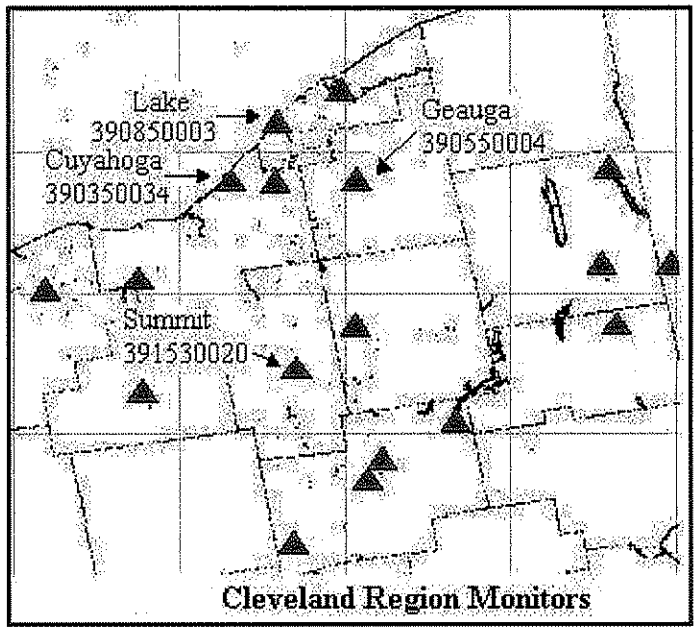
OSAT Preliminary Results

- 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: Cuyahoga, Geauga, Lake and Summit

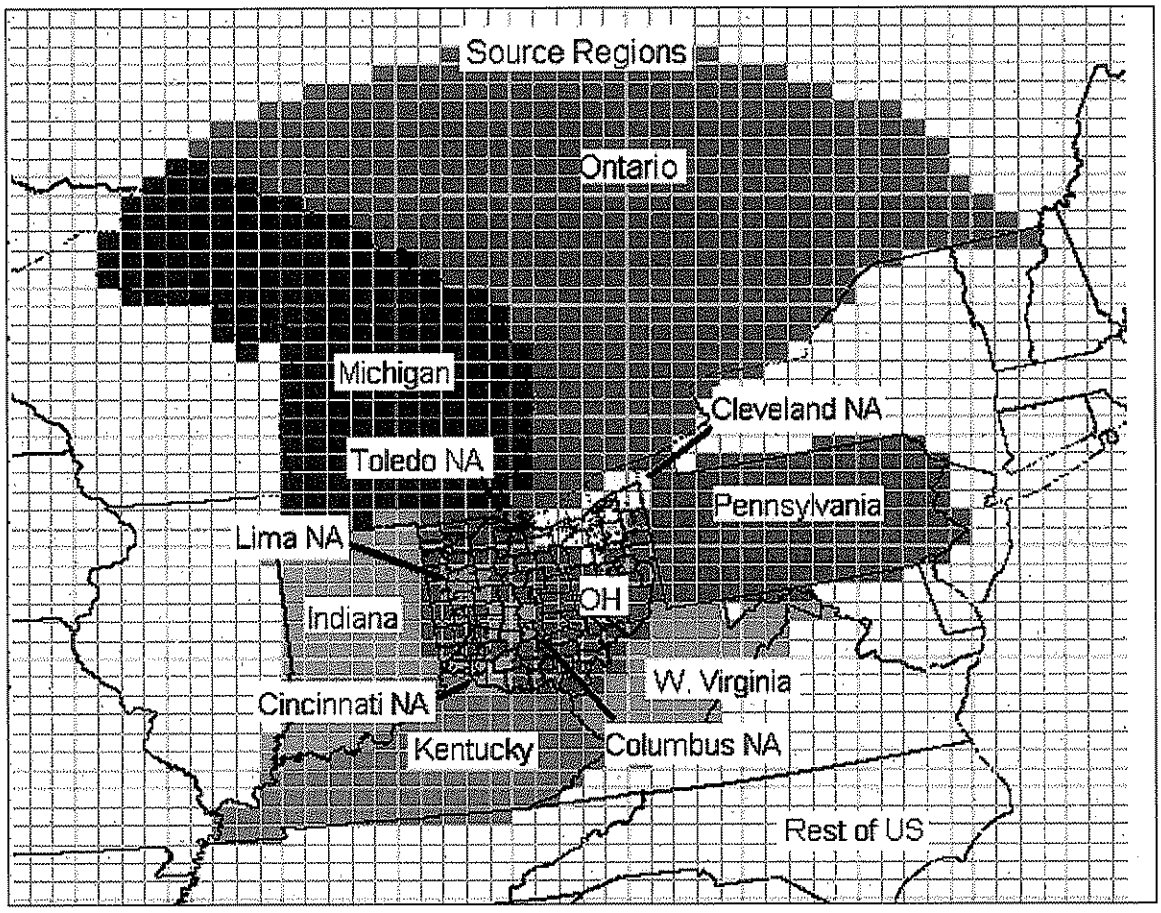


Emission Categories

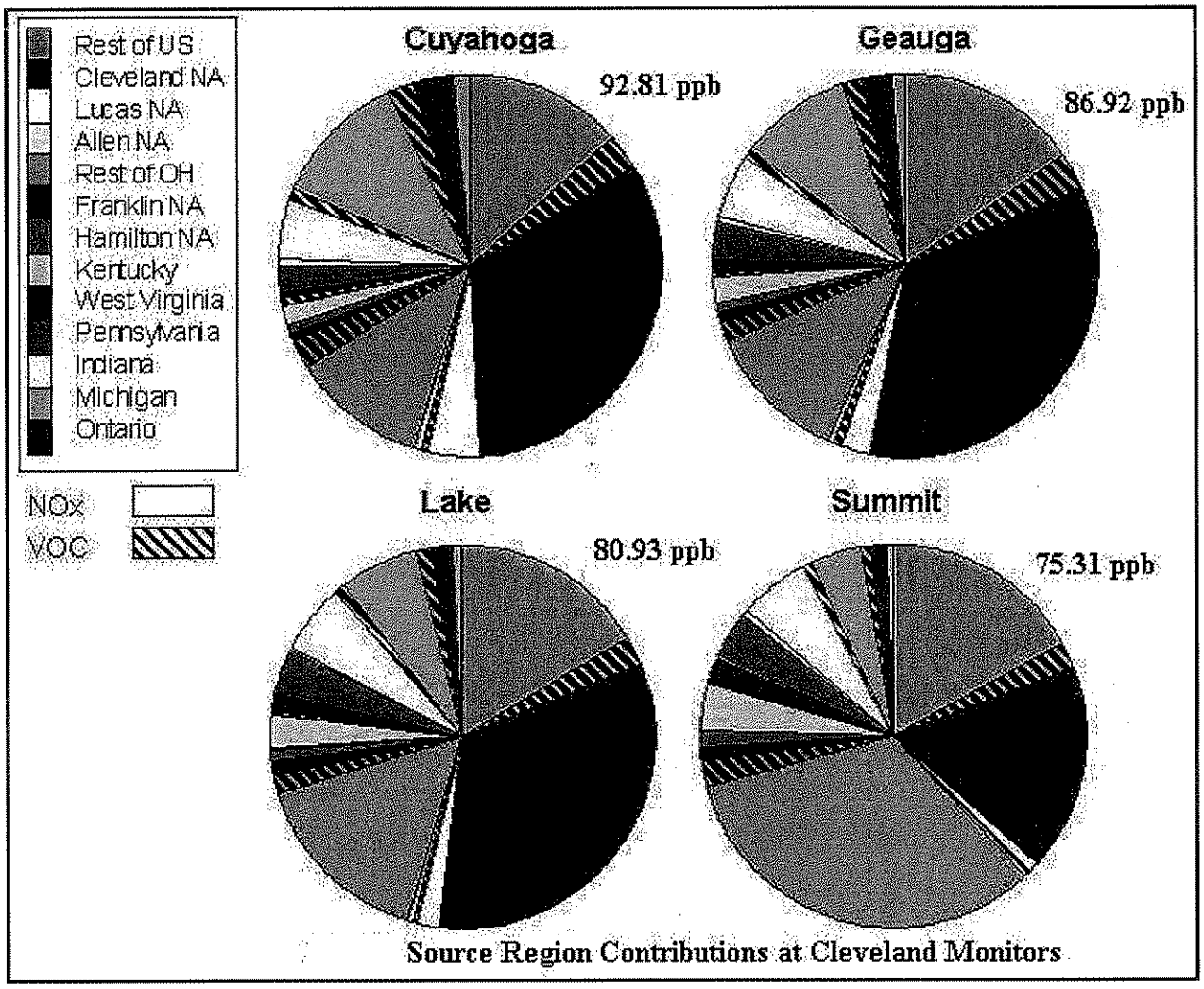
Emission Group 1: Biogenic
Emission Group 2: Ammonia
Emission Group 3: Elevated Point Source
Emission Group 4: Off-Road Area Source
Emission Group 5: Other Area Source
Emission Group 6: Low Point (Non-EGU)
Emission Group 7: Low Point (EGU)
Emission Group 8: Motor Vehicles

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:	Franklin County Region
Region 7:	Hamilton County 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

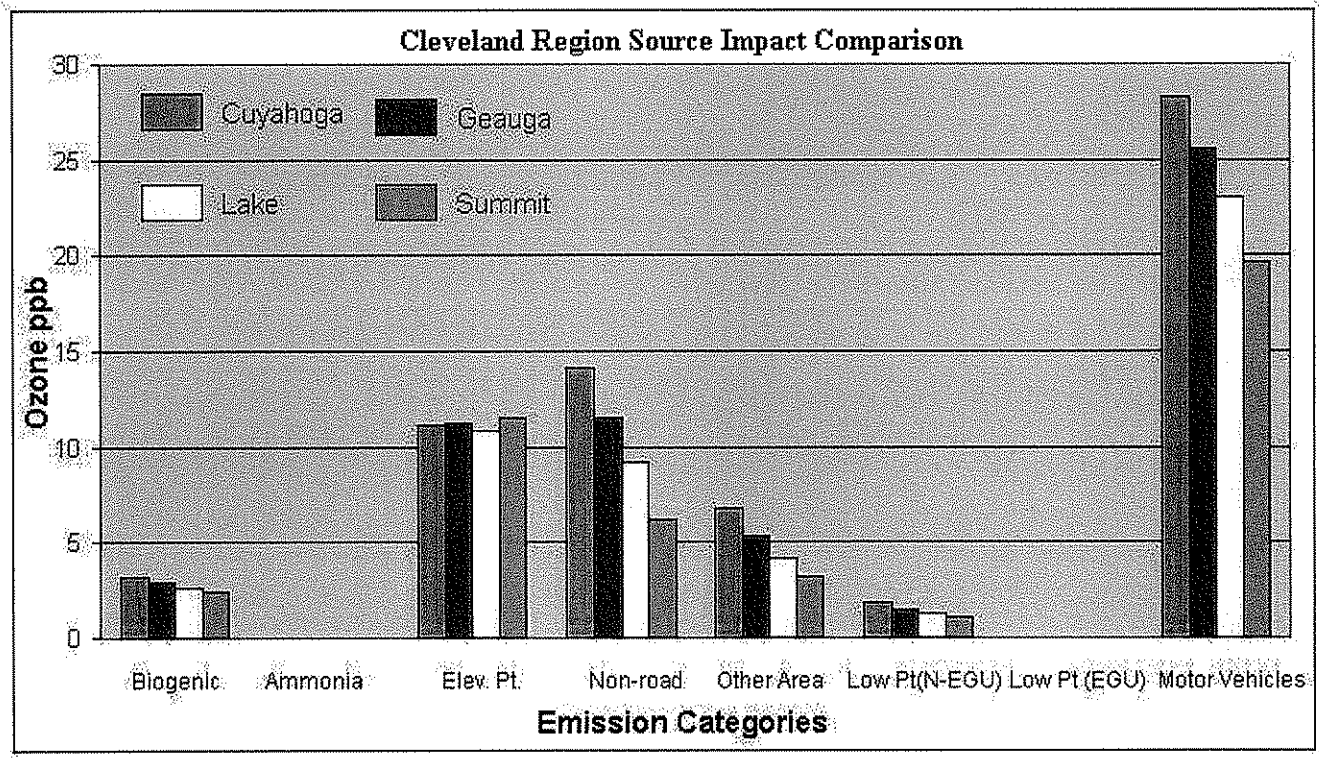


Table 6: Cuyahoga Monitor

Days above 70 ppb: 56

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 (%)
92.81 ppb	11.52%		23.11%		3.49%		0.41%		9.60%		0.59%		0.52%	
Biogenic	0.80%	0.53%	0.09%	0.20%	0.04%	0.05%	0.02%	0.01%	0.27%	0.29%	0.01%	0.01%	0.01%	0.01%
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	2.45%	0.04%	1.70%	0.03%	0.91%	0.01%	0.12%	0.00%	1.88%	0.02%	0.01%	0.00%	0.18%	0.00%
Non-road	1.30%	0.38%	5.51%	2.44%	0.53%	0.17%	0.06%	0.02%	1.64%	0.51%	0.09%	0.02%	0.04%	0.02%
Other Area	0.61%	0.45%	0.67%	0.50%	0.06%	0.07%	0.01%	0.01%	0.29%	0.20%	0.02%	0.02%	0.03%	0.02%
Low Pt (N-EGU)	0.38%	0.11%	0.14%	0.05%	0.06%	0.01%	0.00%	0.01%	0.37%	0.04%	0.00%	0.00%	0.00%	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	3.86%	0.60%	10.28%	1.50%	1.37%	0.21%	0.13%	0.02%	3.57%	0.53%	0.33%	0.06%	0.17%	0.04%
Total	9.41%	2.11%	18.39%	4.72%	2.97%	0.52%	0.34%	0.07%	8.02%	1.59%	0.46%	0.11%	0.43%	0.09%

Kentucky		West Virginia		Pennsylvania		Indiana		Michigan		Ontario		
NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	IC + BC %
1.46%		0.56%		1.92%		4.28%		9.57%		3.31%		29.66%
0.07%	0.08%	0.01%	0.02%	0.02%	0.03%	0.16%	0.17%	0.13%	0.17%	0.15%	0.08%	
0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
0.34%	0.00%	0.21%	0.00%	0.56%	0.00%	1.22%	0.02%	1.86%	0.07%	0.27%	0.06%	
0.11%	0.03%	0.03%	0.01%	0.19%	0.09%	0.47%	0.16%	0.97%	0.39%	0.00%	0.00%	
0.21%	0.04%	0.03%	0.02%	0.05%	0.13%	0.18%	0.15%	0.72%	0.31%	1.88%	0.60%	
0.00%	0.02%	0.01%	0.00%	0.03%	0.01%	0.04%	0.05%	0.30%	0.06%	0.04%	0.22%	
0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
0.50%	0.06%	0.19%	0.02%	0.69%	0.12%	1.39%	0.27%	3.95%	0.63%	0.00%	0.00%	
1.23%	0.23%	0.48%	0.07%	1.54%	0.38%	3.46%	0.82%	7.93%	1.63%	2.34%	0.96%	

Table 7: Geauga Monitor

Days above 70 ppb: 52

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 (%)
86.92 ppb	**12.18%**		**23.15%**		**2.09%**		**0.34%**		**9.20%**		**0.54%**		**0.57%**	
Biogenic	0.90%	0.52%	0.11%	0.17%	0.03%	0.03%	0.02%	0.01%	0.26%	0.23%	0.01%	0.01%	0.01%	0.01%
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	2.71%	0.04%	2.14%	0.02%	0.62%	0.01%	0.10%	0.00%	2.34%	0.02%	0.01%	0.00%	0.20%	0.00%
Non-road	1.38%	0.33%	5.20%	2.03%	0.29%	0.09%	0.05%	0.01%	1.29%	0.32%	0.08%	0.02%	0.05%	0.02%
Other Area	0.65%	0.40%	0.75%	0.43%	0.03%	0.04%	0.01%	0.01%	0.29%	0.17%	0.02%	0.02%	0.03%	0.02%
Low Pt (N-EGU)	0.42%	0.10%	0.15%	0.04%	0.03%	0.00%	0.00%	0.00%	0.28%	0.03%	0.00%	0.00%	0.00%	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	4.18%	0.54%	10.81%	1.31%	0.79%	0.12%	0.11%	0.02%	3.53%	0.43%	0.31%	0.05%	0.19%	0.04%
Total	**10.25%**	**1.93%**	**19.16%**	**4.00%**	**1.79%**	**0.29%**	**0.29%**	**0.05%**	**7.99%**	**1.20%**	**0.43%**	**0.10%**	**0.48%**	**0.09%**

Kentucky		West Virginia		Pennsylvania		Indiana		Michigan		Ontario		
NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	IC + BC %
1.70%		**0.71%**		**2.30%**		**4.21%**		**7.37%**		**2.38%**		**33.26%**
0.09%	0.07%	0.02%	0.02%	0.03%	0.03%	0.16%	0.14%	0.12%	0.13%	0.11%	0.06%	
0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
0.40%	0.00%	0.27%	0.00%	0.72%	0.00%	1.27%	0.02%	1.63%	0.05%	0.25%	0.05%	
0.13%	0.03%	0.05%	0.01%	0.24%	0.08%	0.47%	0.14%	0.71%	0.28%	0.00%	0.00%	
0.25%	0.04%	0.04%	0.02%	0.06%	0.12%	0.18%	0.13%	0.52%	0.21%	1.30%	0.40%	
0.00%	0.02%	0.01%	0.00%	0.04%	0.01%	0.05%	0.04%	0.24%	0.05%	0.04%	0.17%	
0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
0.60%	0.06%	0.24%	0.02%	0.86%	0.10%	1.38%	0.24%	2.97%	0.46%	0.00%	0.00%	
1.47%	**0.22%**	**0.63%**	**0.07%**	**1.95%**	**0.34%**	**3.51%**	**0.71%**	**6.19%**	**1.18%**	**1.70%**	**0.68%**	

Table 8: Lake 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 (%)
80.93 ppb	**11.94%**		**20.79%**		**1.37%**		**0.32%**		**10.94%**		**0.60%**		**0.65%**	
Biogenic	0.87%	0.46%	0.14%	0.17%	0.02%	0.02%	0.02%	0.01%	0.31%	0.23%	0.02%	0.01%	0.01%	0.01%
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	2.70%	0.03%	2.10%	0.01%	0.45%	0.00%	0.09%	0.00%	3.10%	0.02%	0.01%	0.00%	0.24%	0.00%
Non-road	1.34%	0.28%	4.62%	1.08%	0.18%	0.05%	0.05%	0.01%	1.42%	0.24%	0.09%	0.02%	0.06%	0.02%
Other Area	0.64%	0.33%	0.74%	0.28%	0.02%	0.03%	0.01%	0.01%	0.36%	0.15%	0.03%	0.02%	0.04%	0.02%
Low Pt (N-EGU)	0.41%	0.09%	0.14%	0.02%	0.02%	0.00%	0.00%	0.00%	0.28%	0.03%	0.00%	0.00%	0.00%	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	4.32%	0.46%	10.60%	0.89%	0.49%	0.07%	0.11%	0.01%	4.42%	0.39%	0.36%	0.05%	0.22%	0.04%
Total	**10.29%**	**1.65%**	**18.34%**	**2.45%**	**1.18%**	**0.17%**	**0.28%**	**0.04%**	**9.89%**	**1.06%**	**0.51%**	**0.10%**	**0.57%**	**0.09%**

Kentucky		West Virginia		Pennsylvania		Indiana		Michigan		Ontario		
NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	IC + BC %
2.01%		**0.88%**		**2.64%**		**4.15%**		**5.07%**		**1.58%**		**37.06%**
0.11%	0.08%	0.02%	0.03%	0.03%	0.03%	0.17%	0.13%	0.09%	0.09%	0.07%	0.04%	
0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
0.49%	0.00%	0.35%	0.00%	0.89%	0.00%	1.33%	0.01%	1.26%	0.03%	0.19%	0.04%	
0.16%	0.03%	0.06%	0.01%	0.27%	0.07%	0.47%	0.11%	0.48%	0.19%	0.00%	0.00%	
0.30%	0.04%	0.05%	0.02%	0.07%	0.10%	0.17%	0.10%	0.33%	0.14%	0.85%	0.26%	
0.00%	0.02%	0.01%	0.00%	0.06%	0.01%	0.05%	0.03%	0.16%	0.03%	0.03%	0.11%	
0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
0.73%	0.06%	0.31%	0.02%	1.01%	0.09%	1.37%	0.19%	1.96%	0.30%	0.00%	0.00%	
1.79%	**0.23%**	**0.80%**	**0.08%**	**2.33%**	**0.30%**	**3.56%**	**0.57%**	**4.28%**	**0.78%**	**1.14%**	**0.45%**	

Table 9: Summit Monitor

Days above 70 ppb: 36

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 (%)
75.31 ppb	**11.25%**		**10.13%**		**0.64%**		**0.28%**		**20.38%**		**0.73%**		**0.85%**	
Biogenic	0.79%	0.38%	0.14%	0.11%	0.02%	0.01%	0.02%	0.01%	0.59%	0.35%	0.02%	0.01%	0.01%	0.01%
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	2.51%	0.03%	1.46%	0.00%	0.21%	0.00%	0.08%	0.00%	6.38%	0.02%	0.01%	0.00%	0.31%	0.00%
Non-road	1.27%	0.22%	1.73%	0.36%	0.08%	0.02%	0.05%	0.01%	2.50%	0.22%	0.12%	0.02%	0.08%	0.02%
Other Area	0.60%	0.27%	0.35%	0.12%	0.01%	0.01%	0.01%	0.00%	0.66%	0.15%	0.03%	0.01%	0.05%	0.02%
Low Pt (N-EGU)	0.35%	0.07%	0.07%	0.01%	0.01%	0.00%	0.00%	0.00%	0.46%	0.03%	0.00%	0.00%	0.01%	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	4.38%	0.38%	5.34%	0.43%	0.24%	0.04%	0.10%	0.01%	8.61%	0.42%	0.45%	0.05%	0.30%	0.04%
Total	**9.91%**	**1.35%**	**9.09%**	**1.03%**	**0.57%**	**0.08%**	**0.26%**	**0.03%**	**19.20%**	**1.19%**	**0.63%**	**0.09%**	**0.76%**	**0.09%**

Kentucky		West Virginia		Pennsylvania		Indiana		Michigan		Ontario		
NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	NOx (%)	VOC (%)	IC + BC %
2.36%		**1.35%**		**2.61%**		**3.88%**		**2.89%**		**1.15%**		**41.50%**
0.12%	0.06%	0.03%	0.04%	0.03%	0.03%	0.16%	0.12%	0.07%	0.06%	0.05%	0.03%	
0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
0.60%	0.00%	0.55%	0.00%	0.94%	0.00%	1.30%	0.01%	0.67%	0.02%	0.16%	0.03%	
0.18%	0.02%	0.09%	0.01%	0.26%	0.06%	0.44%	0.09%	0.29%	0.12%	0.00%	0.00%	
0.35%	0.04%	0.08%	0.02%	0.07%	0.10%	0.15%	0.08%	0.16%	0.08%	0.63%	0.18%	
0.00%	0.01%	0.02%	0.00%	0.05%	0.01%	0.05%	0.03%	0.09%	0.02%	0.02%	0.06%	
0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
0.90%	0.05%	0.48%	0.02%	0.99%	0.09%	1.29%	0.16%	1.14%	0.17%	0.00%	0.00%	
2.15%	**0.18%**	**1.25%**	**0.09%**	**2.34%**	**0.29%**	**3.39%**	**0.49%**	**2.42%**	**0.47%**	**0.86%**	**0.30%**	