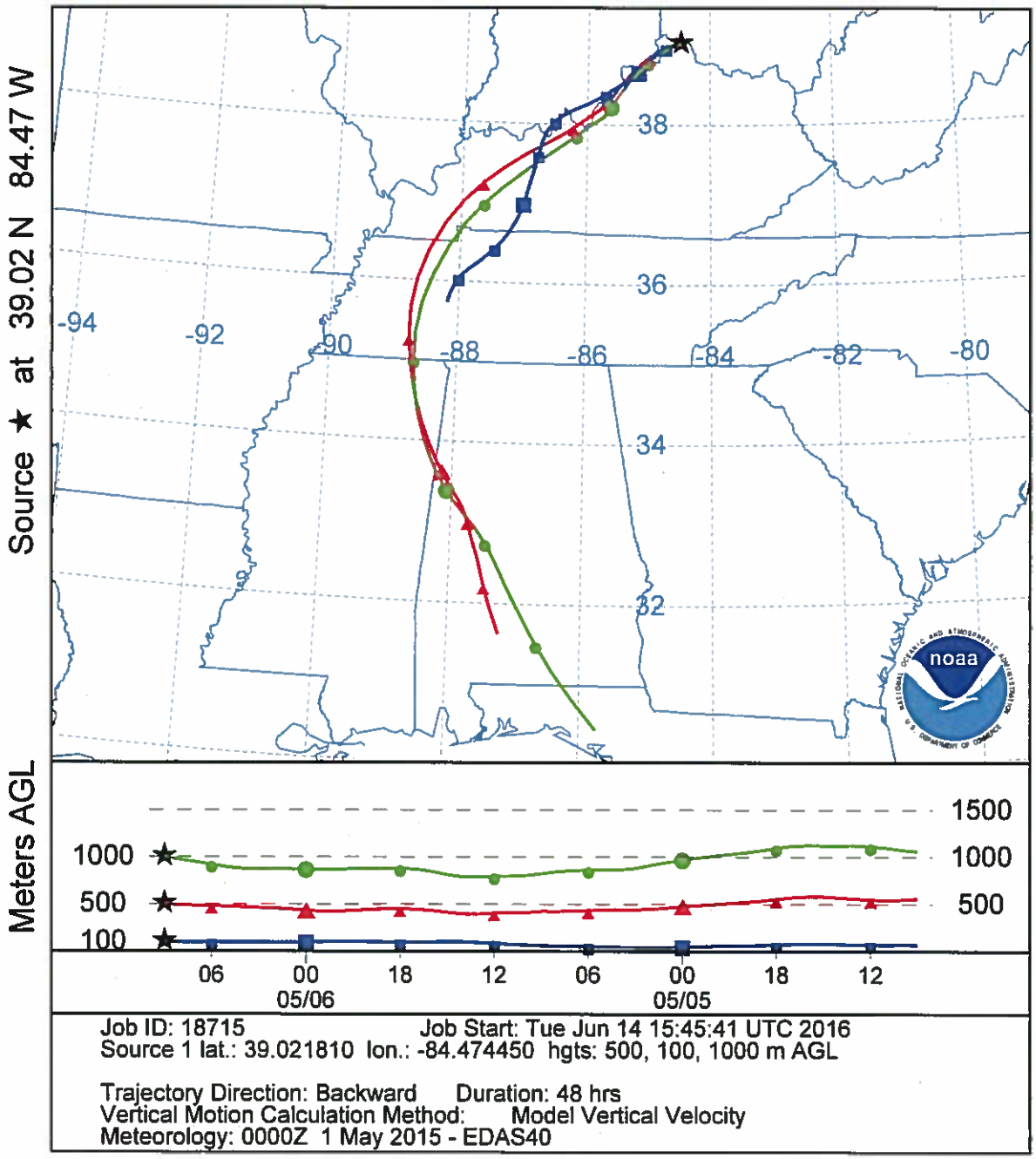
NOAA HYSPLIT MODEL
Backward trajectories ending at 0800 UTC 05 May 15
EDAS Meteorological Data



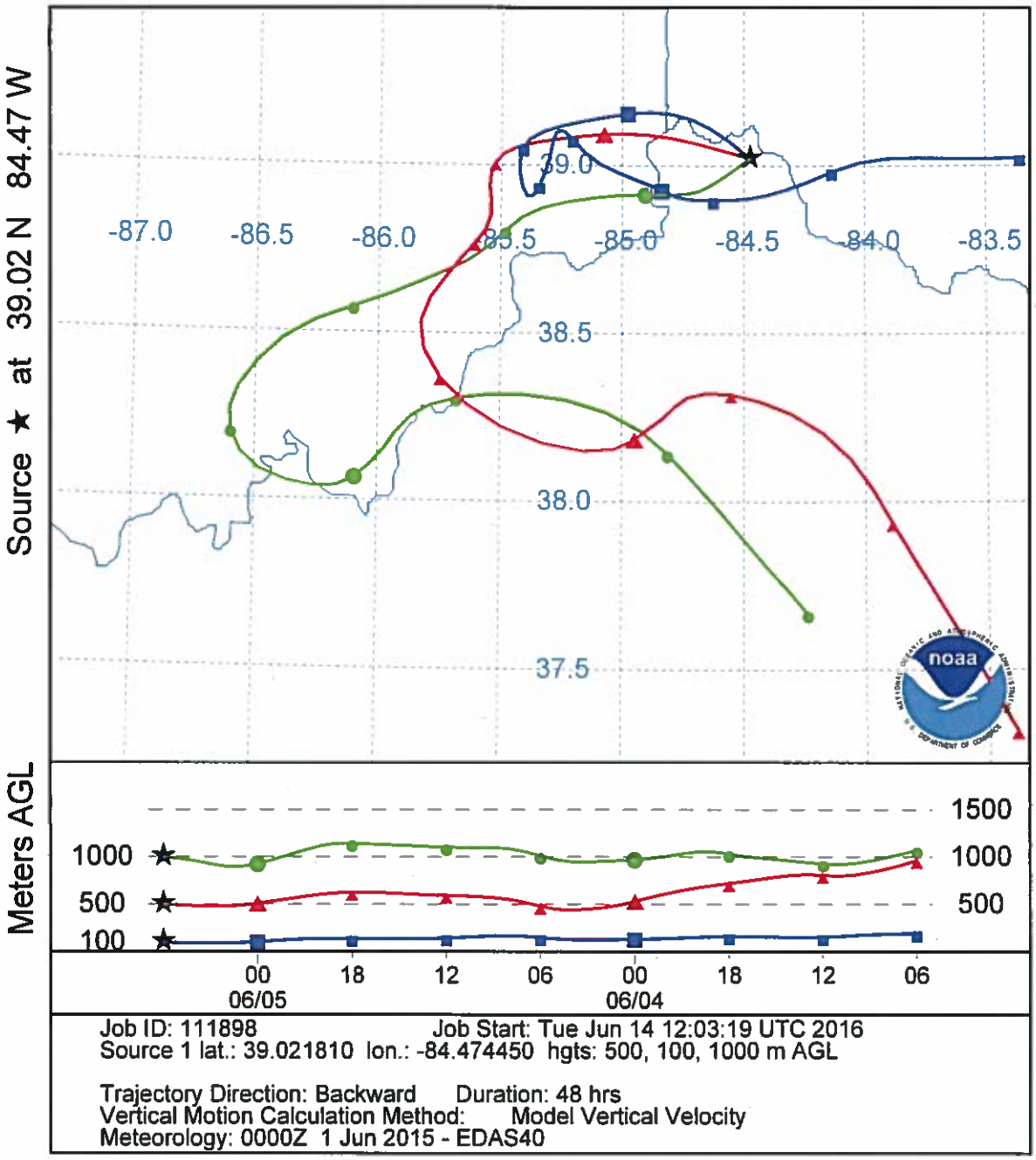
NOAA HYSPLIT MODEL

Backward trajectories ending at 0900 UTC 06 May 15

EDAS Meteorological Data



NOAA HYSPLIT MODEL
Backward trajectories ending at 0600 UTC 05 Jun 15
EDAS Meteorological Data



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Trajectory Direction: Backward Duration: 48 hrs
Vertical Motion Calculation Method: Model Vertical Velocity
Meteorology: 0000Z 1 Jun 2015 - EDAS40

NOAA HYSPLIT MODEL
Backward trajectories ending at 0800 UTC 10 Jun 15
EDAS Meteorological Data