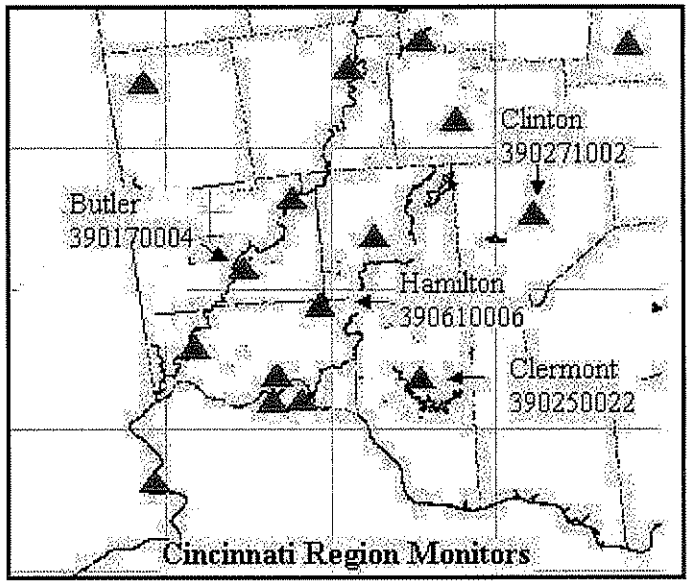
APCA Preliminary Results

- APCA stands for Anthropogenic Precursor Culpability Assessment. It is an Ozone Source Apportionment technique used in Comprehensive Air quality Model with extensions (CAMx).
- The main objective of this study is to identify source regions and emission categories that contribute significantly to Ohio's non-attainment regions.
- APCA recognizes that certain emission groups are not controllable (e.g. biogenic emissions) and that apportioning ozone production to these groups does not provide information that is relevant to control strategies.
- Model Grid was divided into 13 source regions to study the effect of each region on the Monitors near Columbus.
- 8 Emission Categories were used.
- APCA output is in the form of receptor files that contain ozone concentration for each hour of the day for each modeled day.
- A post processor was used to summarize the data. The post processor only processed days that had ozone concentration above 70 ppb (user defined value)

Monitors of Interest:

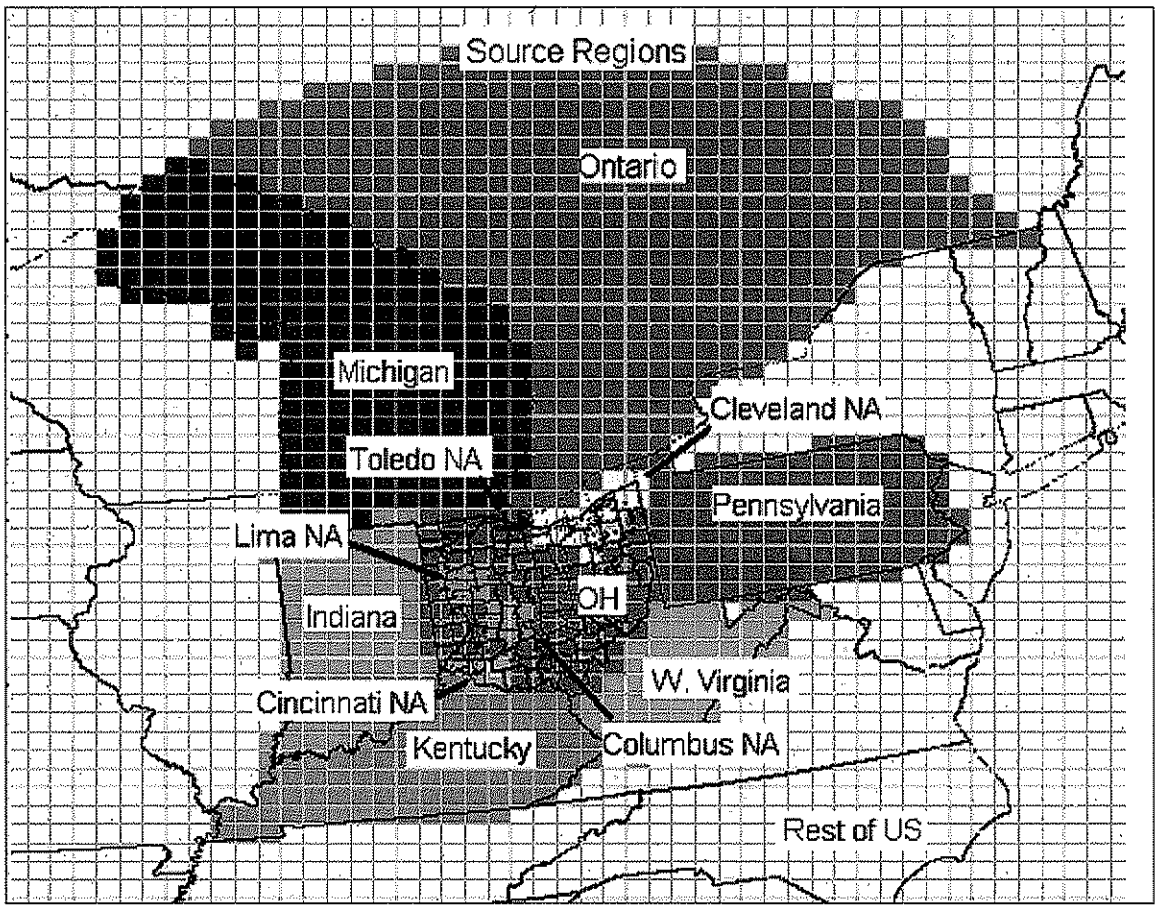


Emission Categories

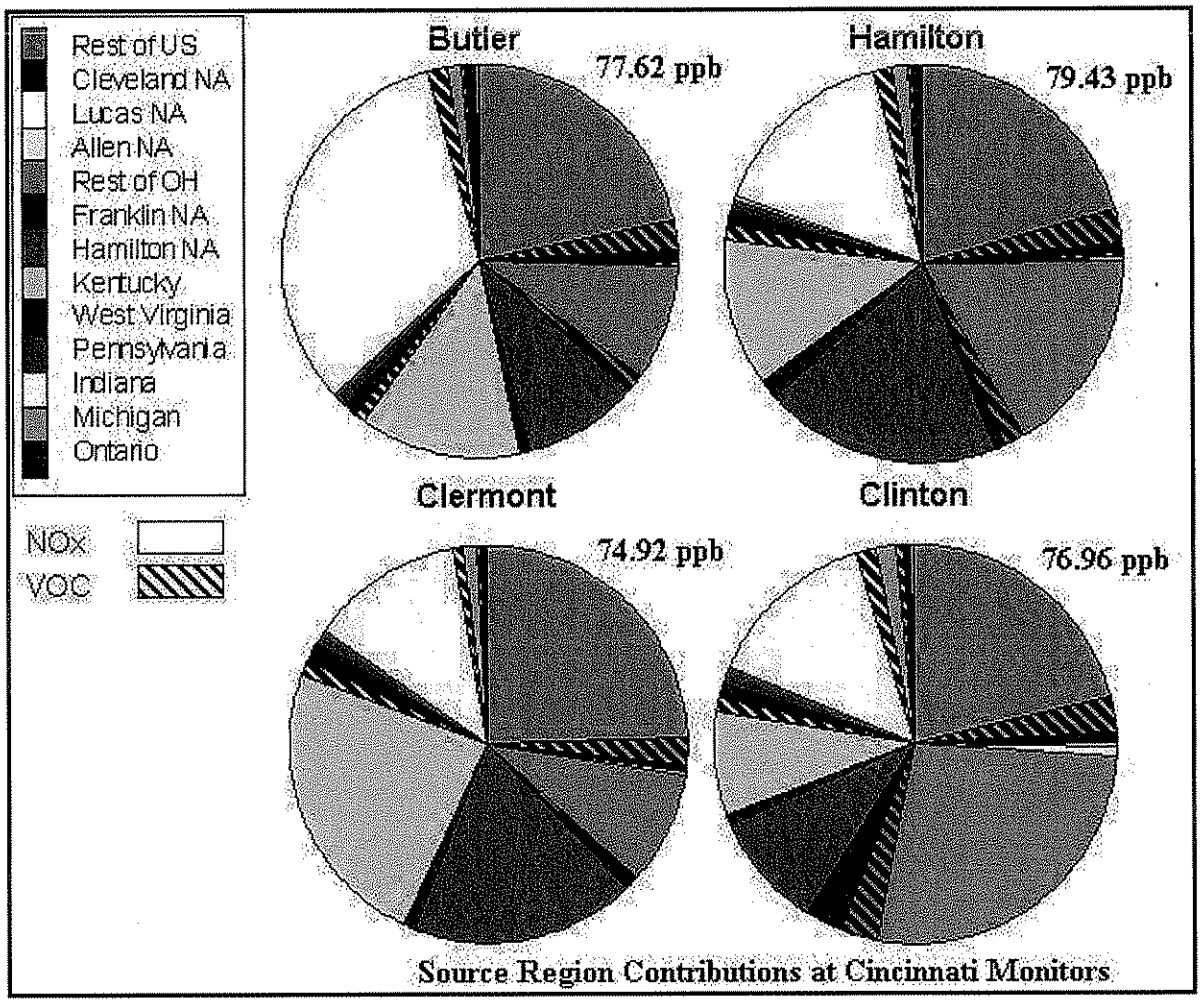
Emission Group 1: Biogenic
Emission Group 2: Ammonia
Emission Group 3: Elevated Point Source
Emission Group 4: Off-Road Area Source
Emission Group 5: Other Area Source
Emission Group 6: Low Point (Non-EGU)
Emission Group 7: Low Point (EGU)
Emission Group 8: Motor Vehicles

Source Regions

Region 1:	Rest of US
Region 2:	Cleveland Region
Region 3:	Lucas County Region
Region 4:	Allen County Region
Region 5:	Rest of OH
Region 6:	Columbus Region
Region 7:	Cincinnati Region
Region 8:	Kentucky
Region 9:	West Virginia
Region 10:	Pennsylvania
Region 11:	Indiana
Region 12:	Michigan
Region 13:	Ontario Region



OSAT Results: Source Region Contributions



Emission Category Contribution

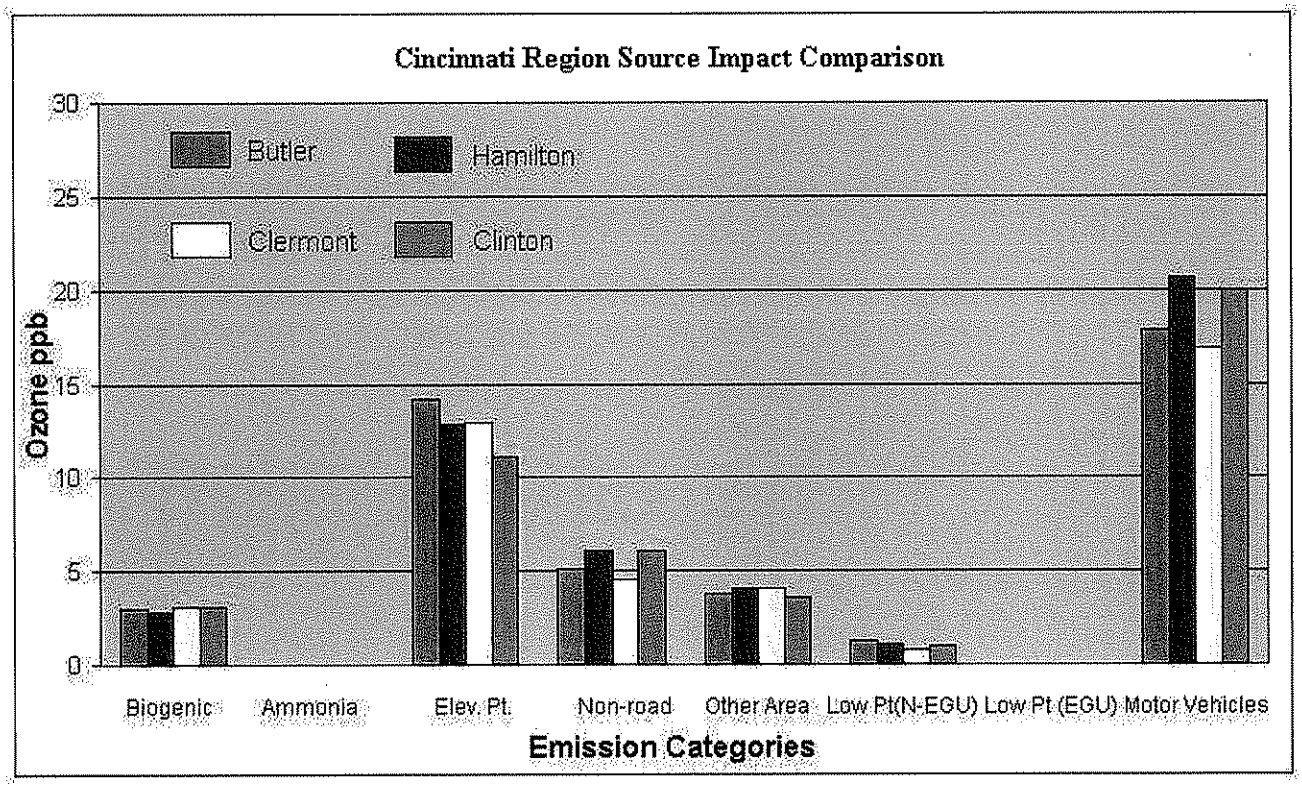


Table 14: Butler Monitor

Days above 70 ppb: 43

CAMx (ppb) & Emissions Groups	Rest of US		Cleveland Region		Lucas Region		Allen Region		Rest of OH		Columbus Region		Cincinnati Region	
	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)
77.62 ppb	14.11%		0.45%		0.13%		0.14%		6.17%		0.26%		6.03%	
Biogenic	1.03%	0.52%	0.00%	0.01%	0.00%	0.00%	0.01%	0.00%	0.29%	0.16%	0.01%	0.00%	0.03%	0.04%
Ammonia	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
El. Point Sources	3.32%	0.03%	0.06%	0.00%	0.03%	0.00%	0.04%	0.00%	1.33%	0.01%	0.00%	0.00%	1.23%	0.00%
Non-road	1.58%	0.21%	0.08%	0.04%	0.02%	0.01%	0.02%	0.00%	0.90%	0.11%	0.04%	0.01%	0.68%	0.12%
Other Area	0.78%	0.26%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.24%	0.08%	0.01%	0.01%	0.44%	0.09%
Low Pt (N-EGU)	0.45%	0.07%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.09%	0.01%	0.00%	0.00%	0.08%	0.01%
Low Pt (EGU)	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Motor Vehicles	5.48%	0.37%	0.18%	0.04%	0.05%	0.01%	0.05%	0.01%	2.74%	0.21%	0.15%	0.02%	3.07%	0.23%
Total	12.65%	1.46%	0.33%	0.10%	0.10%	0.02%	0.12%	0.01%	5.59%	0.58%	0.21%	0.04%	5.53%	0.49%

Kentucky		West Virginia		Pennsylvania		Indiana		Michigan		Ontario		
NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	IC + BC %
8.22%		0.61%		0.64%		20.01%		0.88%		0.58%		41.77%
0.32%	0.22%	0.01%	0.02%	0.01%	0.01%	0.66%	0.37%	0.02%	0.02%	0.01%	0.01%	
0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
1.87%	0.01%	0.23%	0.00%	0.21%	0.00%	9.66%	0.02%	0.16%	0.01%	0.07%	0.02%	
0.64%	0.07%	0.04%	0.01%	0.06%	0.02%	1.57%	0.14%	0.10%	0.05%	0.00%	0.00%	
1.54%	0.10%	0.03%	0.01%	0.02%	0.03%	0.57%	0.13%	0.04%	0.03%	0.31%	0.12%	
0.01%	0.05%	0.01%	0.00%	0.01%	0.00%	0.66%	0.07%	0.03%	0.01%	0.01%	0.02%	
0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
3.25%	0.15%	0.23%	0.01%	0.24%	0.03%	5.87%	0.30%	0.35%	0.06%	0.00%	0.00%	
7.64%	0.60%	0.55%	0.05%	0.55%	0.09%	18.99%	1.03%	0.70%	0.18%	0.40%	0.17%	

Table 15: Hamilton Monitor

Days above 70 ppb: 45

CAMx (ppb) & Emissions Groups	Rest of US		Cleveland Region		Lucas Region		Allen Region		Rest of OH		Columbus Region		Cincinnati Region	
	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)
79.43 ppb	14.00%		0.43%		0.17%		0.22%		11.18%		0.46%		12.40%	
Biogenic	1.01%	0.53%	0.00%	0.00%	0.01%	0.00%	0.01%	0.01%	0.29%	0.24%	0.02%	0.01%	0.09%	0.10%
Ammonia	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
El. Point Sources	3.19%	0.03%	0.06%	0.00%	0.04%	0.00%	0.05%	0.00%	2.22%	0.01%	0.01%	0.00%	3.05%	0.00%
Non-road	1.54%	0.25%	0.08%	0.04%	0.02%	0.01%	0.03%	0.01%	1.74%	0.21%	0.08%	0.01%	1.40%	0.24%
Other Area	0.76%	0.31%	0.01%	0.01%	0.00%	0.00%	0.01%	0.00%	0.42%	0.15%	0.02%	0.01%	0.78%	0.17%
Low Pt (N-EGU)	0.43%	0.08%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.22%	0.02%	0.00%	0.00%	0.12%	0.01%
Low Pt (EGU)	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Motor Vehicles	5.41%	0.44%	0.17%	0.04%	0.06%	0.01%	0.08%	0.01%	5.25%	0.42%	0.26%	0.04%	5.99%	0.45%
Total	12.35%	1.64%	0.32%	0.09%	0.13%	0.02%	0.18%	0.03%	10.14%	1.05%	0.39%	0.07%	11.43%	0.97%

Kentucky		West Virginia		Pennsylvania		Indiana		Michigan		Ontario		
NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	IC + BC %
7.97%		0.74%		0.64%		10.18%		1.00%		0.46%		40.15%
0.33%	0.24%	0.02%	0.02%	0.01%	0.01%	0.30%	0.23%	0.03%	0.03%	0.01%	0.01%	
0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
1.75%	0.01%	0.27%	0.00%	0.21%	0.00%	4.97%	0.02%	0.19%	0.01%	0.06%	0.01%	
0.62%	0.08%	0.05%	0.01%	0.06%	0.02%	0.77%	0.13%	0.11%	0.06%	0.00%	0.00%	
1.38%	0.13%	0.03%	0.01%	0.02%	0.03%	0.31%	0.13%	0.04%	0.03%	0.25%	0.10%	
0.01%	0.06%	0.01%	0.00%	0.01%	0.00%	0.24%	0.05%	0.03%	0.01%	0.01%	0.02%	
0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
3.18%	0.18%	0.28%	0.02%	0.24%	0.03%	2.77%	0.27%	0.40%	0.07%	0.00%	0.00%	
7.27%	0.70%	0.66%	0.06%	0.55%	0.09%	9.36%	0.83%	0.80%	0.21%	0.33%	0.14%	

Table 16: Clermont Monitor

Days above 70 ppb: 29

CAMx (ppb) & Emissions Groups	Rest of US		Cleveland Region		Lucas Region		Allen Region		Rest of OH		Columbus Region		Cincinnati Region	
	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)
74.92 ppb	14.97%		0.32%		0.13%		0.13%		5.50%		0.32%		10.66%	
Biogenic	1.01%	0.48%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%	0.24%	0.09%	0.02%	0.00%	0.47%	0.08%
Ammonia	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
El. Point Sources	3.46%	0.02%	0.05%	0.00%	0.03%	0.00%	0.03%	0.00%	2.02%	0.00%	0.00%	0.00%	3.86%	0.00%
Non-road	1.62%	0.17%	0.06%	0.03%	0.02%	0.01%	0.02%	0.00%	0.60%	0.06%	0.06%	0.01%	1.28%	0.07%
Other Area	0.79%	0.21%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.22%	0.04%	0.01%	0.01%	0.73%	0.05%
Low Pt (N-EGU)	0.44%	0.06%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.16%	0.01%	0.00%	0.00%	0.04%	0.00%
Low Pt (EGU)	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Motor Vehicles	6.40%	0.31%	0.13%	0.02%	0.05%	0.01%	0.05%	0.00%	1.95%	0.11%	0.20%	0.02%	3.94%	0.14%
Total	13.73%	1.25%	0.25%	0.06%	0.10%	0.02%	0.11%	0.00%	5.19%	0.31%	0.29%	0.04%	10.32%	0.34%

Kentucky		West Virginia		Pennsylvania		Indiana		Michigan		Ontario		
NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	IC + BC %
14.25%		0.90%		0.63%		7.53%		0.77%		0.31%		43.58%
0.88%	0.34%	0.02%	0.01%	0.01%	0.00%	0.23%	0.15%	0.02%	0.02%	0.01%	0.01%	
0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
2.89%	0.01%	0.34%	0.00%	0.21%	0.00%	4.06%	0.01%	0.15%	0.00%	0.04%	0.01%	
1.17%	0.06%	0.07%	0.00%	0.06%	0.01%	0.51%	0.07%	0.09%	0.04%	0.00%	0.00%	
2.45%	0.10%	0.04%	0.01%	0.02%	0.02%	0.24%	0.07%	0.04%	0.02%	0.18%	0.06%	
0.02%	0.05%	0.01%	0.00%	0.01%	0.00%	0.16%	0.03%	0.03%	0.00%	0.00%	0.01%	
0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
6.12%	0.15%	0.37%	0.01%	0.25%	0.02%	1.84%	0.15%	0.31%	0.05%	0.00%	0.00%	
13.53%	0.71%	0.85%	0.03%	0.56%	0.05%	7.04%	0.48%	0.64%	0.13%	0.23%	0.09%	

Table 17: Clinton Monitor

Days above 70 ppb: 38

CAMx (ppb) & Emissions Groups	Rest of US		Cleveland Region		Lucas Region		Allen Region		Rest of OH		Columbus Region		Cincinnati Region	
	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)
76.96 ppb	**13.96%**		**0.52%**		**0.24%**		**0.43%**		**17.43%**		**1.78%**		**5.69%**	
Biogenic	1.04%	0.55%	0.01%	0.01%	0.01%	0.00%	0.03%	0.01%	0.42%	0.36%	0.13%	0.03%	0.06%	0.06%
Ammonia	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
El. Point Sources	3.19%	0.03%	0.07%	0.00%	0.06%	0.00%	0.08%	0.00%	3.09%	0.01%	0.02%	0.00%	1.76%	0.00%
Non-road	1.54%	0.25%	0.10%	0.05%	0.03%	0.01%	0.07%	0.01%	2.64%	0.35%	0.38%	0.03%	0.57%	0.10%
Other Area	0.74%	0.30%	0.01%	0.02%	0.00%	0.01%	0.01%	0.01%	0.67%	0.25%	0.07%	0.03%	0.35%	0.08%
Low Pt (N-EGU)	0.43%	0.08%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%	0.23%	0.03%	0.00%	0.00%	0.05%	0.01%
Low Pt (EGU)	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Motor Vehicles	5.37%	0.43%	0.21%	0.04%	0.09%	0.01%	0.18%	0.02%	8.66%	0.73%	1.02%	0.08%	2.46%	0.19%
Total	**12.32%**	**1.64%**	**0.40%**	**0.12%**	**0.19%**	**0.03%**	**0.38%**	**0.05%**	**15.71%**	**1.73%**	**1.62%**	**0.17%**	**5.25%**	**0.44%**

Kentucky		West Virginia		Pennsylvania		Indiana		Michigan		Ontario		
NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	IC + BC %
5.65%		**0.77%**		**0.79%**		**8.90%**		**1.30%**		**0.56%**		**41.98%**
0.26%	0.22%	0.02%	0.03%	0.01%	0.01%	0.31%	0.26%	0.04%	0.04%	0.02%	0.01%	
0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
1.32%	0.01%	0.28%	0.00%	0.25%	0.00%	3.79%	0.02%	0.24%	0.01%	0.07%	0.01%	
0.43%	0.07%	0.06%	0.01%	0.07%	0.03%	0.76%	0.14%	0.14%	0.07%	0.00%	0.00%	
0.95%	0.10%	0.04%	0.01%	0.02%	0.04%	0.31%	0.14%	0.06%	0.04%	0.30%	0.11%	
0.01%	0.04%	0.01%	0.00%	0.01%	0.00%	0.16%	0.05%	0.04%	0.01%	0.01%	0.02%	
0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
2.09%	0.14%	0.30%	0.02%	0.30%	0.04%	2.69%	0.27%	0.52%	0.09%	0.00%	0.00%	
5.06%	**0.58%**	**0.71%**	**0.07%**	**0.66%**	**0.12%**	**8.02%**	**0.88%**	**1.04%**	**0.26%**	**0.40%**	**0.15%**	