Using EPA's Designations Guidance, Data Sets, and the PM Designations Mapping Tool to Support Initial Area Designation Decisions: A Sample Application

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August 21, 2013

THE DATA DISPLAYED IN THIS PRESENTATION IS FOR ILLUSTRATIVE PURPOSES ONLY

ANTICIPATED TIMELINE FOR 2012 ANNUAL $PM_{2.5}$ NAAQS DESIGNATION PROCESS	
Milestone	**Date**
The EPA promulgates 2012 $PM_{2.5}$ NAAQS rule	December 14, 2012
Issue Designations Guidance	April 16, 2013
States and tribes submit recommendations for $PM_{2.5}$ designations to the EPA	No later than December 13, 2013
The EPA notifies states and tribes concerning any intended modifications to their recommendations (120-day letters)	No later than August 14, 2014 (120 days prior to final $PM_{2.5}$ area designations)
The EPA publishes public notice of state recommendations and the EPA's intended modifications, if any, and initiates 30-day public comment period	No later than August 29, 2014
End of 30-day public comment period	No later than September 29, 2014
States and tribes submit additional information, if any, to respond to the EPA's modification of a recommended designation	No later than October 29, 2014
The EPA promulgates final $PM_{2.5}$ area designations	No later than December 12, 2014

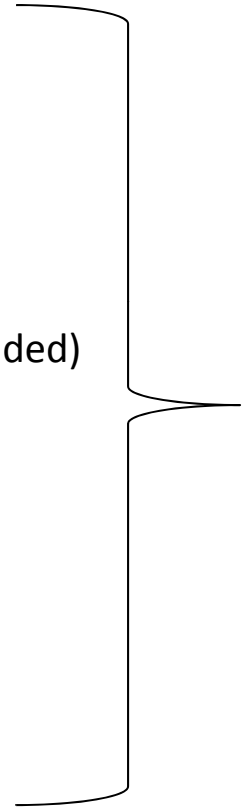
Purpose of Examples

- Illustrate applying 5-factor analysis according to 04/16/13 EPA PM2.5 Designations guidance

- Demonstrate the application of EPA's *PM2.5 Designations Mapping Tool*

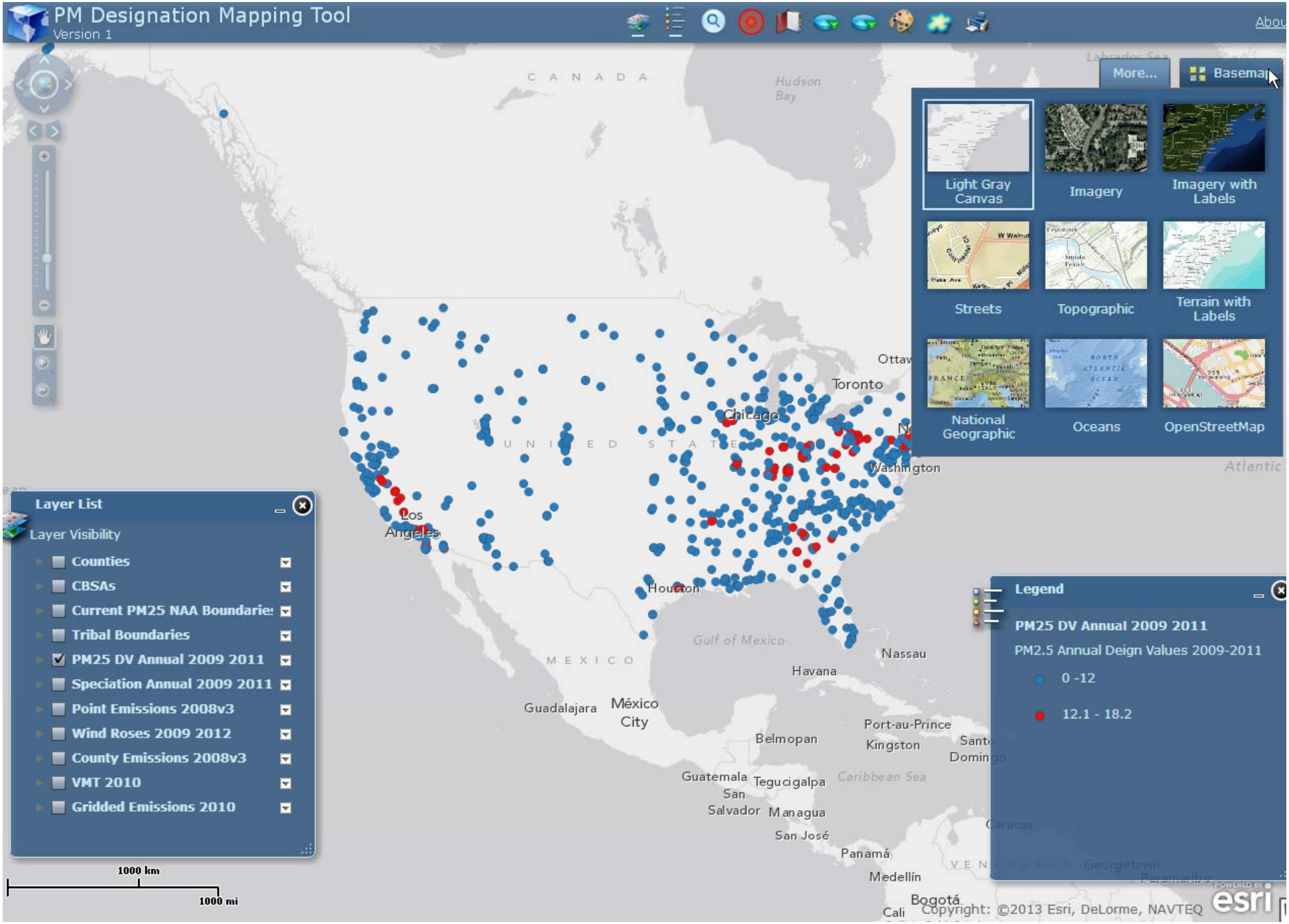
The Five Factors

- Factor 1: Air quality data
  - Design values
  - PM2.5 compositional analysis
  - Urban increment
- Factor 2: Emissions and Emissions-related data
  - PM2.5 and precursor emissions (county and gridded)
  - VMT
  - Population
- Factor 3: Meteorology
  - Windrose
  - HYSPLIT
- Factor 4: Geography/topography
- Factor 5: Jurisdictional boundaries

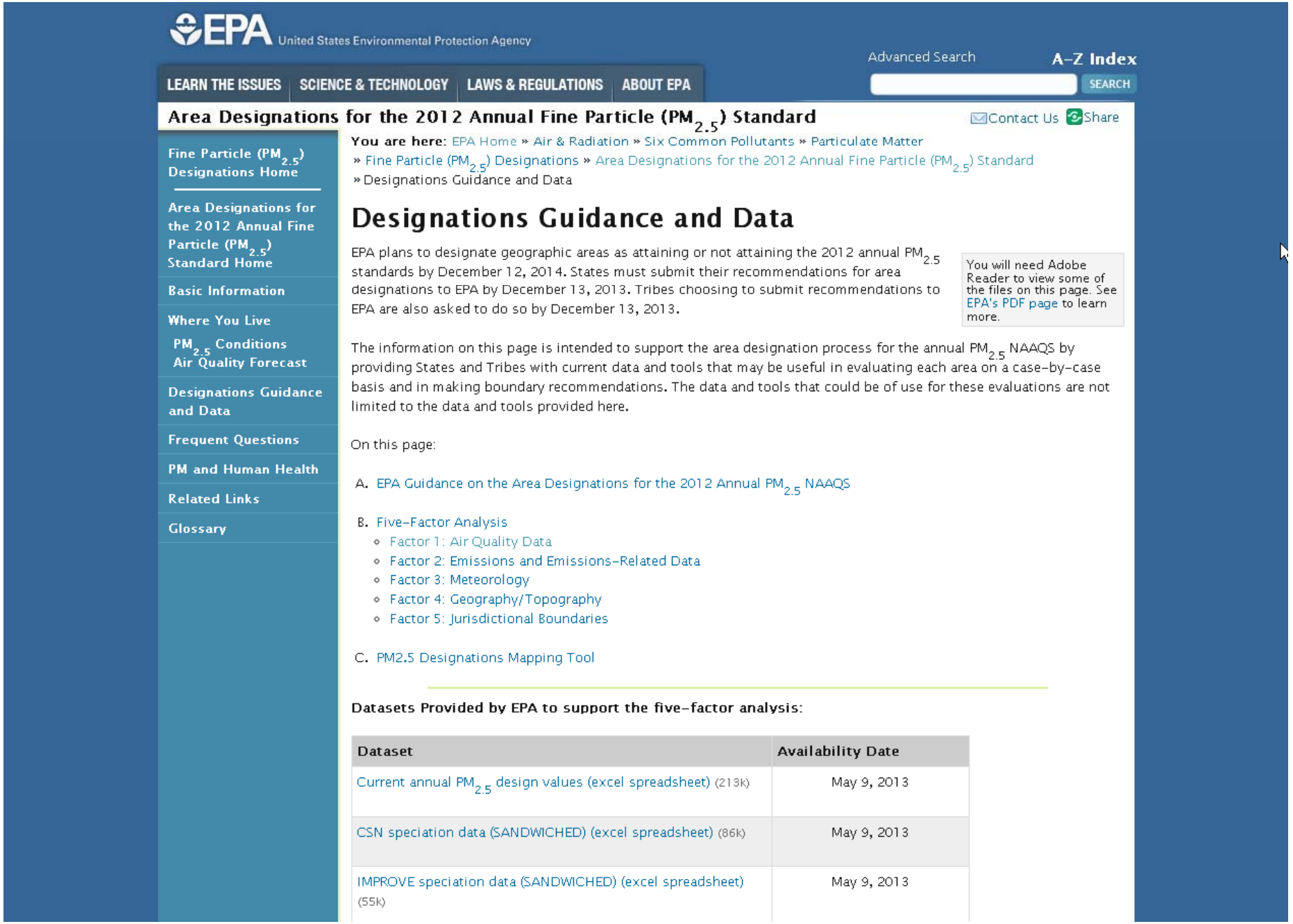


Synthesize into recommendation

Added value from the PM Mapping tool.



http://geoplatform2.epa.gov/PM_MAP/



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Area Designations for the 2012 Annual Fine Particle ($PM_{2.5}$) Standard

You are here: EPA Home » Air & Radiation » Six Common Pollutants » Particulate Matter » Fine Particle ($PM_{2.5}$) Designations » Area Designations for the 2012 Annual Fine Particle ($PM_{2.5}$) Standard » Designations Guidance and Data

- Fine Particle ($PM_{2.5}$) Designations Home
- Area Designations for the 2012 Annual Fine Particle ($PM_{2.5}$) Standard Home
- Basic Information
- Where You Live
- $PM_{2.5}$ Conditions Air Quality Forecast
- Designations Guidance and Data
- Frequent Questions
- PM and Human Health
- Related Links
- Glossary

Designations Guidance and Data

EPA plans to designate geographic areas as attaining or not attaining the 2012 annual $PM_{2.5}$ standards by December 12, 2014. States must submit their recommendations for area designations to EPA by December 13, 2013. Tribes choosing to submit recommendations to EPA are also asked to do so by December 13, 2013.

You will need Adobe Reader to view some of the files on this page. See EPA's PDF page to learn more.

The information on this page is intended to support the area designation process for the annual $PM_{2.5}$ NAAQS by providing States and Tribes with current data and tools that may be useful in evaluating each area on a case-by-case basis and in making boundary recommendations. The data and tools that could be of use for these evaluations are not limited to the data and tools provided here.

On this page:

A. EPA Guidance on the Area Designations for the 2012 Annual $PM_{2.5}$ NAAQS

B. Five-Factor Analysis
- Factor 1: Air Quality Data
- Factor 2: Emissions and Emissions-Related Data
- Factor 3: Meteorology
- Factor 4: Geography/Topography
- Factor 5: Jurisdictional Boundaries

C. PM2.5 Designations Mapping Tool

Datasets Provided by EPA to support the five-factor analysis:

Dataset	Availability Date
Current annual $PM_{2.5}$ design values (excel spreadsheet) (213k)	May 9, 2013
CSN speciation data (SANDWICHED) (excel spreadsheet) (86k)	May 9, 2013
IMPROVE speciation data (SANDWICHED) (excel spreadsheet) (55k)	May 9, 2013

http://www.epa.gov/pmdesignations/2012standards/techinfo.htm

Datasets Provided by EPA to Support the Five-Factor Analysis:

Factor 1: Air Quality Data

- Summary of 2009-2011 $PM_{2.5}$ Design Values (excel spreadsheet) (213k)
- Map showing counties with sites violating the annual $PM_{2.5}$ air quality standard for 2009-2011 (PDF)(1pg, 147k)
- $PM_{2.5}$ Compositional Analysis
- CSN speciation data (SANDWICHED) (excel spreadsheet) (86k)
- IMPROVE speciation data (SANDWICHED) (excel spreadsheet) (55k)
- Clarification/supporting documentation on SANDWICH techniques
- See Derivation of the Contributing Emissions Score (PDF) (1200 pp, 7.4 MB)
- Presentation at $PM_{2.5}$ Implementation and Designations Workshop, held June 20-21, 2007 in Chicago, IL The Chemical Composition of $PM_{2.5}$ to support PM Implementation (PDF) (43 pp, 3.7 MB)
- SANDWICH: A Material Balance Approach for $PM_{2.5}$ Analysis and Quality Control (45 pp, 5.0 MB)
- Urban Increments

For additional information about $PM_{2.5}$ air quality data, visit EPA's Air Trends site.

Factor 2: Emissions and Emissions-Related Data

- NEI emissions summaries (excel spreadsheet) (4.0 MB)
- Gridded emissions (provided as part of web-based mapping tool)
- Vehicle miles traveled (excel spreadsheet) (1.0 MB)
- Population (excel spreadsheet) (404k)

More information about the NEI.

Datasets Provided by EPA to Support the Five-Factor Analysis:

Factor 3: Meteorology

- Wind speed/direction data (zip file) (34.4 MB)
- Wind roses (provided as part of web-based mapping tool)
- HYSPLIT trajectory data

Factor 4 Geography/Topography

- Information for this factor can be found in the PM2.5 Designations Mapping Tool*

Factor 5: Jurisdictional Boundaries

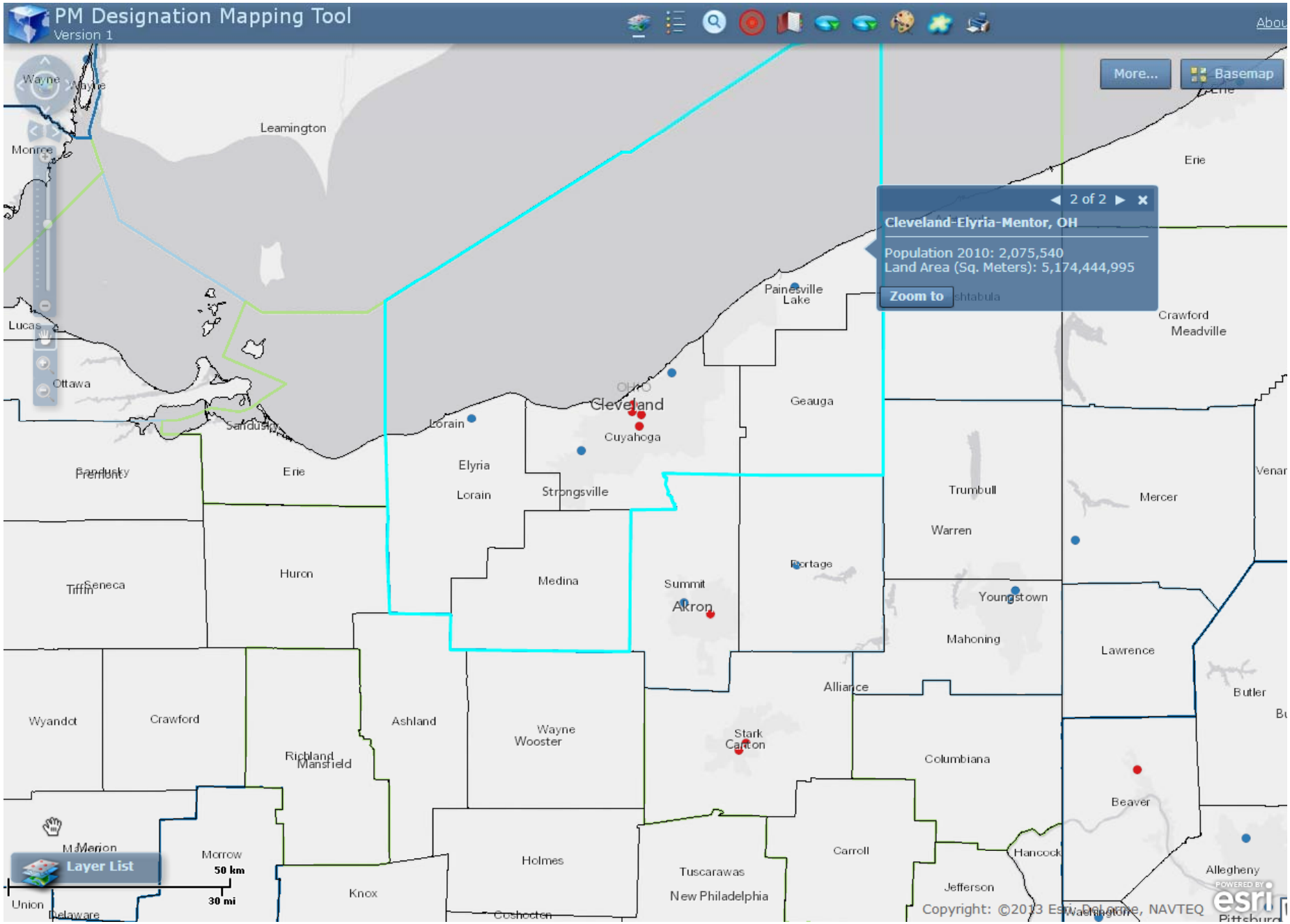
- Information for this factor can be found in the PM2.5 Designations Mapping Tool*

***PM2.5 Designations Mapping Tool**

- PM Designations Mapping Tool and Data Documentation (PDF) (15pp, 996k)
- Data and Mapping Tool Documentation V2 (xlsx) (30k)
- PM2.5 Designations Mapping Tool Questions and Answers (PDF) (7pp, 118k)

EPA Guidance on the Area Designations for the 2012 Annual $PM_{2.5}$ NAAQS

- April 2013 Guidance for Area Designations for the 2012 Annual $PM_{2.5}$ NAAQS (PDF) (34pp, 11.5 MB)


PM Designation Mapping Tool
Version 1
More...
Basemap
2 of 2
Cleveland-Elyria-Mentor, OH
Population 2010: 2,075,540
Land Area (Sq. Meters): 5,174,444,995
Zoom to
Leamington
Monroe
Lucas
Ottawa
Sandusky
Fremont
Erie
Lorain
Elyria
Cleveland
Cuyahoga
Geauga
Painesville
Lake
Crawford
Meadville
Erie
Trumbull
Warren
Mercer
Portage
Medina
Summit
Akron
Youngstown
Mahoning
Lawrence
Butler
Alliance
Stark
Canton
Columbiana
Beaver
Allegheny
Pittsburgh
Tiffin
Seneca
Huron
Wyandot
Crawford
Ashland
Wayne
Wooster
Richland
Mansfield
Marion
Morrow
Knox
Holmes
Coshocton
Tuscarawas
New Philadelphia
Carroll
Hancock
Jefferson
Washington
Union
Delaware
Layer List
50 km
30 mi
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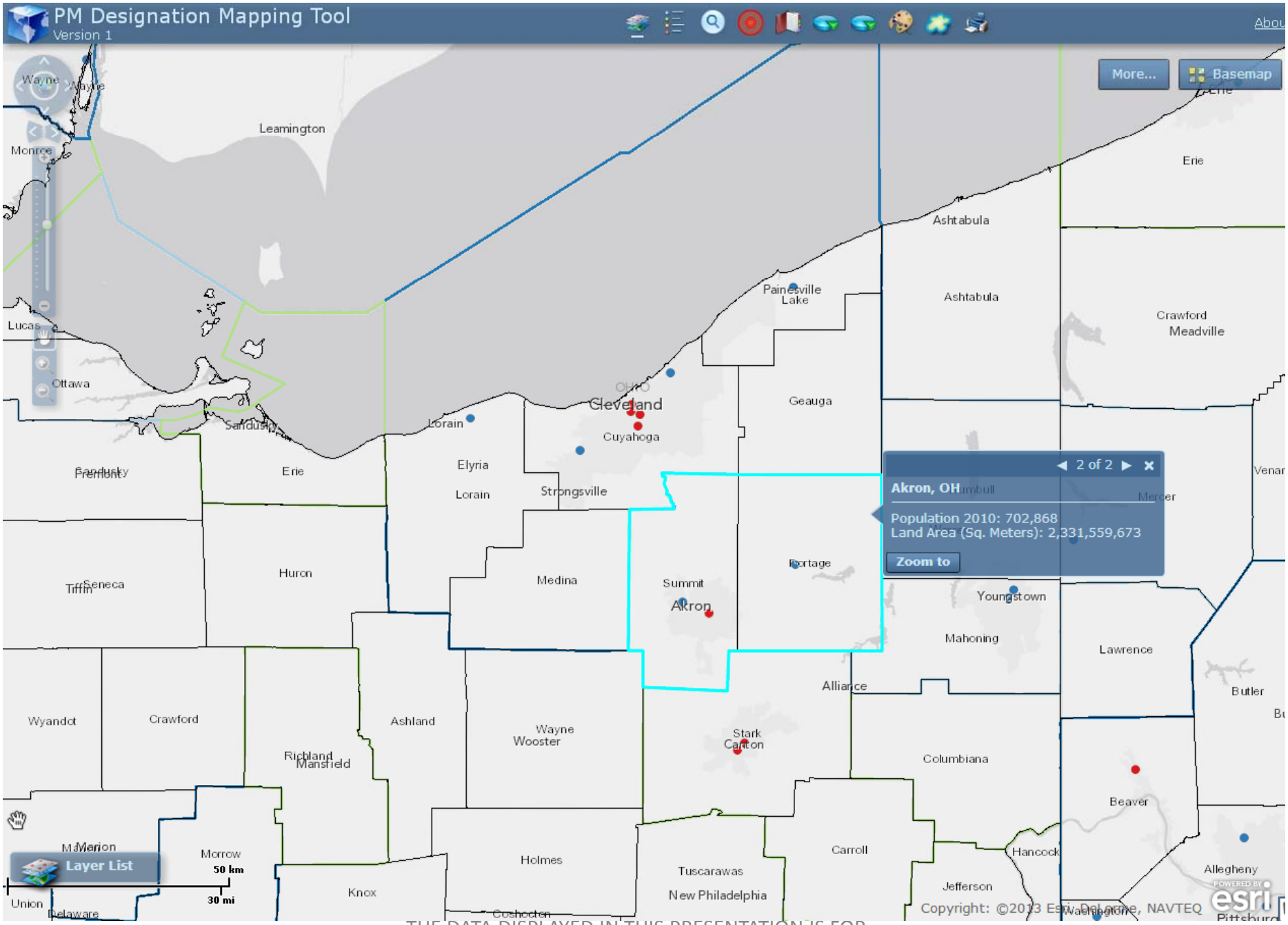

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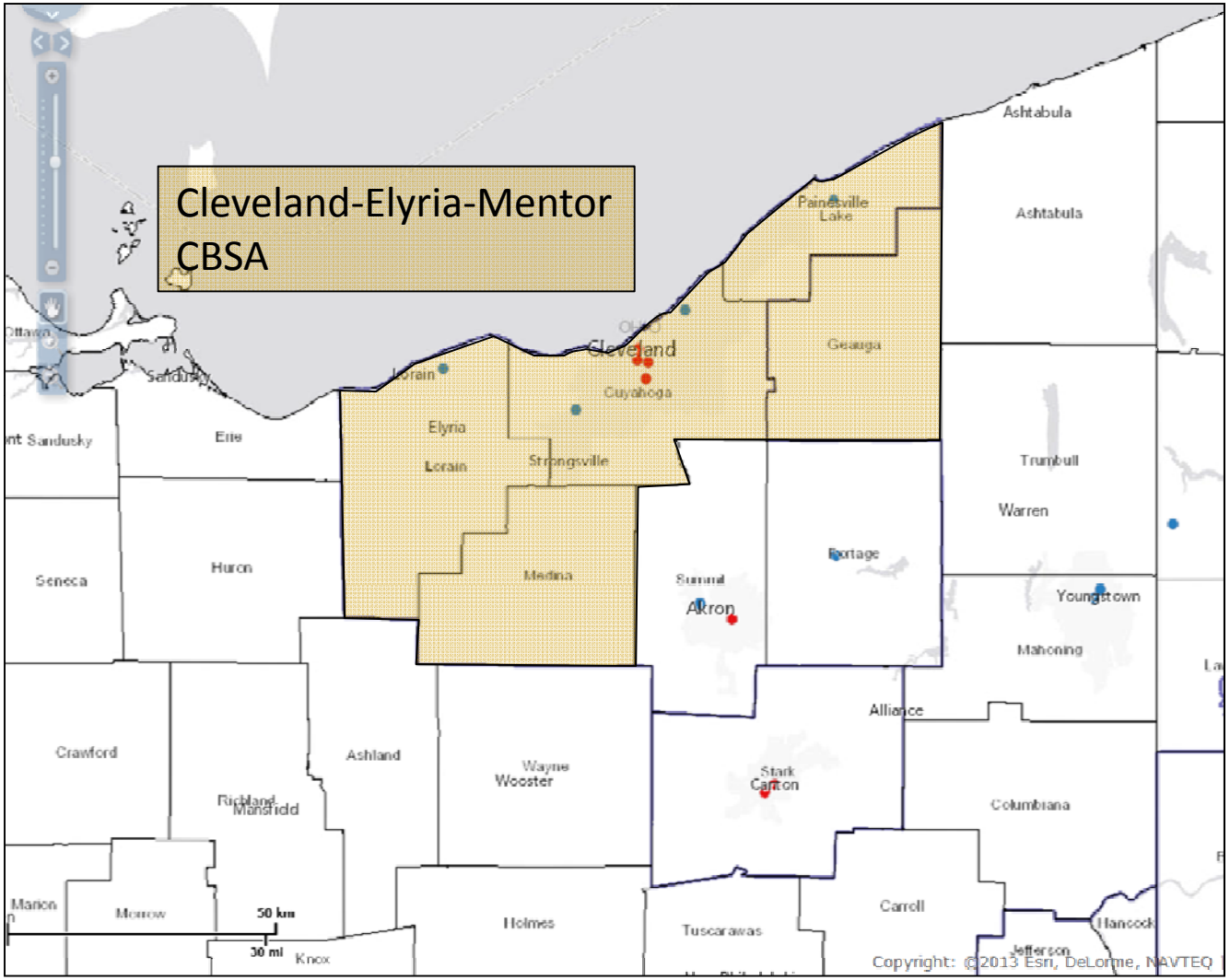
Example: Cleveland CBSA & Akron CBSA



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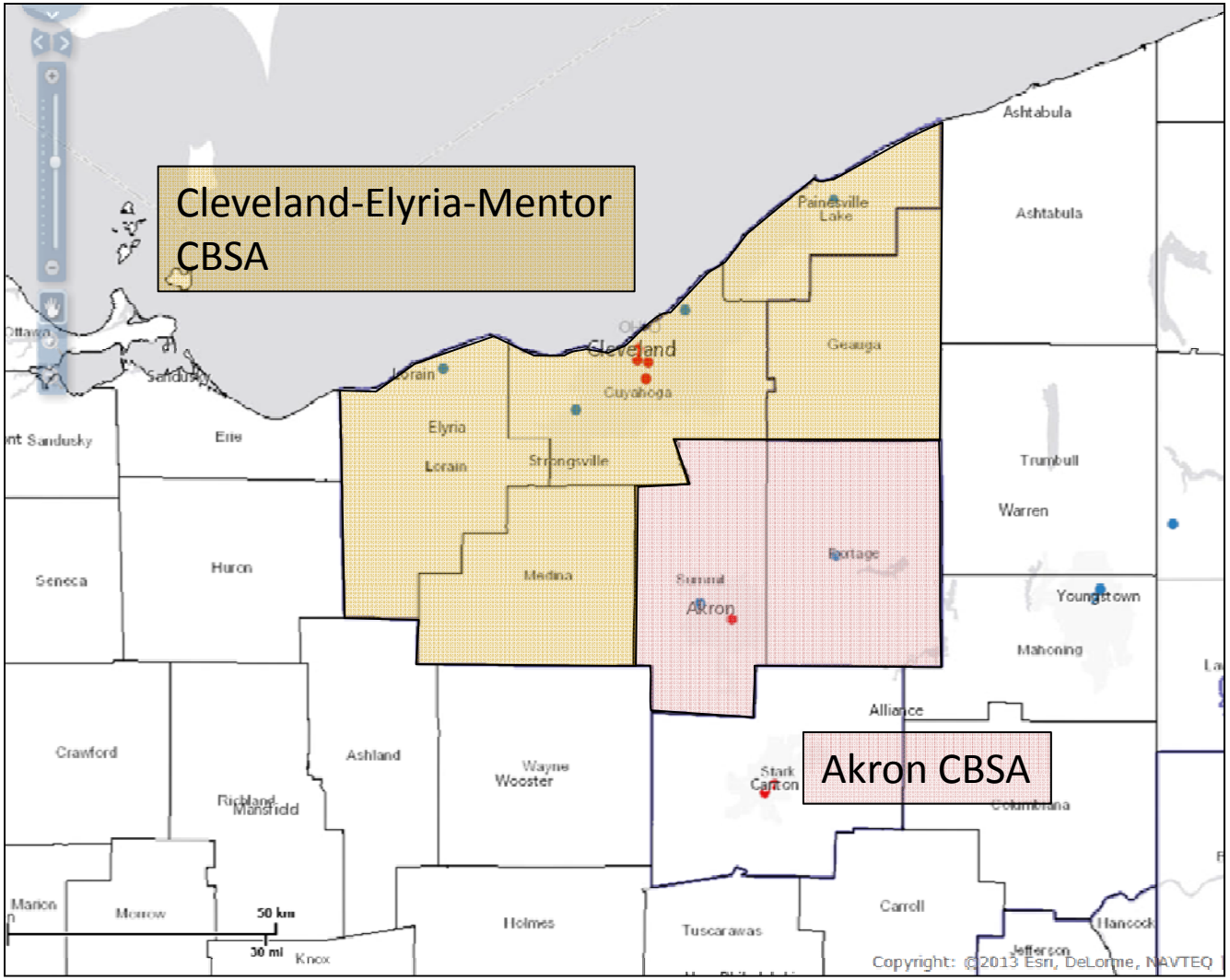

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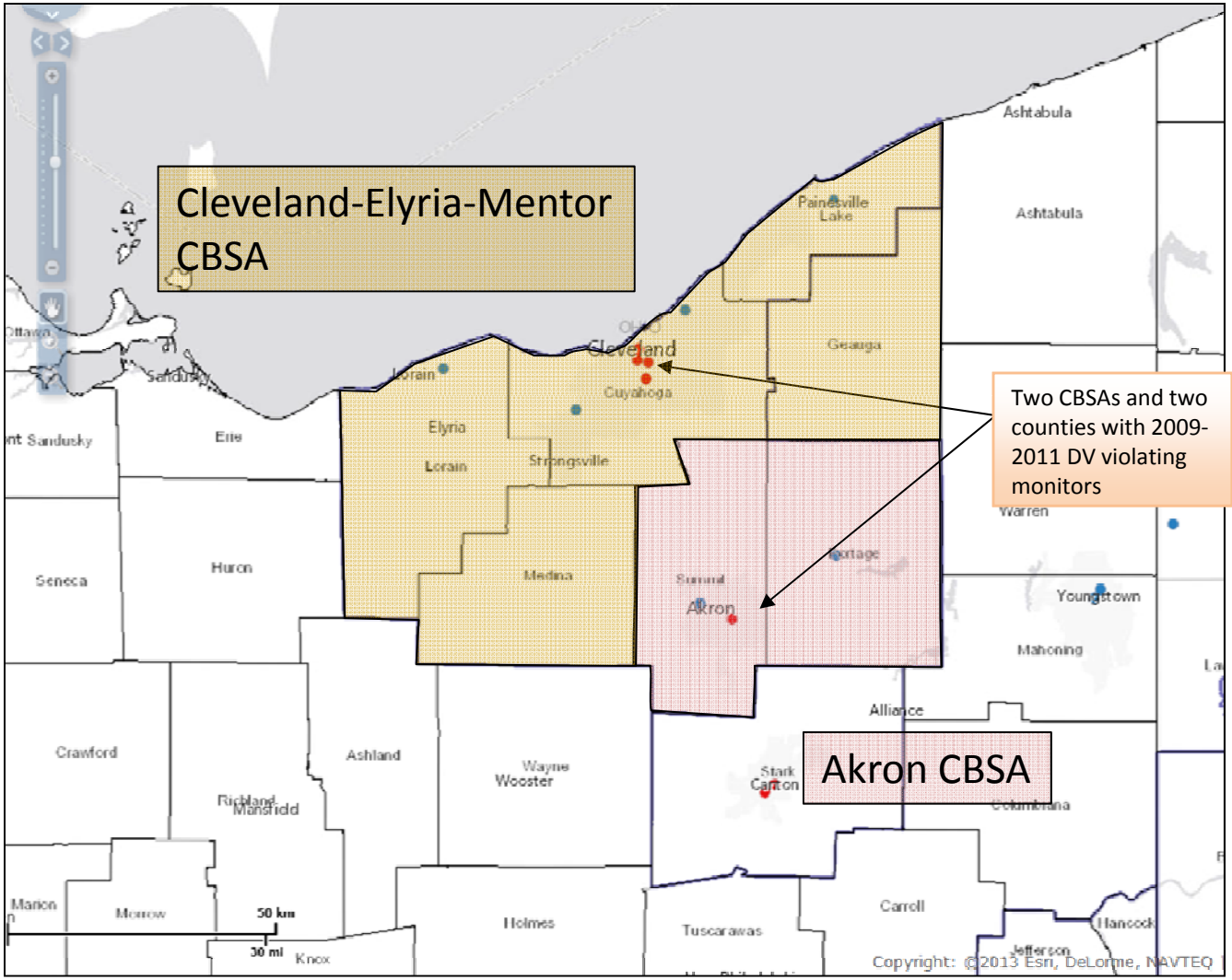

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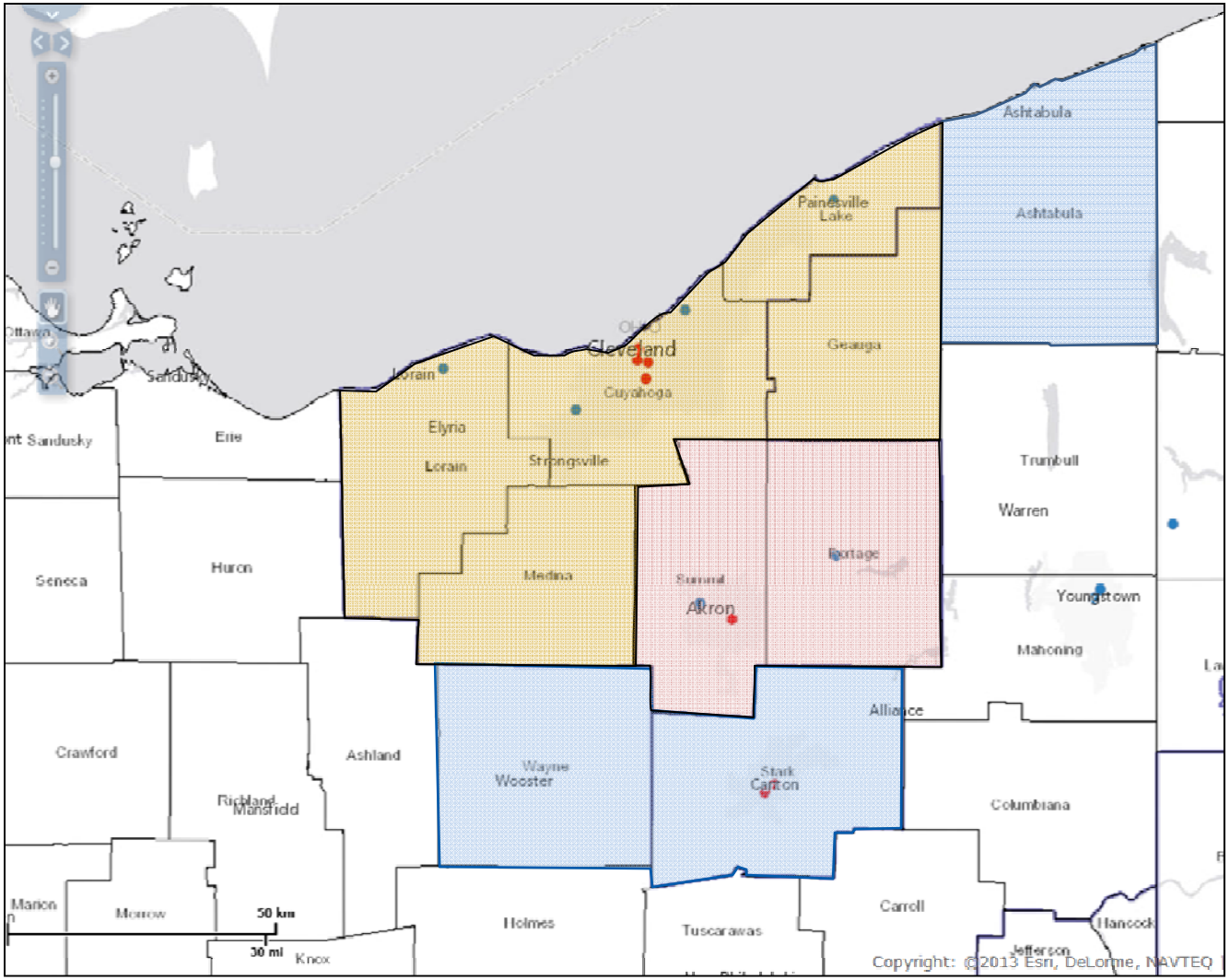
Example: Cleveland CBSA & Akron CBSA



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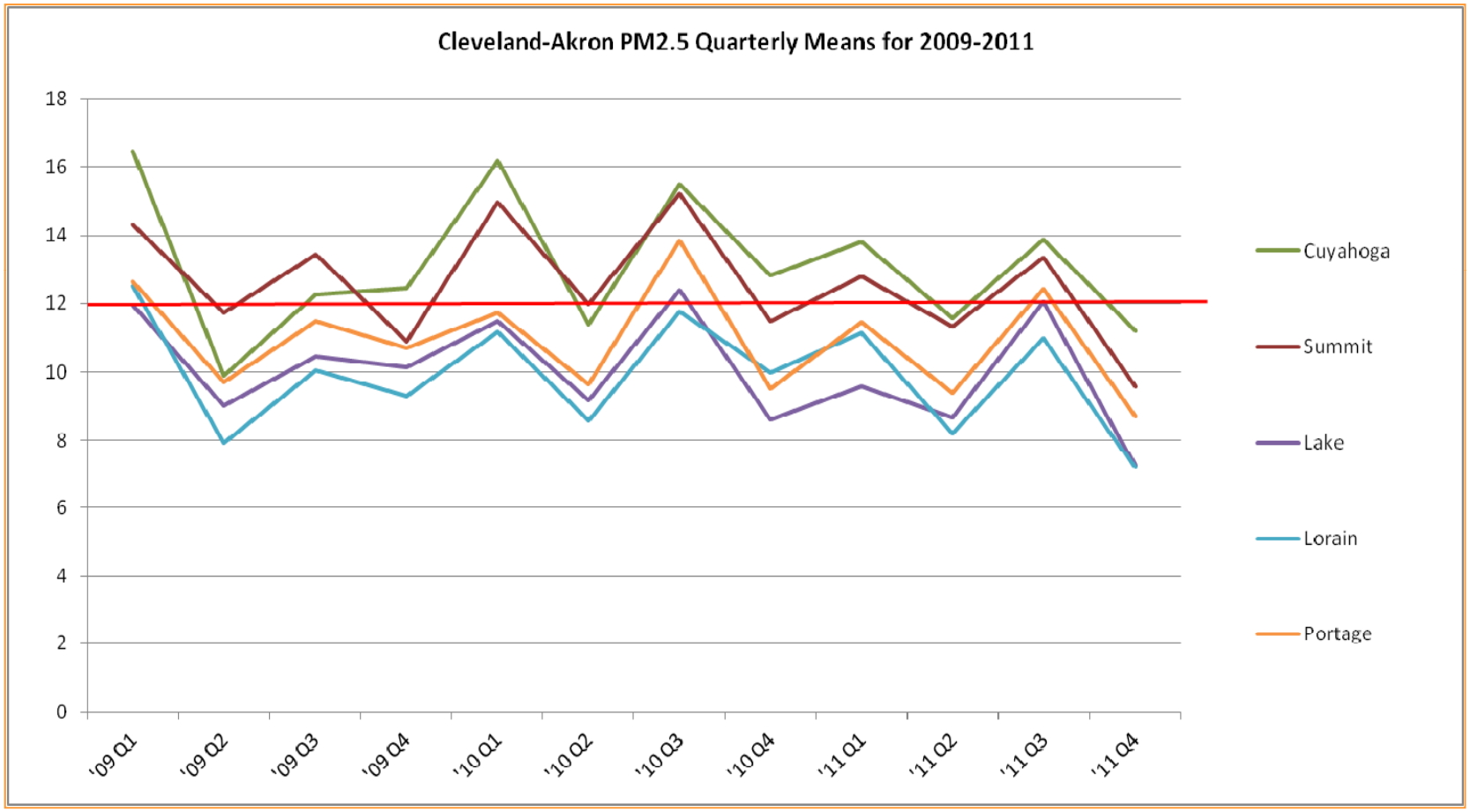
Factor 1: Air Quality

The high design value (DV) site for the nonattainment area is in Cuyahoga County, near the city center of Cleveland (Site Id# 390350038). Five monitors exceed the 12.0 ug/m3 NAAQS value, with four of those near the city center of Cleveland and one near the city center of Akron, in Summit County.

	Monitor Site ID#	2009-2011 Design Value
Cuyahoga County	390350027	10.6
Cuyahoga County	390350034	10.4
Cuyahoga County	**390350038 (DV site)**	**13.1**
Cuyahoga County	**390350045**	**12.3**
Cuyahoga County	**390350060**	**12.8**
Cuyahoga County	**390350065**	**12.7**
Cuyahoga County	390351002	10.9
Summit County	**391530017**	**12.6**
Summit County	391530023	11.7
Lake	390850007	10.1
Lorain	390933002	9.9
Portage	391330002	10.9
Geauga County	No Monitor	N/A
Ashtabula County	No Monitor	N/A
Medina County	No Monitor	N/A
Wayne County	No Monitor	N/A
Stark County	No Monitor	N/A

Factor 1: Air Quality

Note the high degree of correlation across the three year period and across all Cleveland and Akron CBSA monitors. Quarterly values across the period vary by 2-4 µg/m^3 at each site, with consistent annual peaks occurring in Q1 and Q3. Note that Portage and Lake county monitors have had some quarterly averages above NAAQS.



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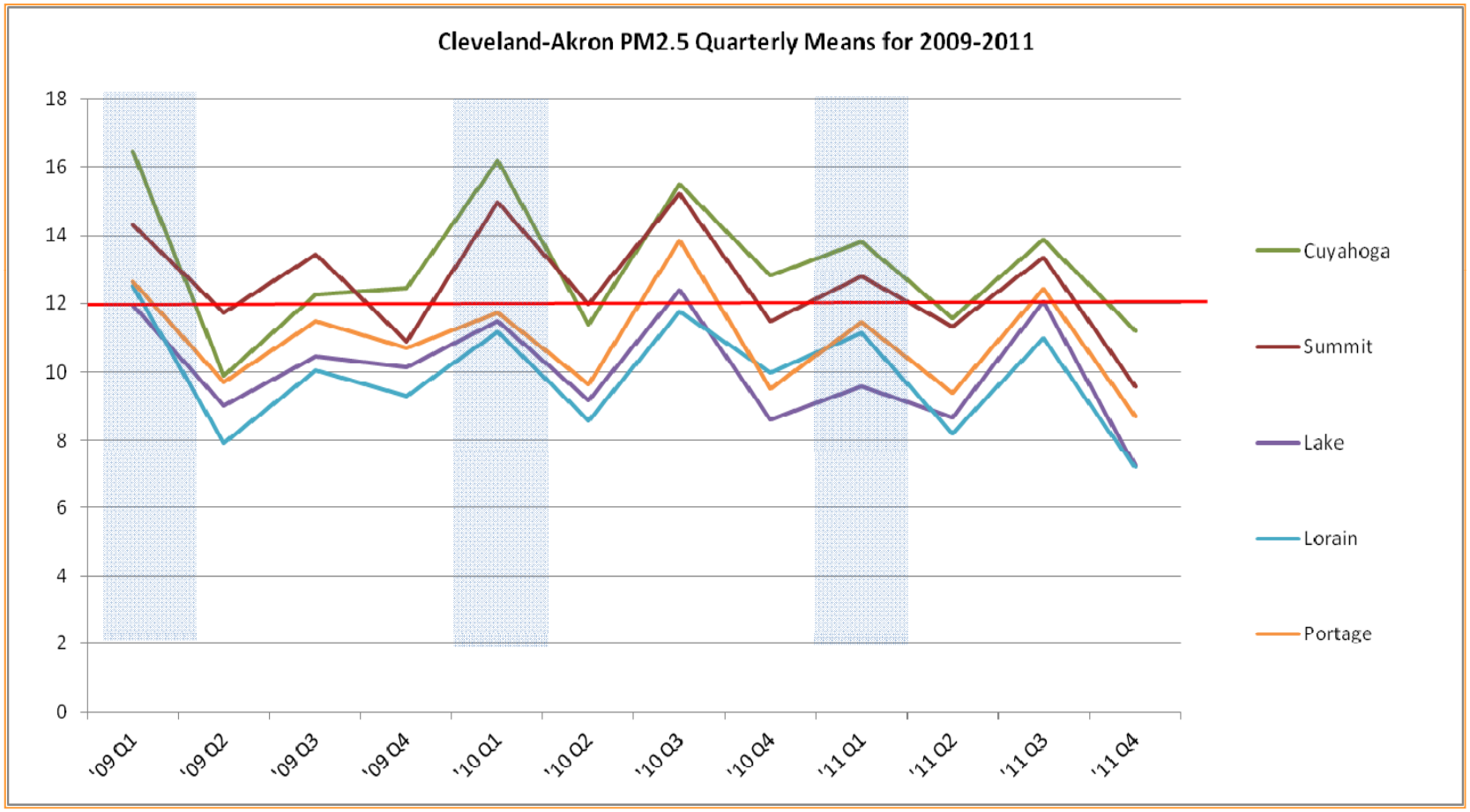

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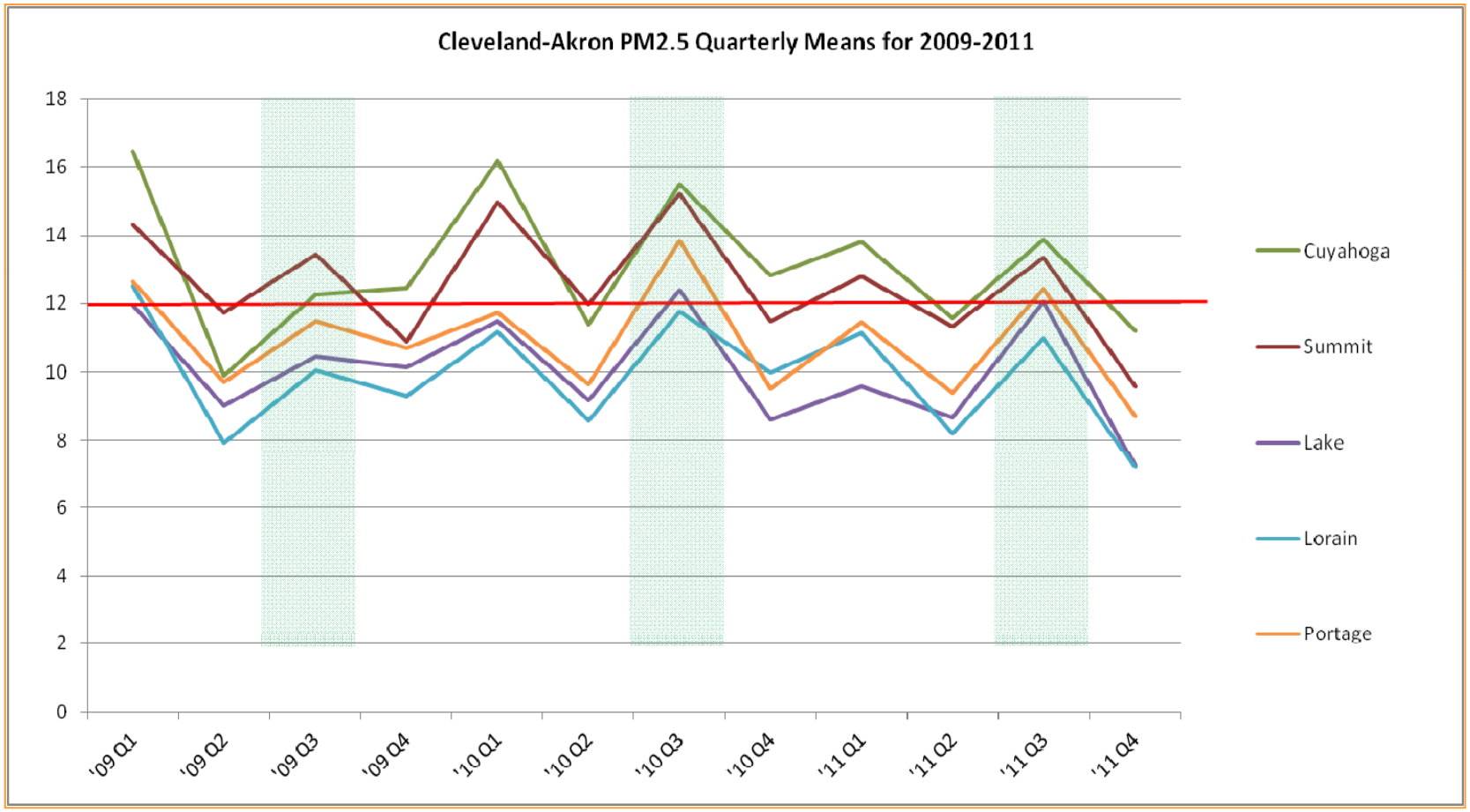
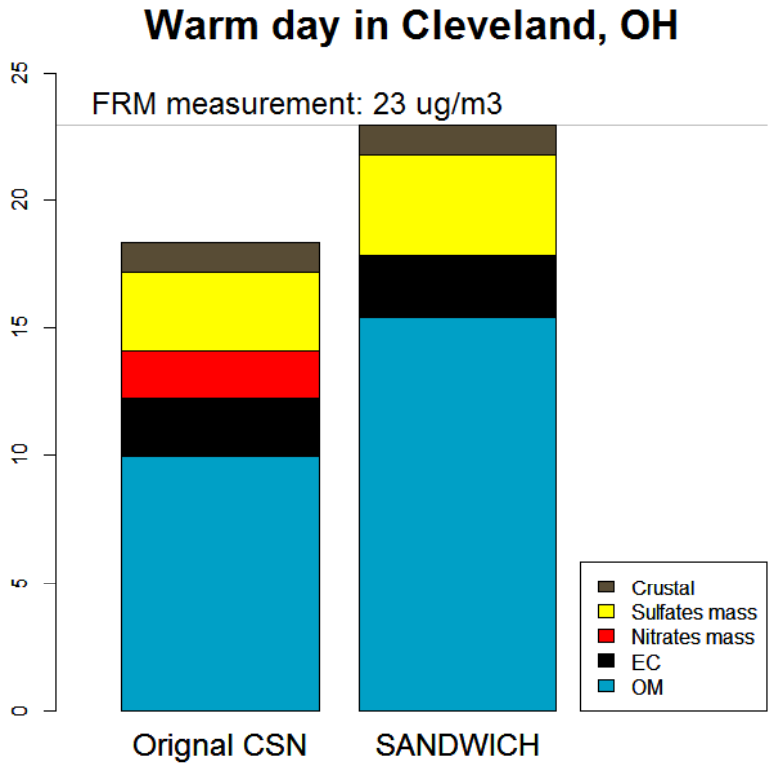


Factor 1: Air Quality

SANDWICH

Sulfate, Adjusted Nitrate, Derived Water, Inferred Carbonaceous Mass approach

- What does SANDWICH do?
  - Adjusts nitrate mass to mimic FRM retained nitrate
  - Adds water for ammonium nitrate and ammonium sulfate
  - Assumes remaining difference between the FRM and EC + Nitrate mass + Sulfate mass + Crustal is organic mass (OM)



Neil H. Frank (2006) Retained Nitrate, Hydrated Sulfates, and Carbonaceous Mass in Federal Reference Method Fine Particulate Matter for Six Eastern U.S. Cities, Journal of the Air & Waste Management Association, 56:4, 500-511, DOI: 10.1080/10473289.2006.10464517 (http://www.tandfonline.com/toc/uawm20/current to access AWMA articles.)

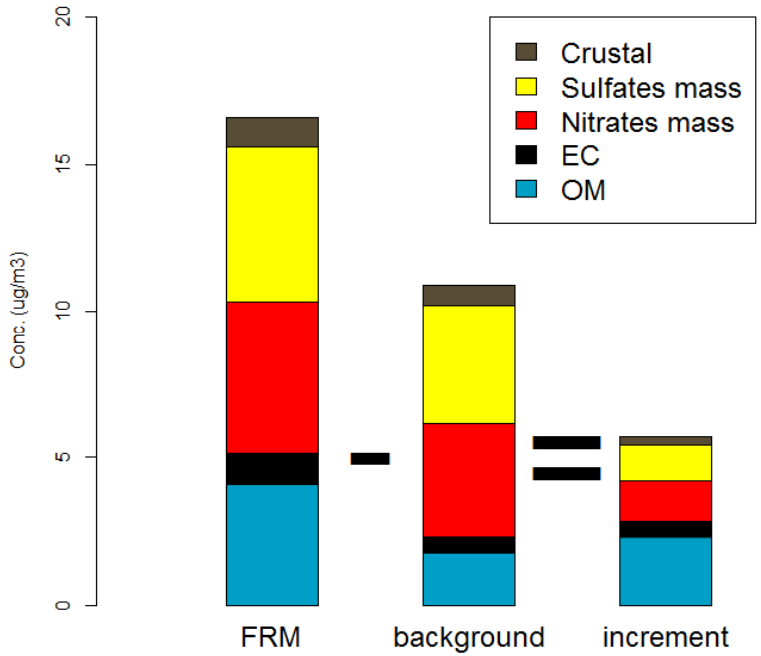
Factor 1: Air Quality

The Urban Increment

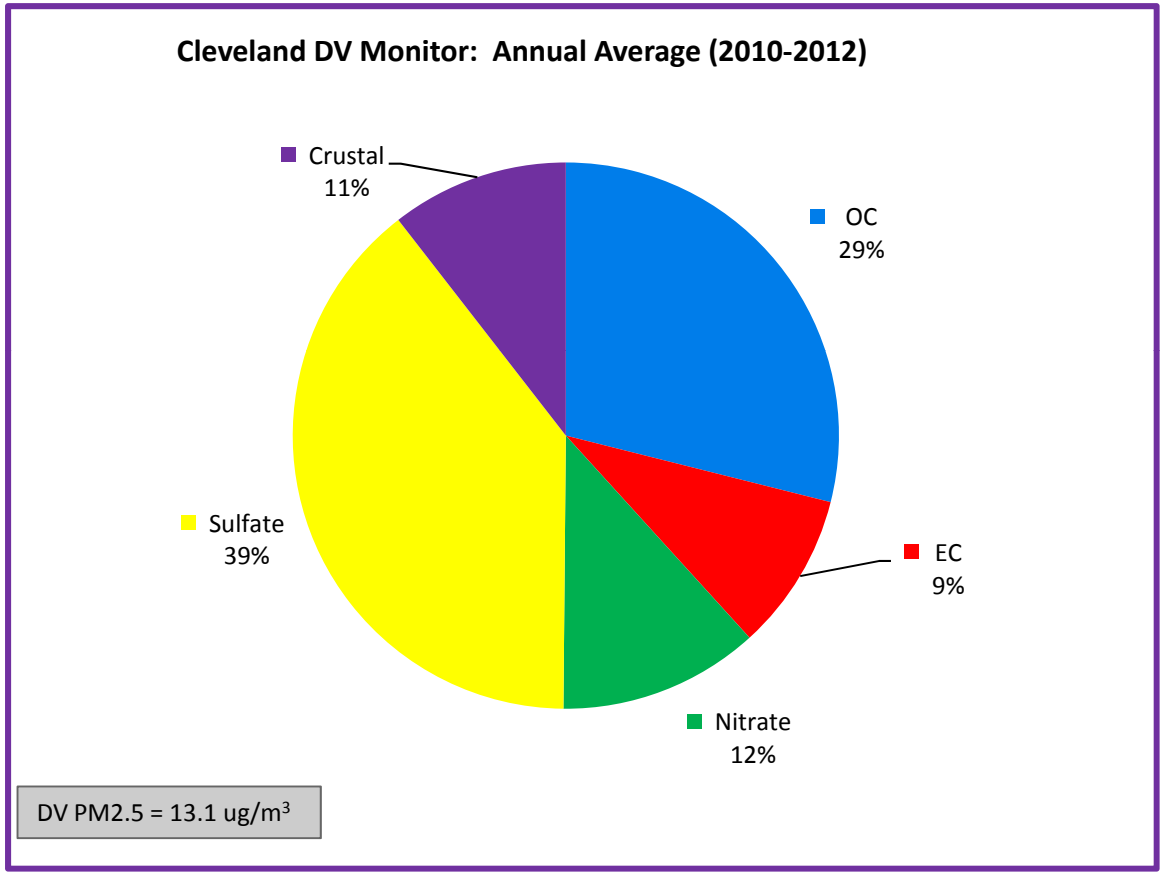
- The increment estimates the amount of PM2.5 contributed by the nearby area emissions
- It reveals the composition of the fine particulate influencing annual average concentrations including higher concentration days
- Key to defining the boundaries of nearby contributing emission sources
- Constructed by calendar quarter to take into account seasonality of PM2.5
- Allows weighting of emissions

Calculating the Increment

The background concentrations are subtracted from the estimated concentrations at the urban FRM site.

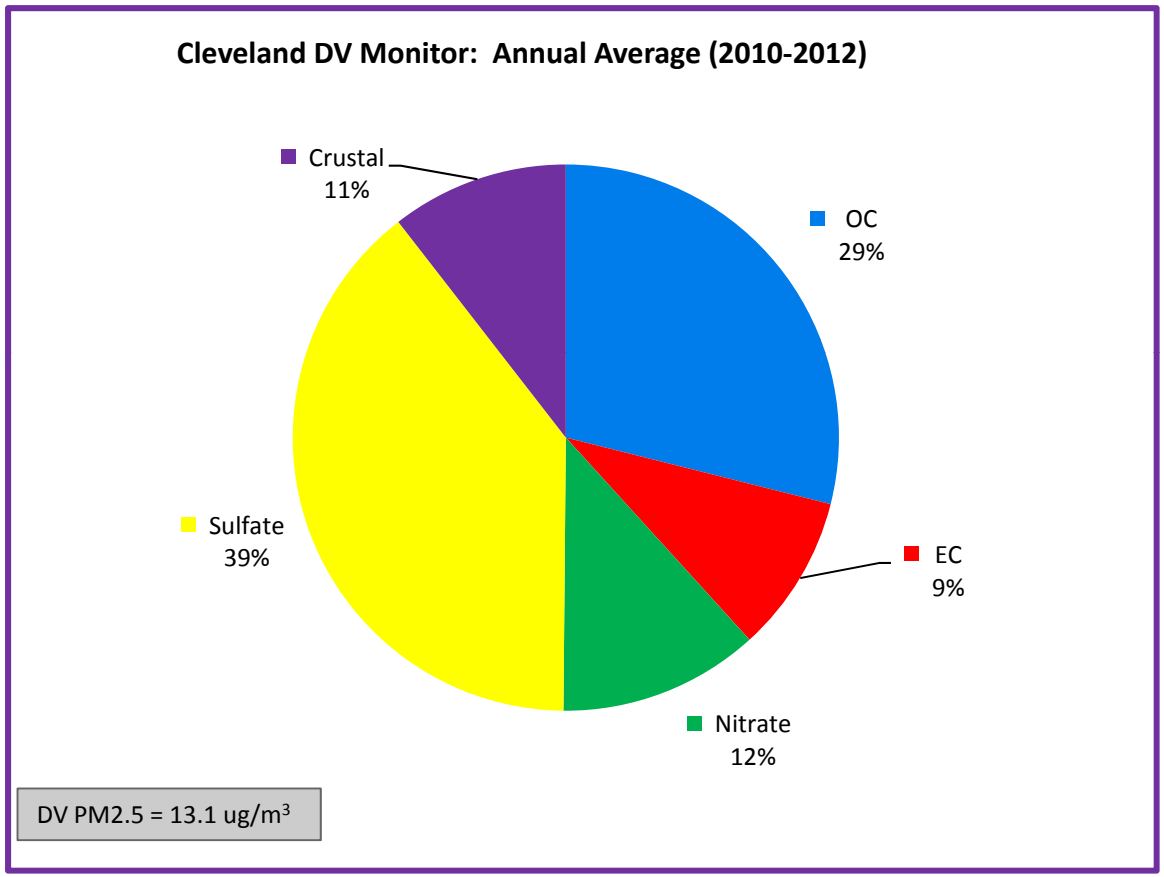


Factor 1: Air Quality
Urban Increment Analysis
Cleveland CBSA



Factor 1: Air Quality
Urban Increment Analysis
Cleveland CBSA

Cleveland DV Monitor
- ***Not*** adjusted for urban increment
- Note the high sulfate %.

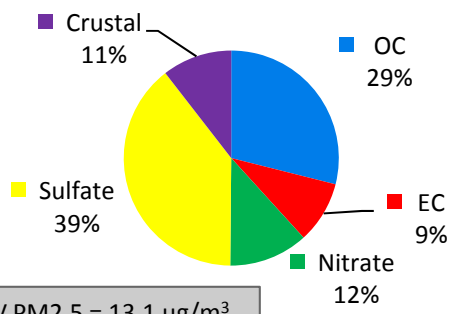


Factor 1: Air Quality
Urban Increment Analysis
Cleveland CBSA

Cleveland DV Monitor

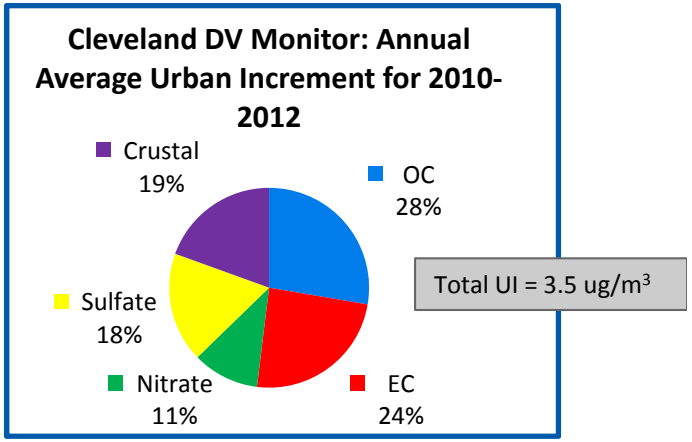
- ***Not*** adjusted for urban increment
- Note the high sulfate %.

Cleveland DV Monitor: Annual Average (2010-2012)



DV PM2.5 = 13.1 ug/m^3

Factor 1: Air Quality
Urban Increment Analysis
Cleveland CBSA



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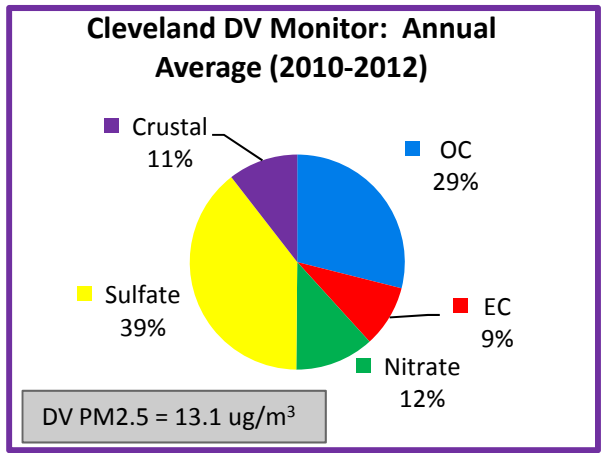
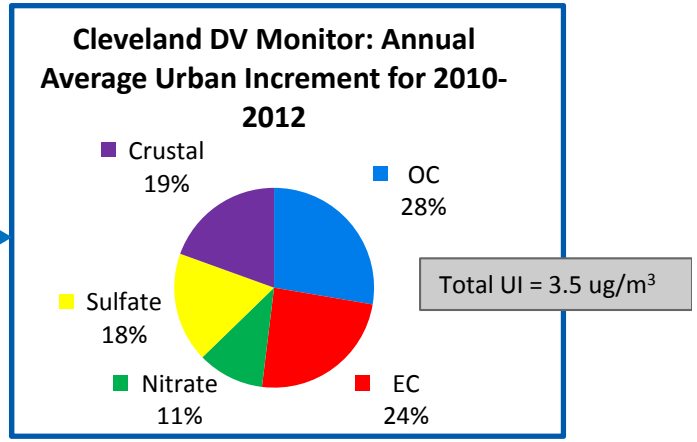


Factor 1: Air Quality
Urban Increment Analysis
Cleveland CBSA

PM2.5 urban increments:

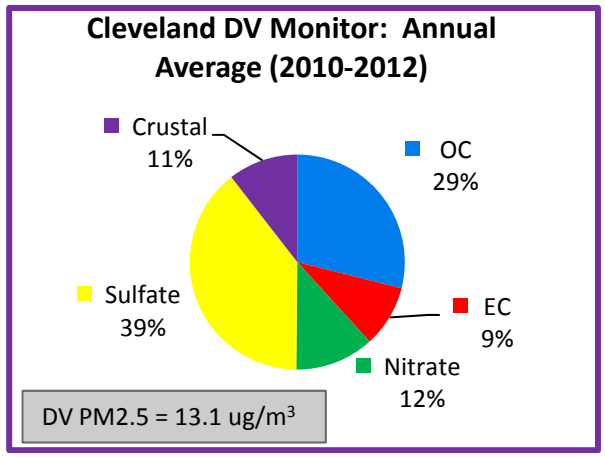
Annual Average

- Lower sulfate %
- Higher EC %
- Consistent Nitrate, OC %



Cleveland DV Monitor

- ***Not*** adjusted for urban increment
- Note the high sulfate %.



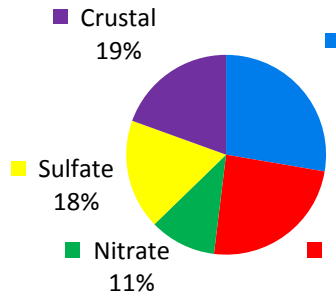
Factor 1: Air Quality
Urban Increment Analysis
Cleveland CBSA

PM2.5 urban increments:

Annual Average

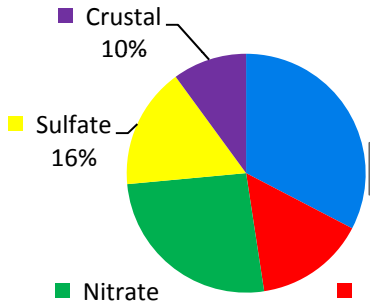
- Lower sulfate %
- Higher EC %
- Consistent Nitrate, OC %

Cleveland DV Monitor: Annual Average Urban Increment for 2010-2012



Total UI = 3.5 ug/m^3

Cleveland DV Monitor: Q1 Urban Increment for 2010-2012

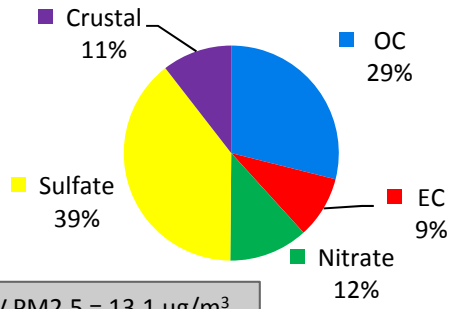


Total UI = 5.0 ug/m^3

Cleveland DV Monitor

- ***Not*** adjusted for urban increment
- Note the high sulfate %.

Cleveland DV Monitor: Annual Average (2010-2012)

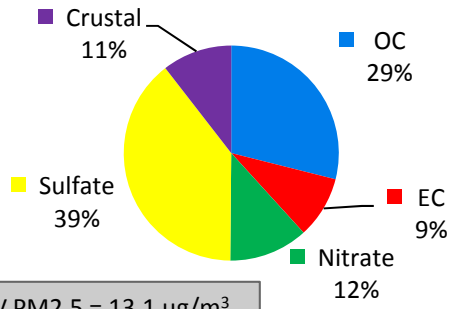


DV PM2.5 = 13.1 ug/m^3

Factor 1: Air Quality
Urban Increment Analysis
Cleveland CBSA

Cleveland DV Monitor
- ***Not*** adjusted for urban increment
- Note the high sulfate %.

Cleveland DV Monitor: Annual Average (2010-2012)

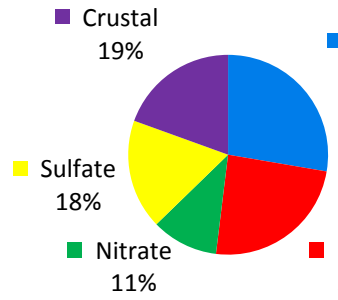


DV PM2.5 = 13.1 ug/m³

PM2.5 urban increments:

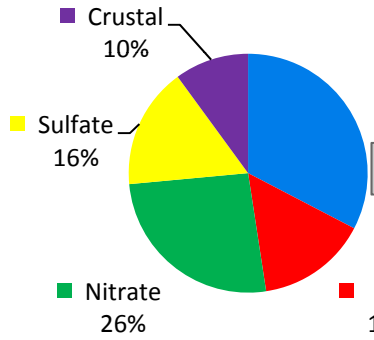
Annual Average
- Lower sulfate %
- Higher EC %
- Consistent Nitrate, OC %

Cleveland DV Monitor: Annual Average Urban Increment for 2010-2012



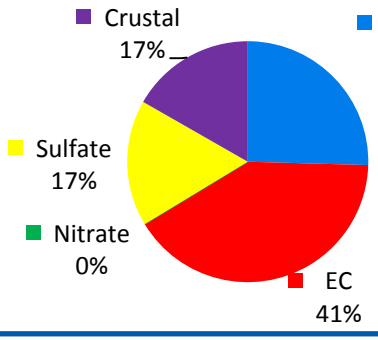
Total UI = 3.5 ug/m³

Cleveland DV Monitor: Q1 Urban Increment for 2010-2012



Total UI = 5.0 ug/m³

Cleveland DV Monitor: Q3 Urban Increment for 2010-2012

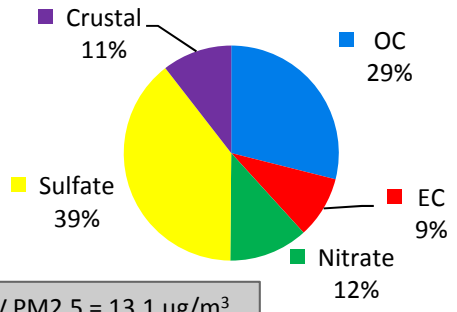


Total UI = 3.3 ug/m³

Factor 1: Air Quality
Urban Increment Analysis
Cleveland CBSA

Cleveland DV Monitor
- ***Not*** adjusted for urban increment
- Note the high sulfate %.

Cleveland DV Monitor: Annual Average (2010-2012)

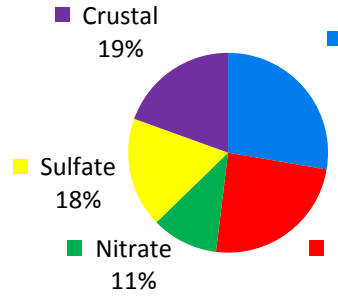


DV PM2.5 = 13.1 ug/m³

PM2.5 urban increments:

Annual Average
- Lower sulfate %
- Higher EC %
- Consistent Nitrate, OC %

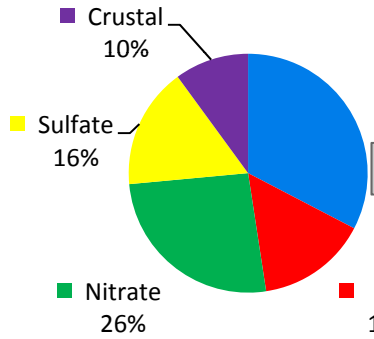
Cleveland DV Monitor: Annual Average Urban Increment for 2010-2012



Total UI = 3.5 ug/m³

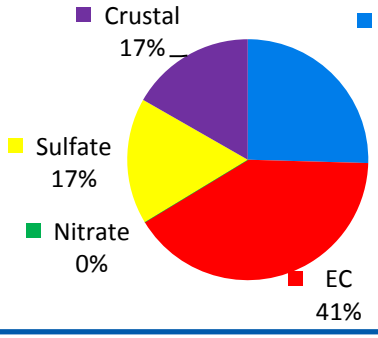
Quarterly UI
- Sulfate and OC UI consistent
- Higher EC in Q3 than in Q1
- Increased nitrate % in peak Q1 winter season
- No nitrate % in second peak Q3 summer season

Cleveland DV Monitor: Q1 Urban Increment for 2010-2012



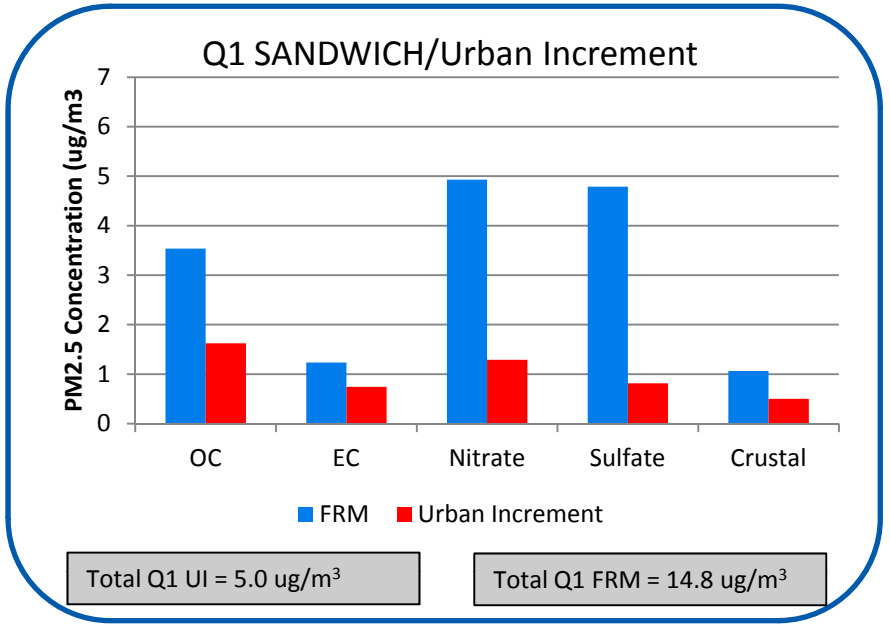
Total UI = 5.0 ug/m³

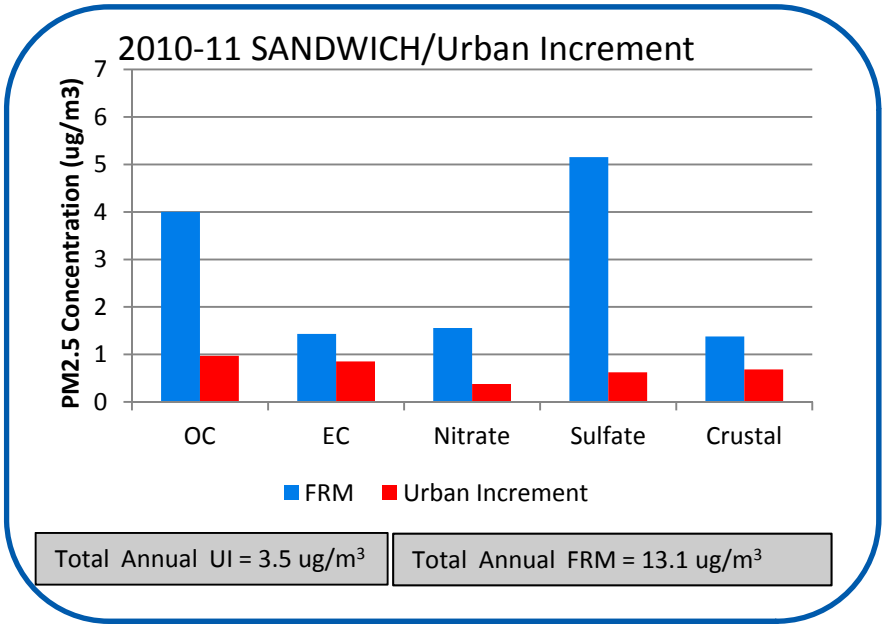
Cleveland DV Monitor: Q3 Urban Increment for 2010-2012

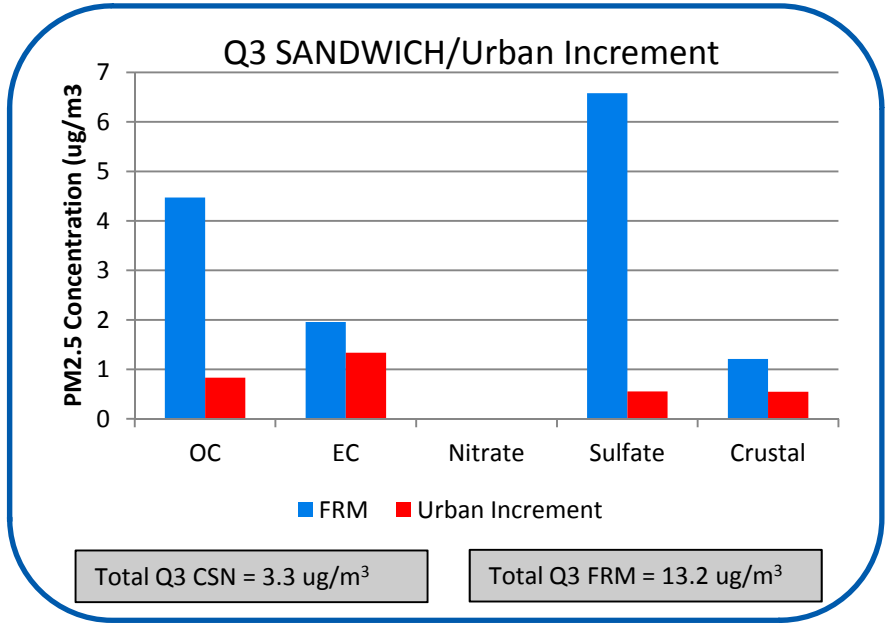


Total UI = 3.3 ug/m³

Factor 1: Air Quality
Urban Increment Analysis Values vs. DV Monitor SANDWICH (FRM)Values
Cleveland CBSA

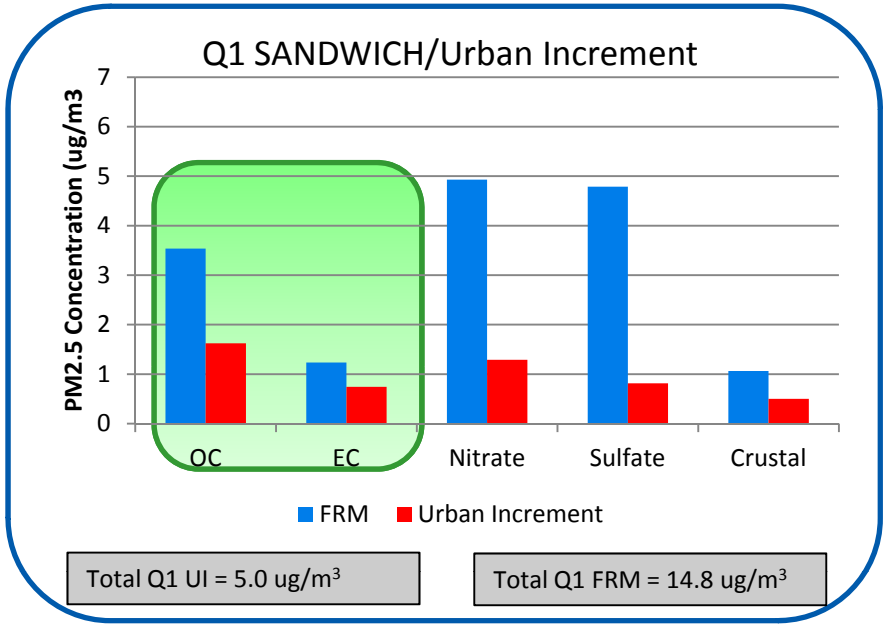


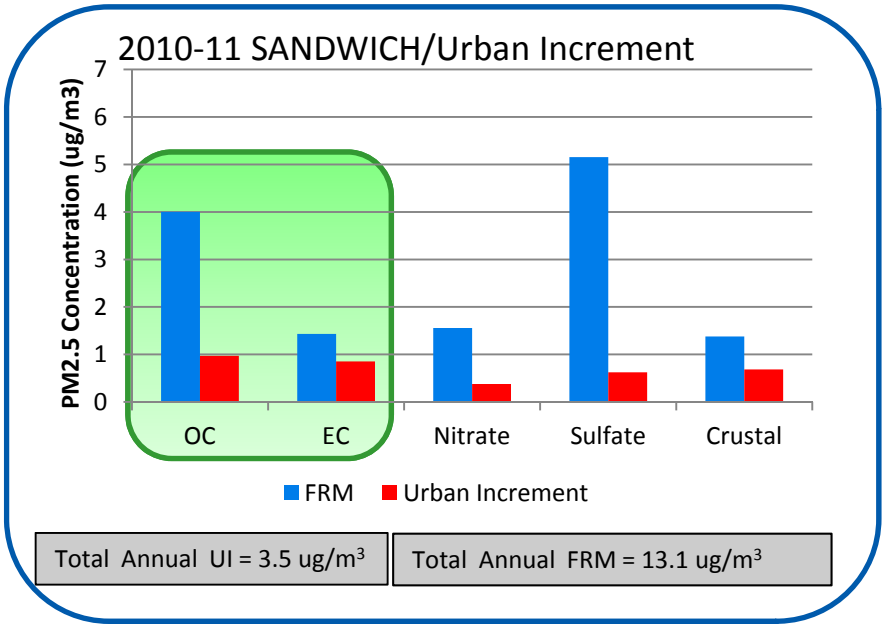


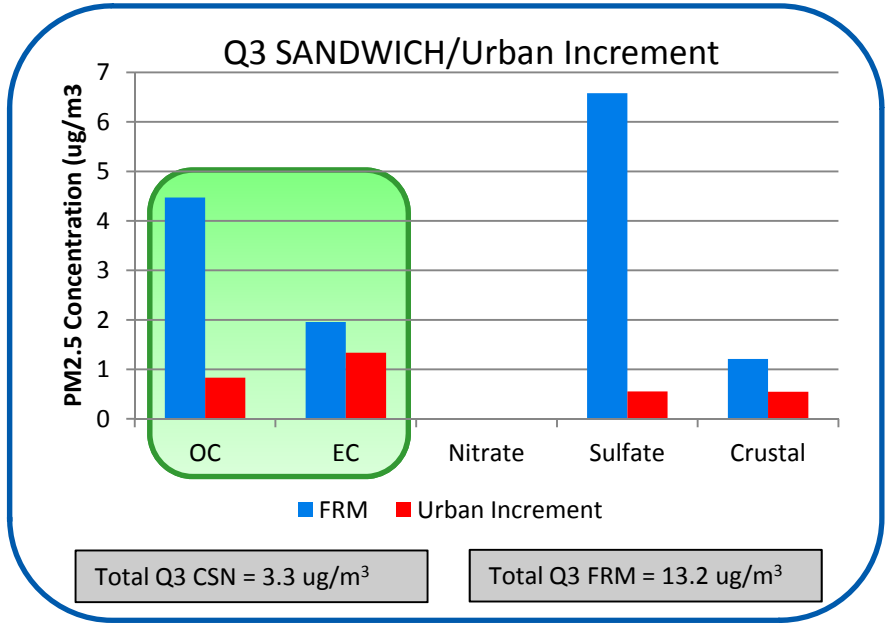


Factor 1: Air Quality
Urban Increment Analysis Values vs. DV Monitor SANDWICH (FRM)Values
Cleveland CBSA

- High Urban Increments for OC and EC

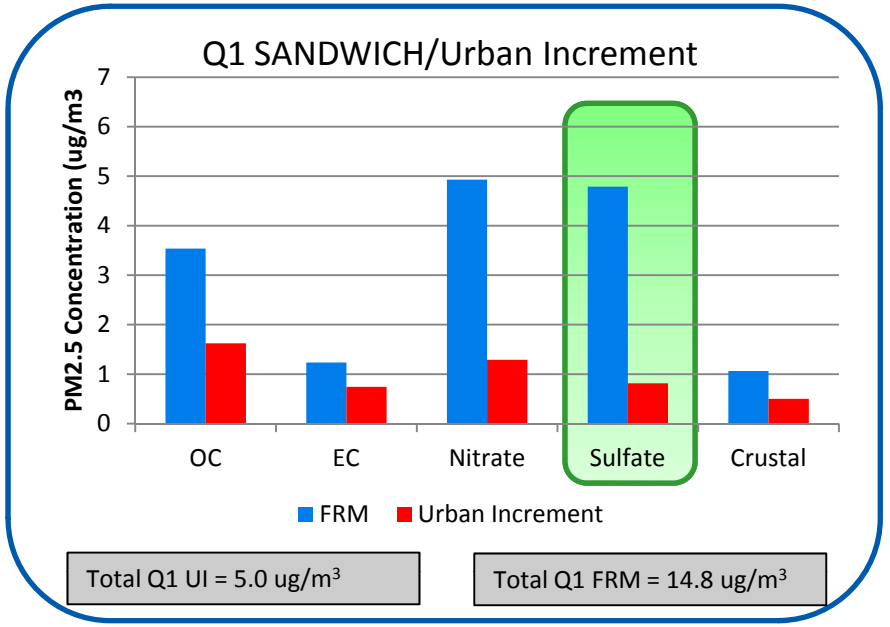


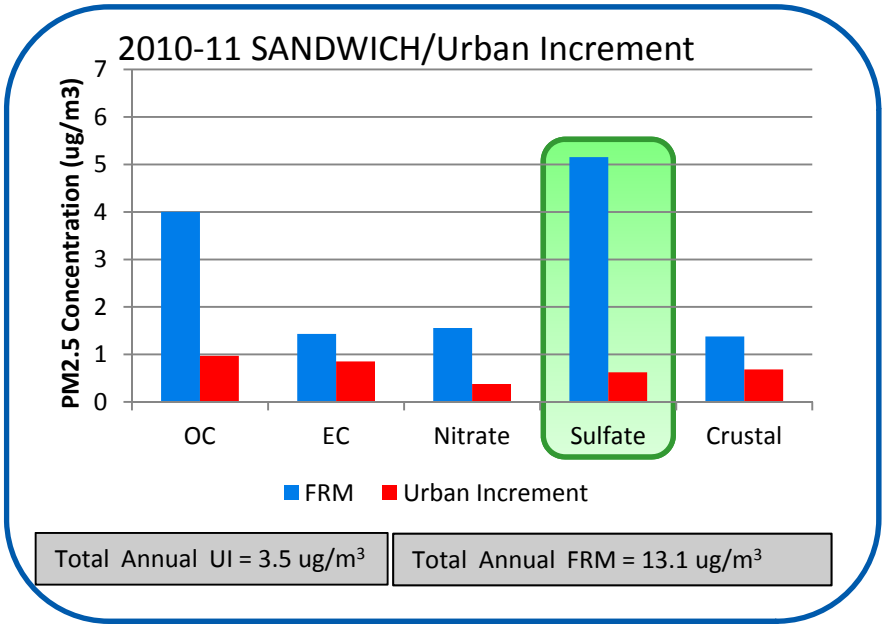


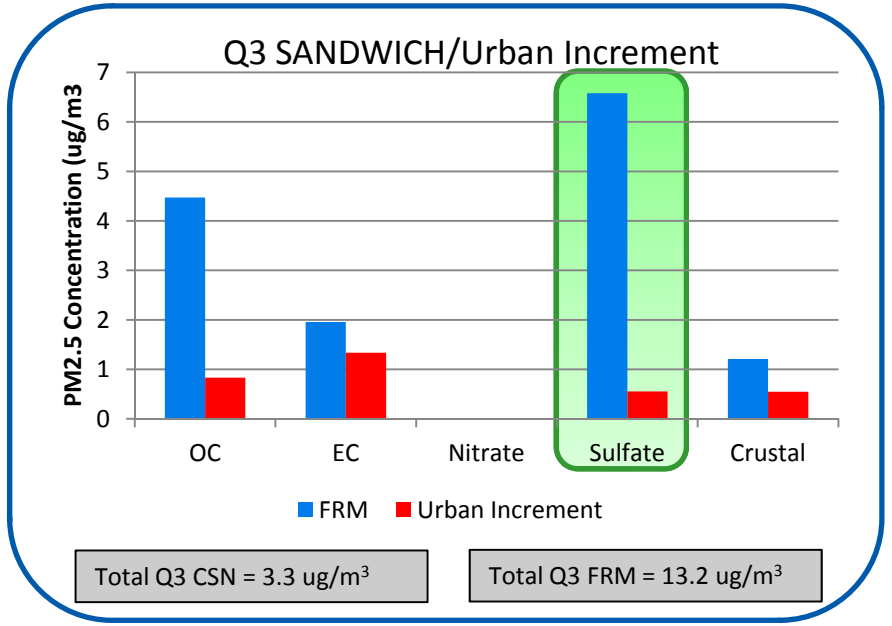


Factor 1: Air Quality
Urban Increment Analysis Values vs. DV Monitor SANDWICH (FRM)Values
Cleveland CBSA

- High Urban Increments for OC and EC
- Sulfate has modest Urban Increments *Consider local influence.*

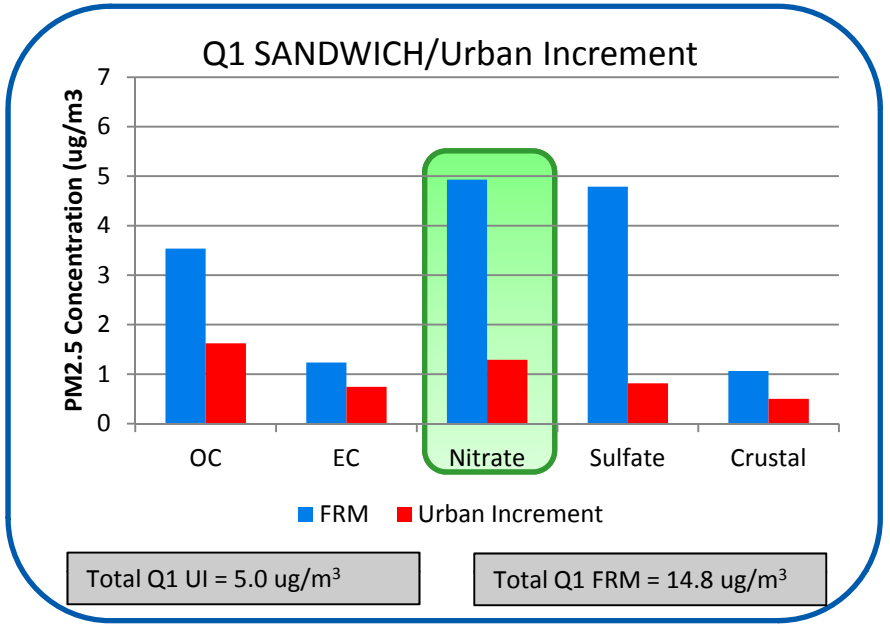


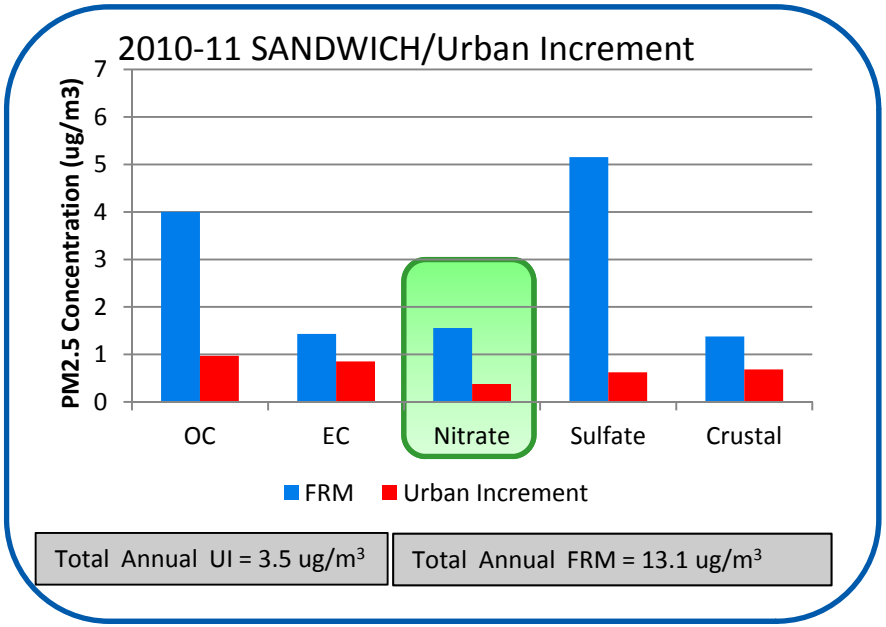


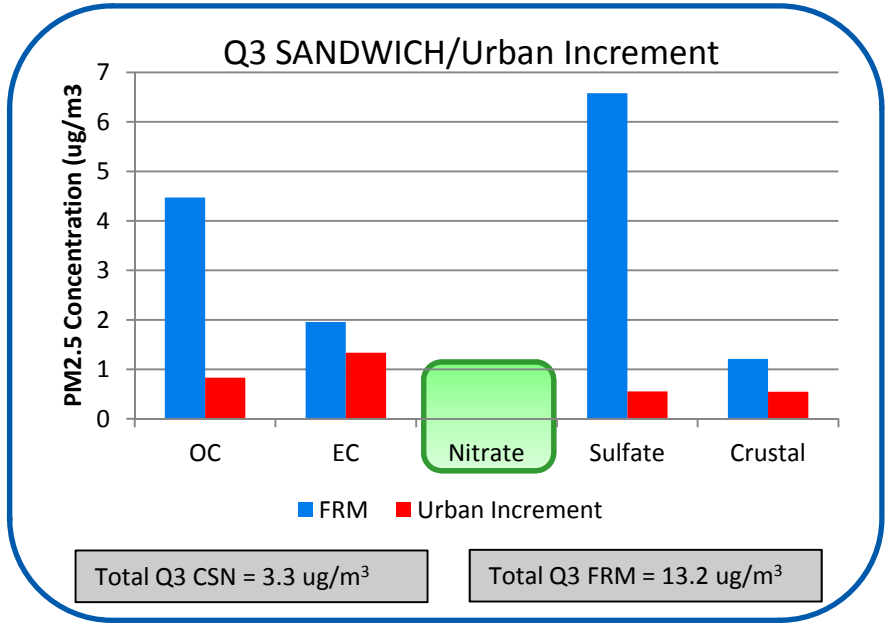


Factor 1: Air Quality
Urban Increment Analysis Values vs. DV Monitor SANDWICH (FRM)Values
Cleveland CBSA

- High Urban Increments for OC and EC
- Sulfate has modest Urban Increments *Consider local influence.*
- Increased UI nitrate in Q1 peak (winter). No UI nitrate in Q3 peak (summer). *Consider winter NOx contributions.*







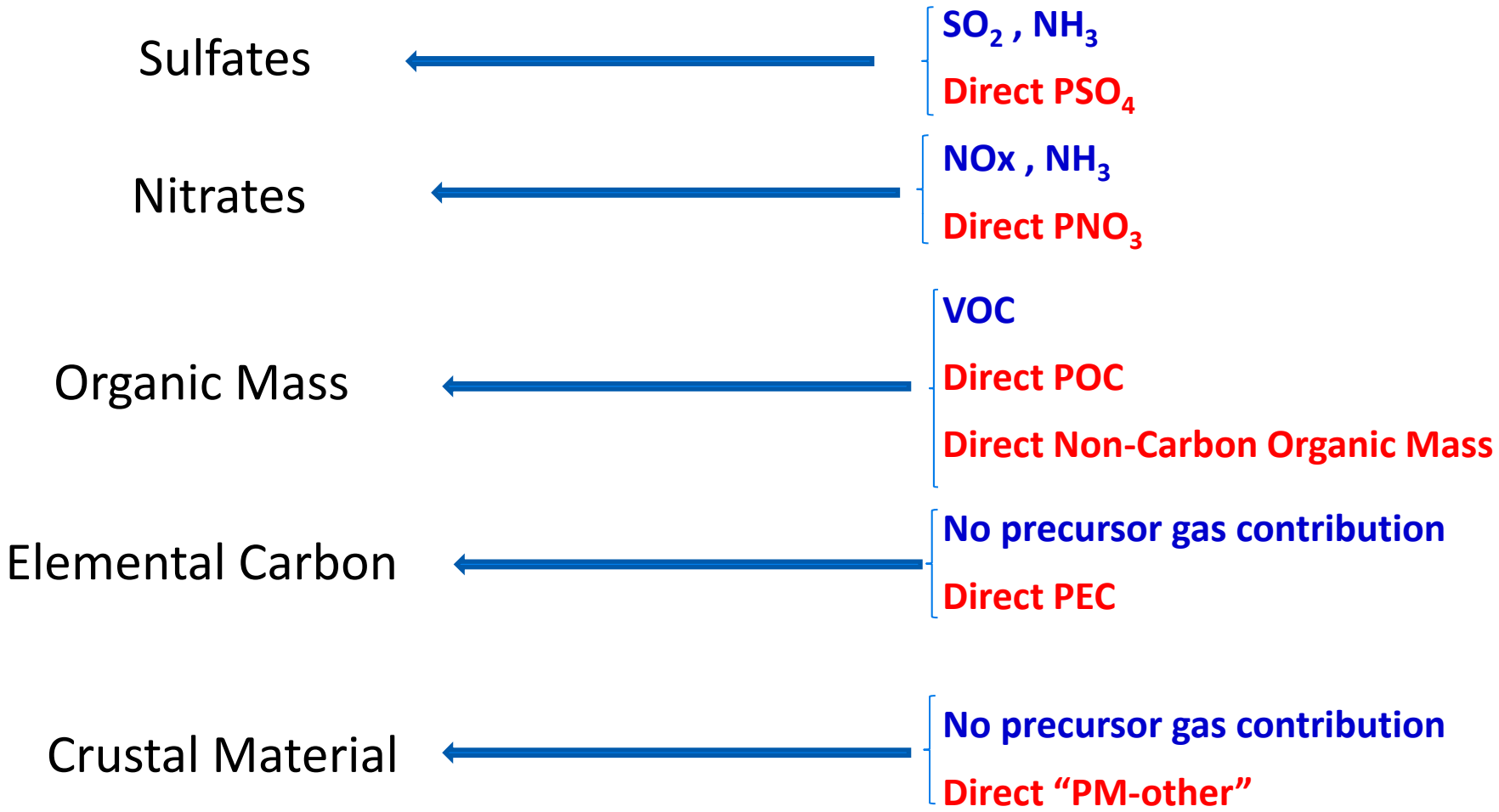
Assessment of Factor 1: Air Quality Data Analysis

- ***Cuyahoga and Summit Counties:*** Each has one or more monitor's DV exceeding NAAQS.
- There are clear seasonal peaks in ambient PM2.5 in Q1 and Q3.
- ***Portage and Lake Counties: E***ach has at least two quarters during 2009-2011 that exceed NAAQS level of 12.0 ug/m3.
- Urban Increment analysis:
  - Sulfate component appears to have small UI, therefore large regional contribution. *Consider local influences*.
  - Nitrate is second highest UI component for the peak Q1, but not a factor in Q3 peak season. *Consider contributions of NOx emissions and available ammonia.*
  - EC and Crustal combined for over 40% of annual average UI for Cleveland. *Consider local PM2.5 source contributions.*

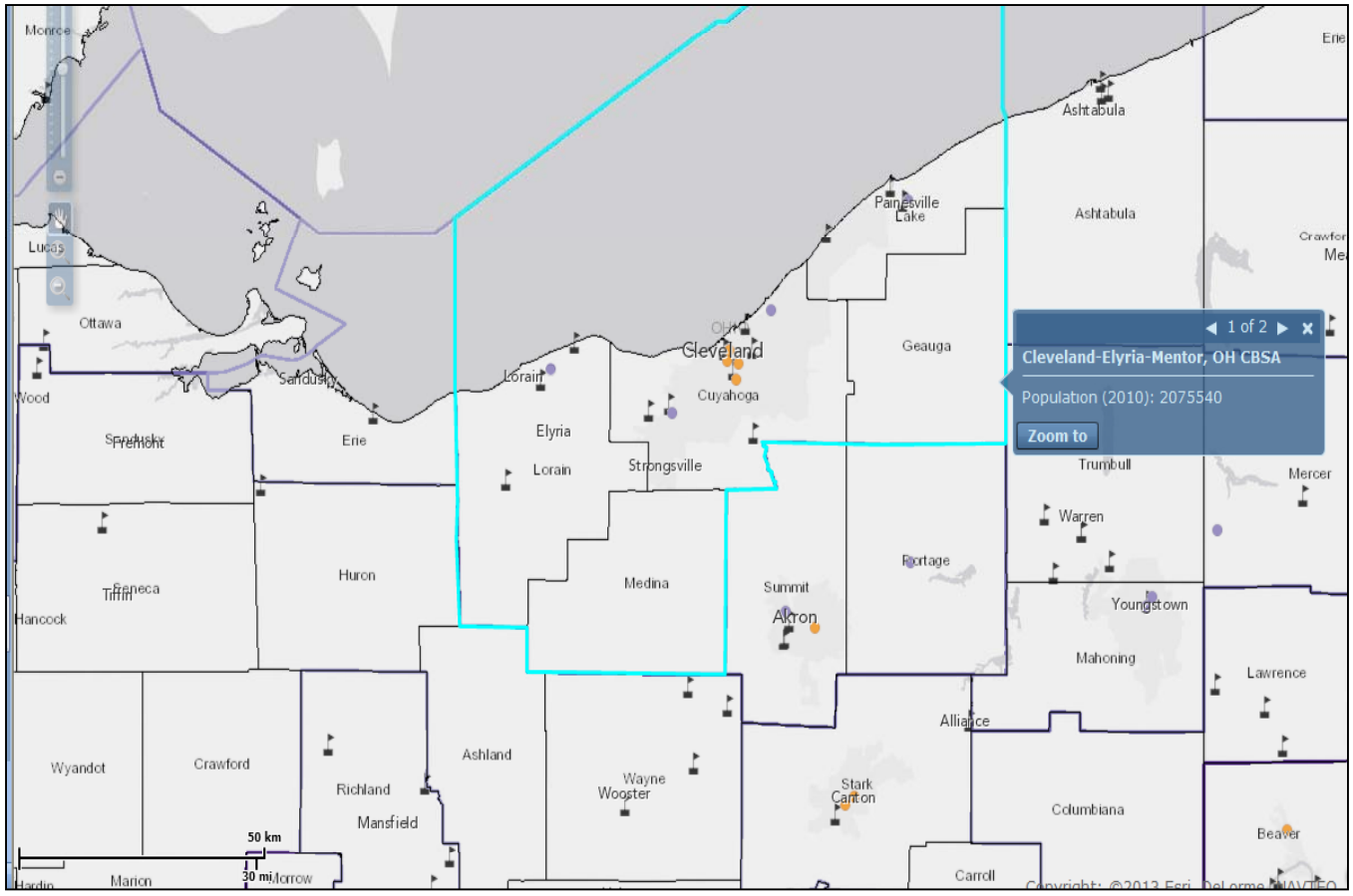
Ambient to Emission Connections

PM2.5 components on Filter (Ambient Measurement)

Emissions: Precursor gases
Direct $PM_{2.5}$



Factor 2: Emissions and Emissions Related Data – Major Point Sources (2011 NEI)



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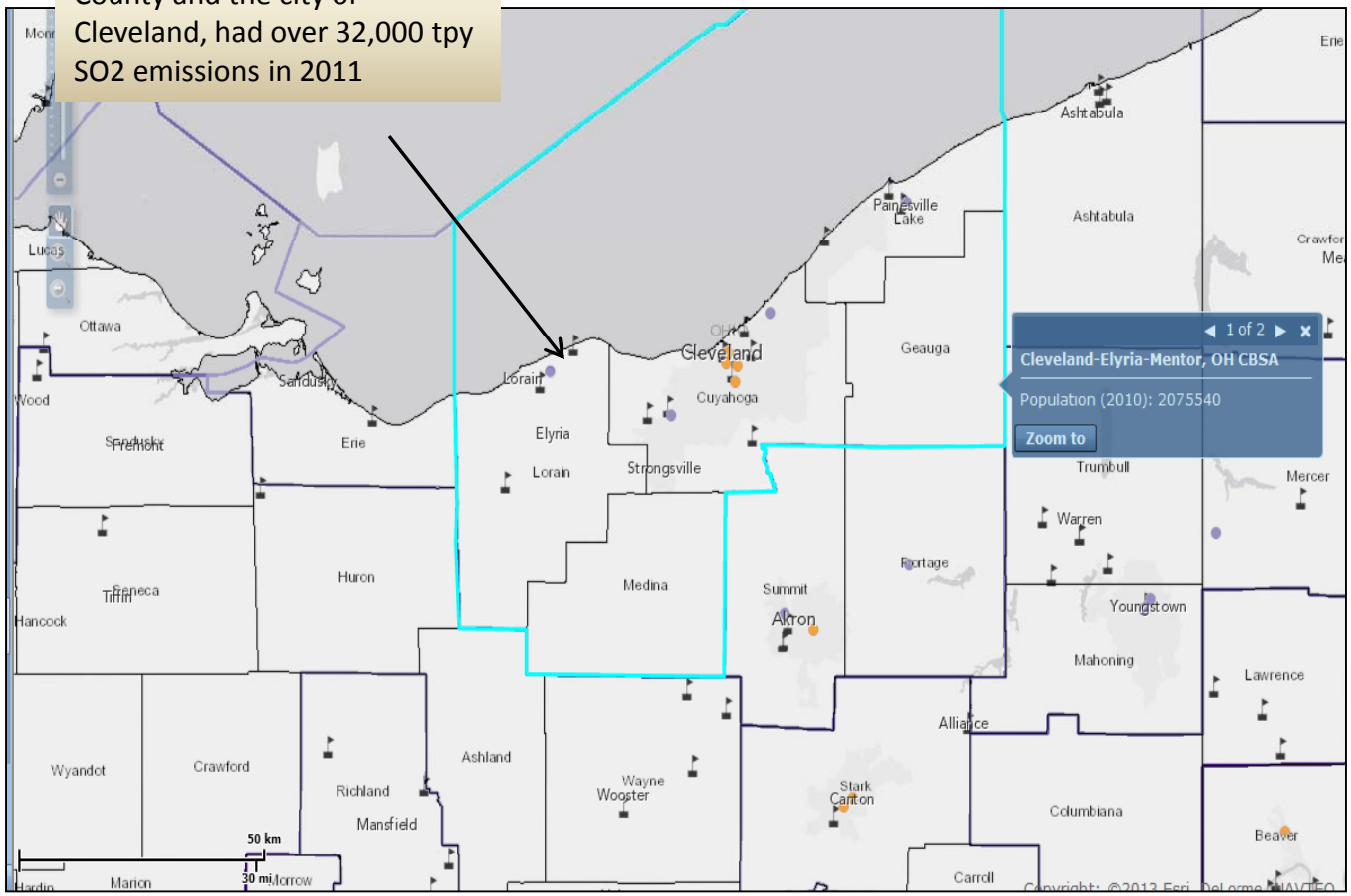
Factor 2: Emissions and Emissions Related Data – Major Point Sources (2011 NEI)

Avon Lake Power Company in northern Lorain County, immediately west of Cuyahoga County and the city of Cleveland, had over 32,000 tpy SO2 emissions in 2011



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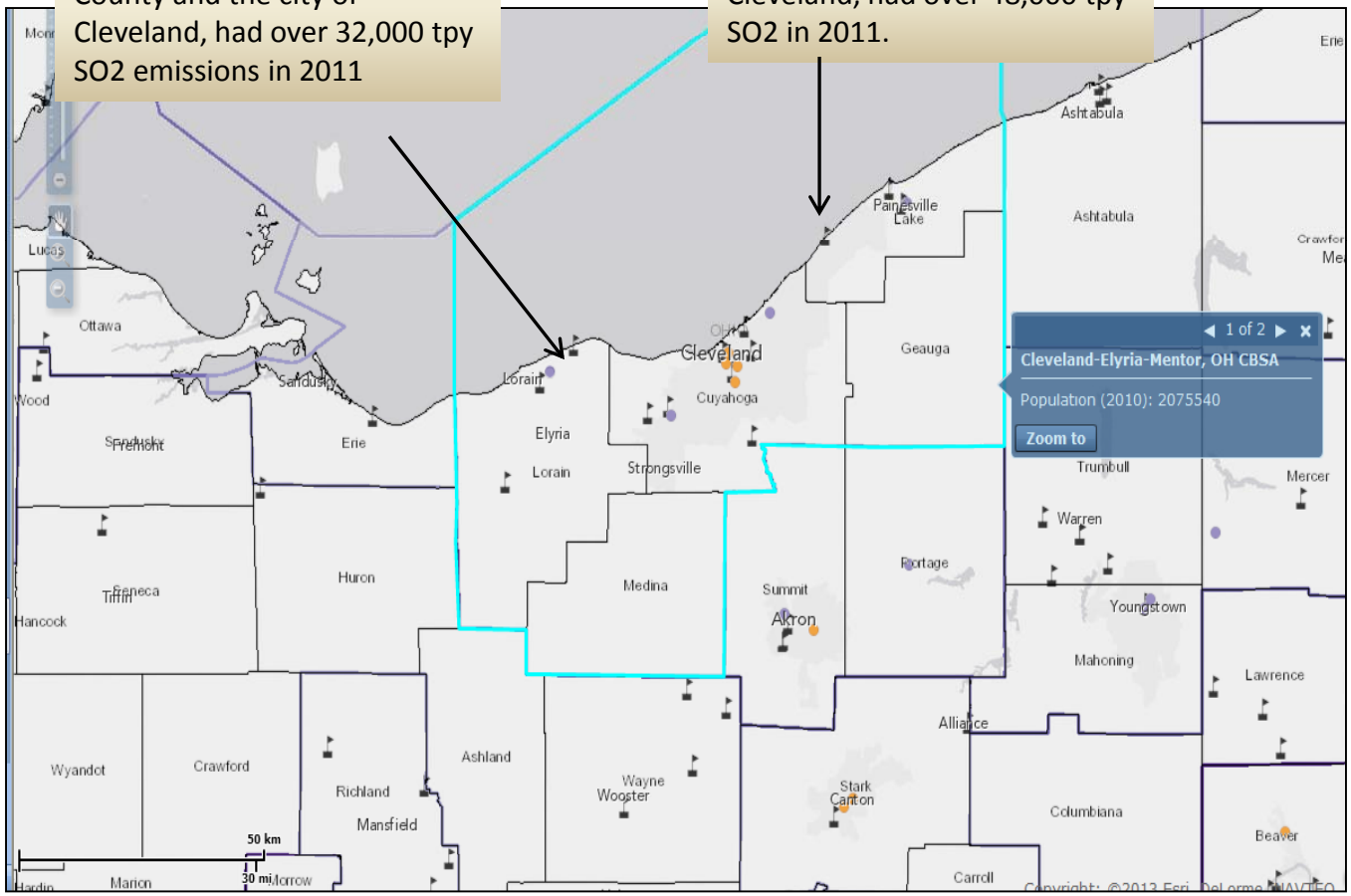

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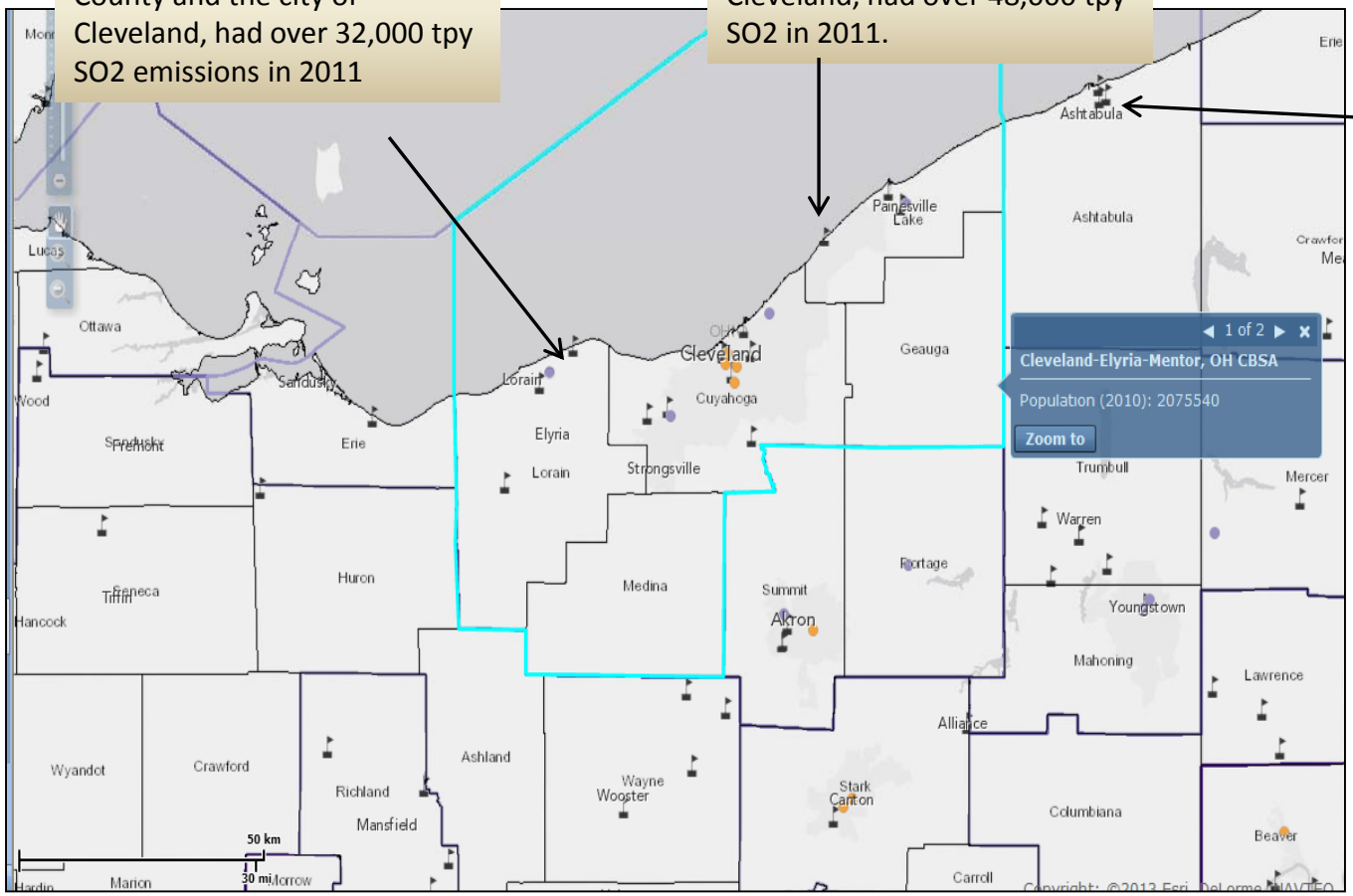
In northern Ashtabula County, FirstEnergy Generation Corp. power plant with over 3,400 tpy SO2 emissions in 2011 and two Millennium Inorganic Chemicals plants with close to 2,500 tpy total VOC in 2011.



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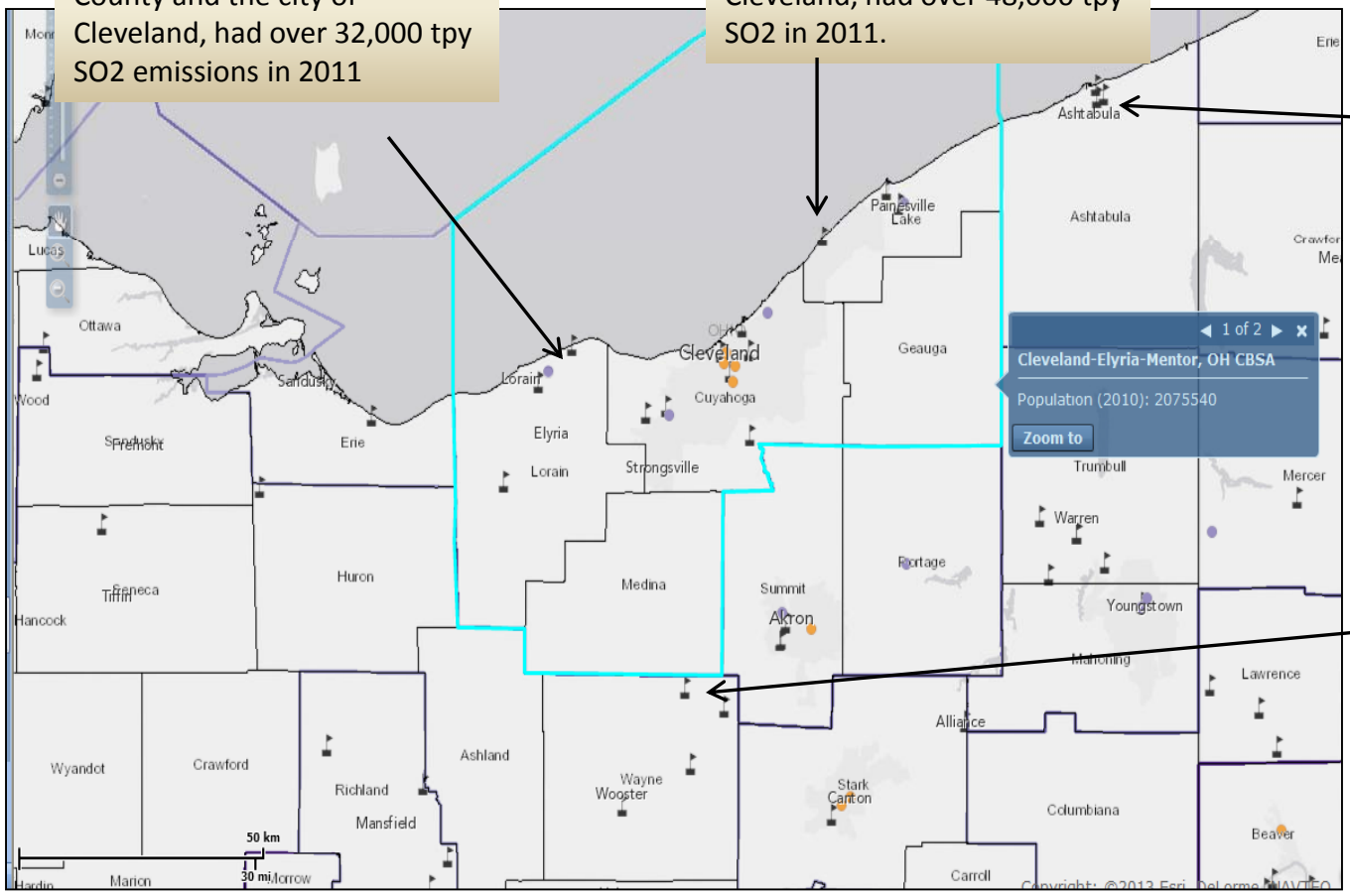

Wayne County, southwest of Akron, two large point sources in the northeast portion of the county, including City of Orrville Dept of Utilities (over 13,000 tpy SO2 in 2011) and Morton Salt Inc with over 4,000 tpy SO2.

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Factor 2: Emissions and Emissions Related Data (2008 NEI)

Pollutants reviewed linked to earlier urban increment results for PM2.5 composition: NOX and SO2

NOX Total Emissions

County	Tons/year	Percent	Cumulative
Cuyahoga	42,449	28.7%	28.7%
Lake	20,420	13.8%	42.5%
Summit	17,754	12.0%	54.5%
Stark	17,754	12.0%	66.6%
Lorain	16,164	10.9%	77.5%
Ashtabula	9,479	6.4%	83.9%
Wayne	8,020	5.4%	89.3%
Portage	6,821	4.6%	94.0%
Medina	6,243	4.2%	98.2%
Geauga	2,695	1.8%	100.0%

NOX Stationary Emissions

County	Tons/year	Percent	Cumulative
Lake	13,892	23.0%	23.0%
Lorain	10,443	17.3%	40.3%
Wayne	9,663	16.0%	56.3%
Ashtabula	7,626	12.6%	69.0%
Cuyahoga	6,311	10.5%	79.4%
Geauga	4,164	6.9%	86.3%
Summit	2,947	4.9%	91.2%
Portage	2,460	4.1%	95.3%
Medina	2,381	3.9%	99.2%
Stark	456	0.8%	100.0%

NOX Mobile Emissions

County	Tons/year	Percent	Cumulative
Cuyahoga	28,557	32.7%	32.7%
Summit	14,109	16.1%	48.8%
Stark	10,128	11.6%	60.4%
Lorain	7,311	8.4%	68.7%
Lake	6,501	7.4%	76.2%
Portage	5,315	6.1%	82.2%
Medina	5,073	5.8%	88.0%
Ashtabula	4,361	5.0%	93.0%
Wayne	3,862	4.4%	97.4%
Geauga	2,239	2.6%	100.0%

SO2 Total Emissions

County	Tons/year	Percent	Cumulative
Lake	59,429	44.9%	44.9%
Lorain	23,447	17.7%	62.6%
Wayne	21,884	16.5%	79.2%
Cuyahoga	11,460	8.7%	87.8%
Summit	5,278	4.0%	91.8%
Stark	5278	4.0%	95.8%
Ashtabula	4,690	3.5%	99.4%
Portage	292	0.2%	99.6%
Medina	292	0.2%	99.8%
Geauga	268	0.2%	100.0%

SO2 Stationary Emissions

County	Tons/year	Percent	Cumulative
Lake	59,188	45.0%	45.0%
Lorain	23,337	17.7%	62.7%
Wayne	21,808	16.6%	79.3%
Cuyahoga	11,392	8.7%	87.9%
Summit	5,238	4.0%	91.9%
Stark	5,225	4.0%	95.9%
Ashtabula	4,652	3.5%	99.4%
Portage	265	0.2%	99.6%
Medina	263	0.2%	99.8%
Geauga	249	0.2%	100.0%

SO2 Mobile Emissions

County	Tons/year	Percent	Cumulative
Cuyahoga	241	34.4%	34.4%
Summit	110	15.7%	50.1%
Stark	76	10.8%	60.9%
Lorain	68	9.7%	70.6%
Lake	53	7.5%	78.2%
Medina	40	5.7%	83.8%
Portage	38	5.4%	89.3%
Ashtabula	29	4.1%	93.4%
Wayne	27	3.9%	97.3%
Geauga	19	2.7%	100.0%

Factor 2: Emissions and Emissions Related Data (2008 NEI)

Pollutants reviewed linked to earlier urban increment results for PM2.5 composition: OC+EC

OC + EC Total Emissions

County	Tons/year	Percent	Cumulative
Cuyahoga	3,766	28.6%	28.6%
Summit	1,630	12.4%	41.0%
Stark	1630	12.4%	53.3%
Lake	1,187	9.0%	62.4%
Lorain	1,048	8.0%	70.3%
Portage	900	6.8%	77.1%
Medina	871	6.6%	83.8%
Wayne	808	6.1%	89.9%
Ashtabula	749	5.7%	95.6%
Geauga	582	4.4%	100.0%

OC + EC Stationary Emissions

County	Tons/year	Percent	Cumulative
Cuyahoga	2,564	26.9%	26.9%
Lake	1,240	13.0%	39.9%
Summit	1,043	10.9%	50.8%
Lorain	864	9.1%	59.9%
Portage	787	8.2%	68.1%
Wayne	672	7.0%	75.1%
Medina	656	6.9%	82.0%
Geauga	634	6.6%	88.7%
Ashtabula	604	6.3%	95.0%
Stark	478	5.0%	100.0%

OC + EC Mobile Emissions

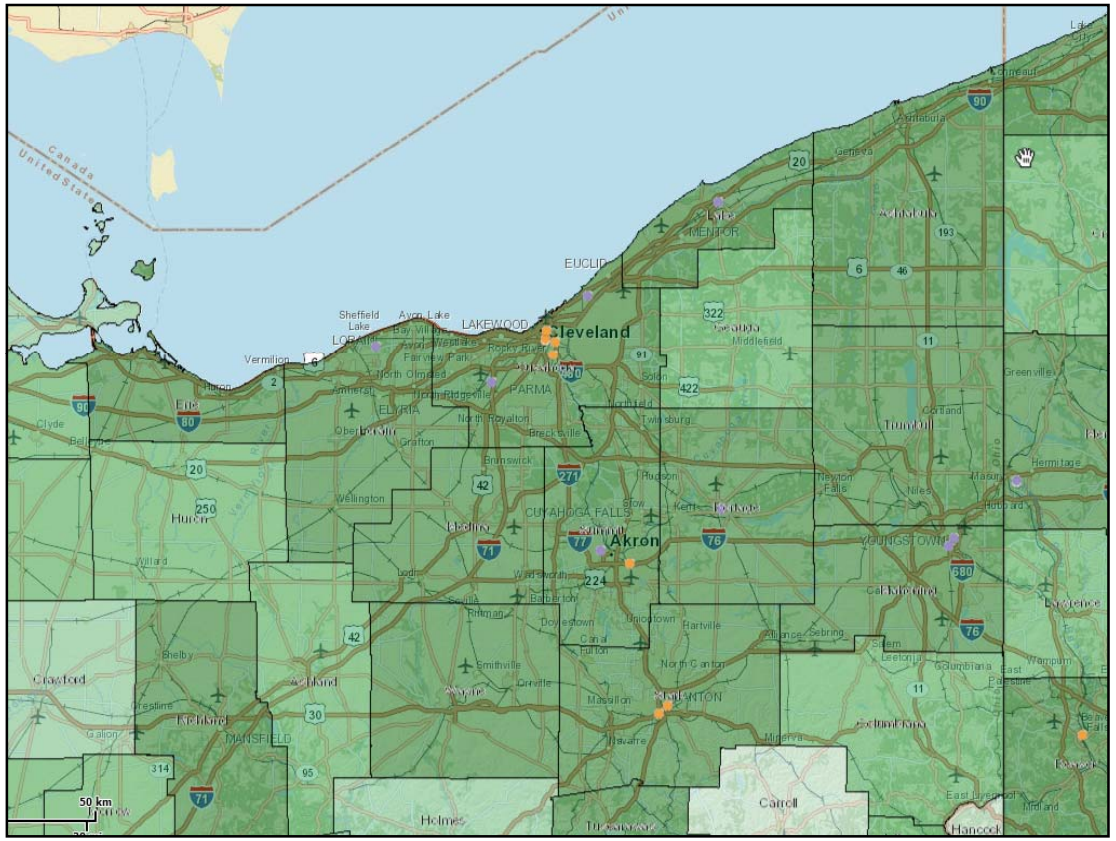
County	Tons/year	Percent	Cumulative
Cuyahoga	1,202	33.1%	33.1%
Summit	587	16.2%	49.3%
Stark	390	10.7%	60.0%
Lorain	323	8.9%	68.9%
Lake	261	7.2%	76.1%
Portage	228	6.3%	82.4%
Medina	215	5.9%	88.3%
Ashtabula	174	4.8%	93.1%
Wayne	145	4.0%	97.1%
Geauga	104	2.9%	100.0%

[OC and EC are large components of PM2.5 urban increment. Although tons are small, contribution can be large.]

Factor 2: Emissions and Emissions-related Data: Onroad Mobile VMT

County	VMT 2010	Percent	Cumulative
Cuyahoga	10,441,337,655	35%	35%
Summit	5,636,455,011	19%	54%
Stark	3,078,116,937	10%	64%
Lorain	2,435,782,506	8%	72%
Lake	2,172,294,290	7%	79%
Portage	1,703,175,680	6%	85%
Medina	1,580,013,546	5%	90%
Wayne	1,086,668,001	4%	94%
Ashtabula	1,071,810,361	4%	97%
Geauga	765,557,120	3%	100%

VMT associates mobile source emissions of NOX and VOCs and direct PM with probable locations of these emissions.

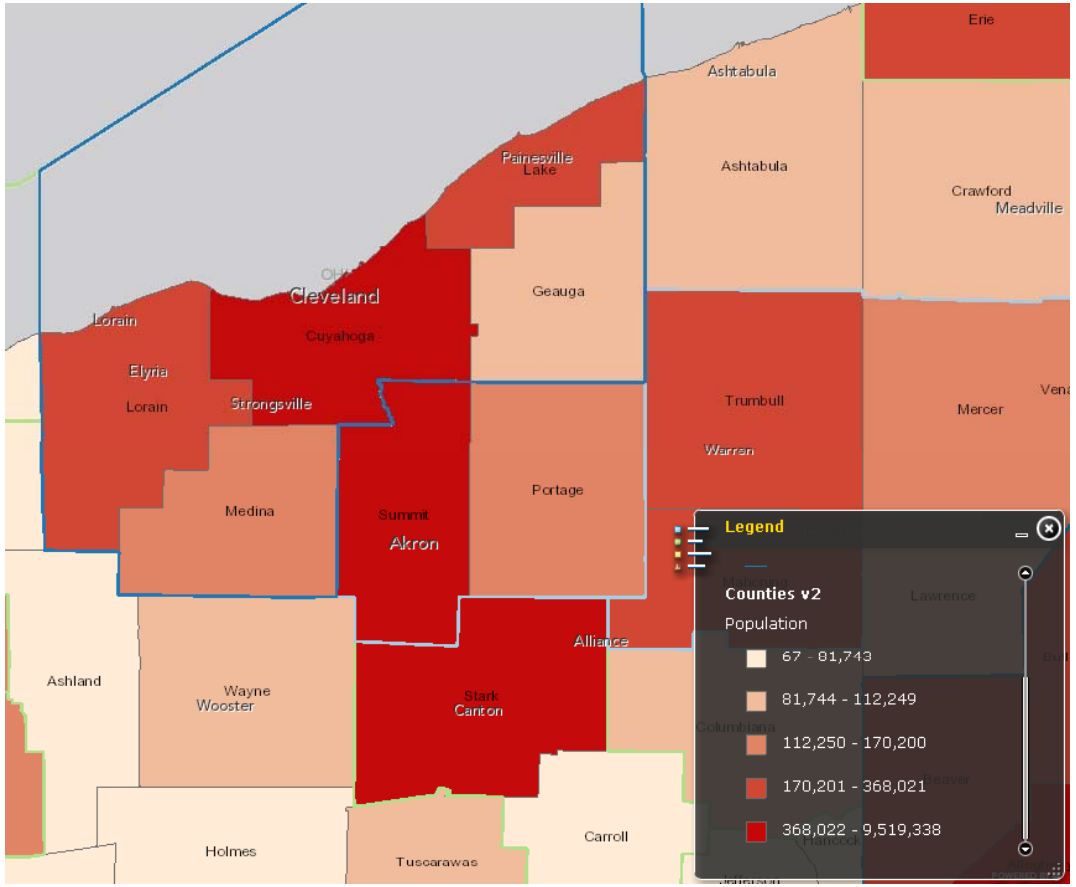


2010 County Level Annual VMT overlay of streets base map

Factor 2: Emissions and Emissions-related Data: Population

County	Pop Density per sq. mile	Pop. 2010	Percent	Cumulative
Cuyahoga	3,040	1,393,978	41%	41%
Summit	1,315	542,899	16%	56%
Stark	656	378,098	11%	67%
Lorain	578	284,664	8%	76%
Lake	997	227,511	7%	82%
Portage	309	152,061	4%	87%
Medina	358	151,095	4%	91%
Wayne	201	111,564	3%	94%
Ashtabula	146	102,728	3%	97%
Geauga	225	90,895	3%	100%

Population associates non-industrial emissions from human activity with probable locations of these emissions.



2010 County-level population

Assessment of Factor 2: Information on Emissions

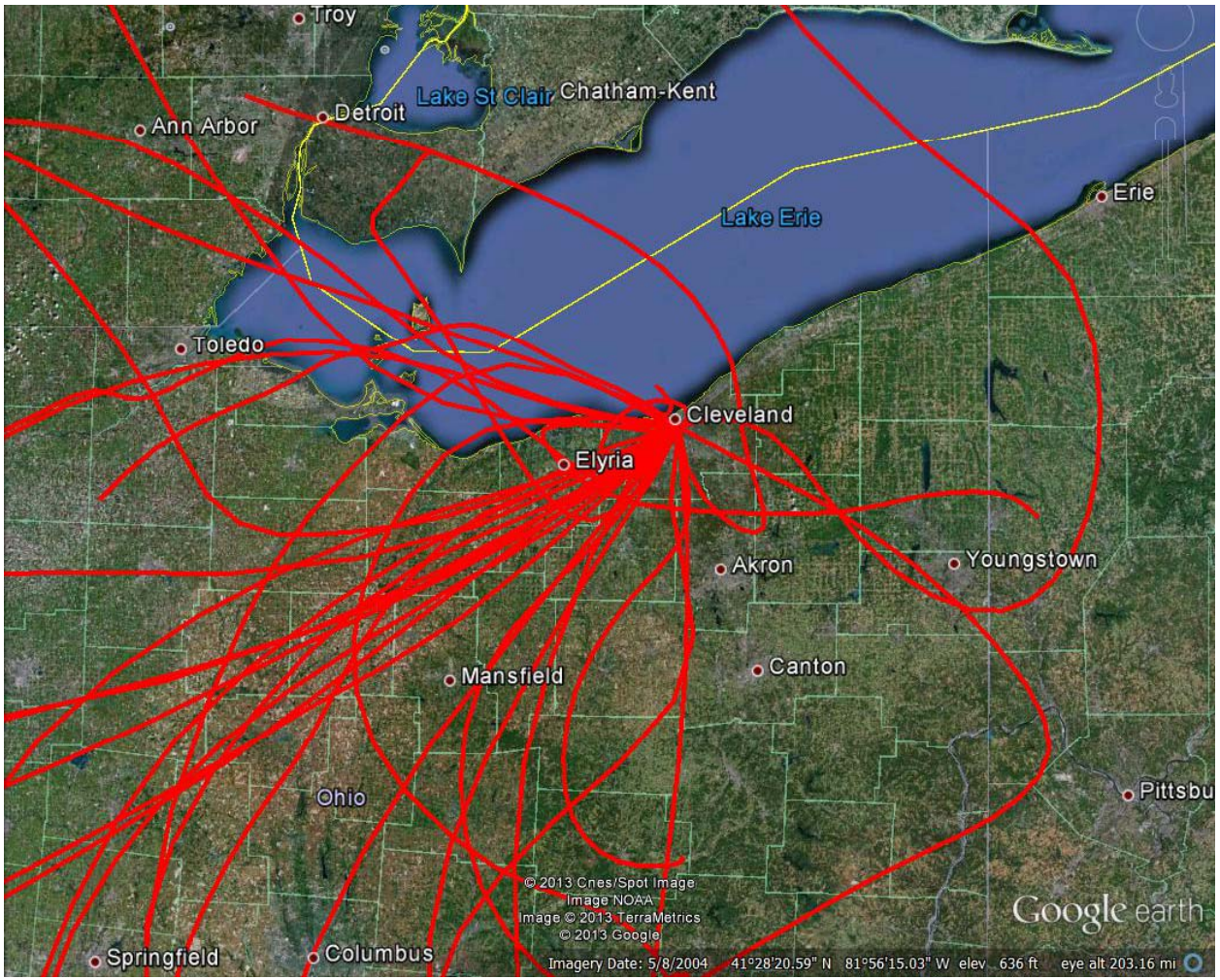
- ***Cuyahoga, Summit, Lake and Lorain*** consistently rank highest in direct PM2.5/key precursor emissions (VMT and population).
- ***Ashtabula*** contributed more than 12% of NOX and nearly 19% VOC emissions from stationary sources.
- ***Portage and Stark*** are mid-ranked in emissions and mid-ranked for population and VMT, having multiple interstates running through each county.
- ***Geauga*** has relatively low emissions and relatively low VMT/population counts, and lacks large singular point source contributors.

Factor 3: Meteorology – HYSPLIT

HYSPLIT backward-trajectories have been a useful part of meteorological analyses for designation determinations.

In this example, selected individual trajectories from 2009-2012 are shown.

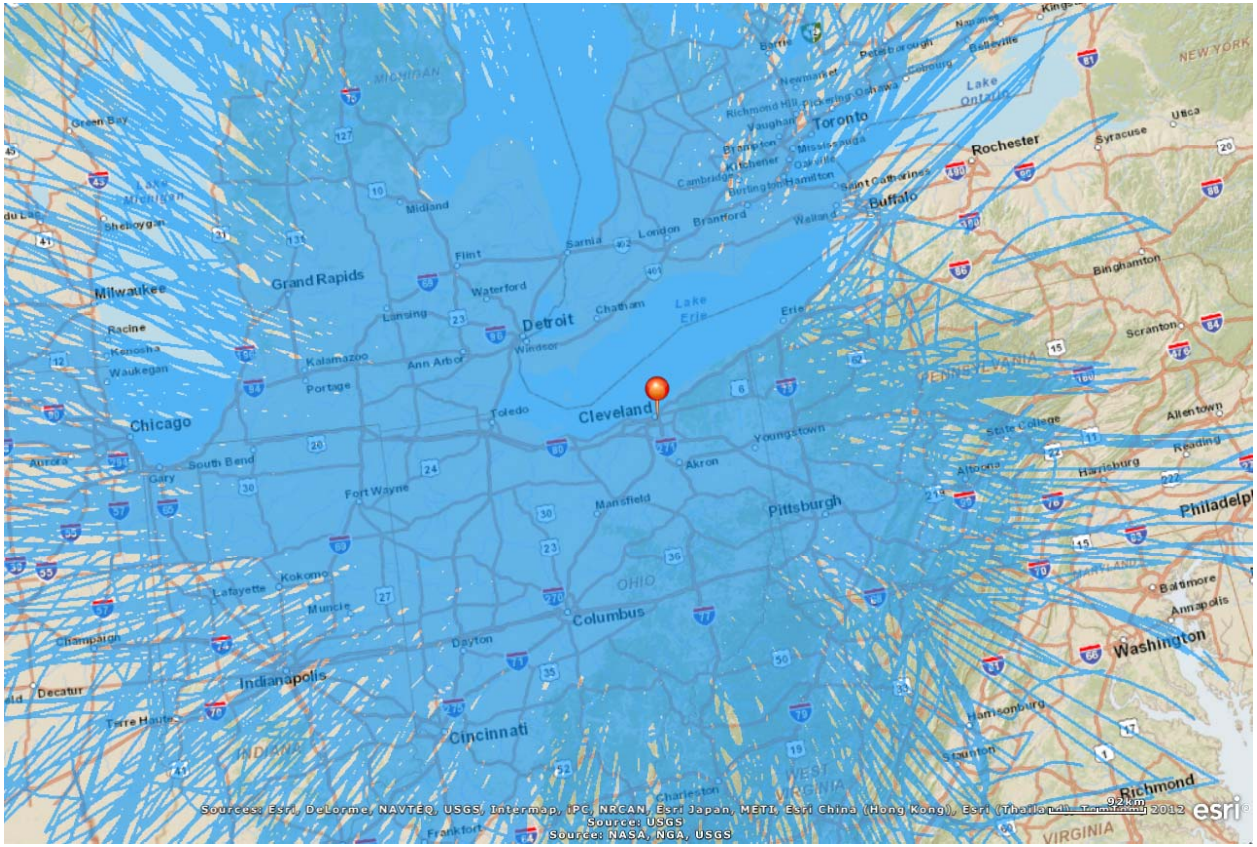
Examining subsets of individual trajectories is useful when considering an exceedance-based standard.



Factor 3: Meteorology – HYSPLIT

For an annual standard, however, every trajectory is important .

This image shows trajectories for the first quarters (Q1) of the years 2010-12.

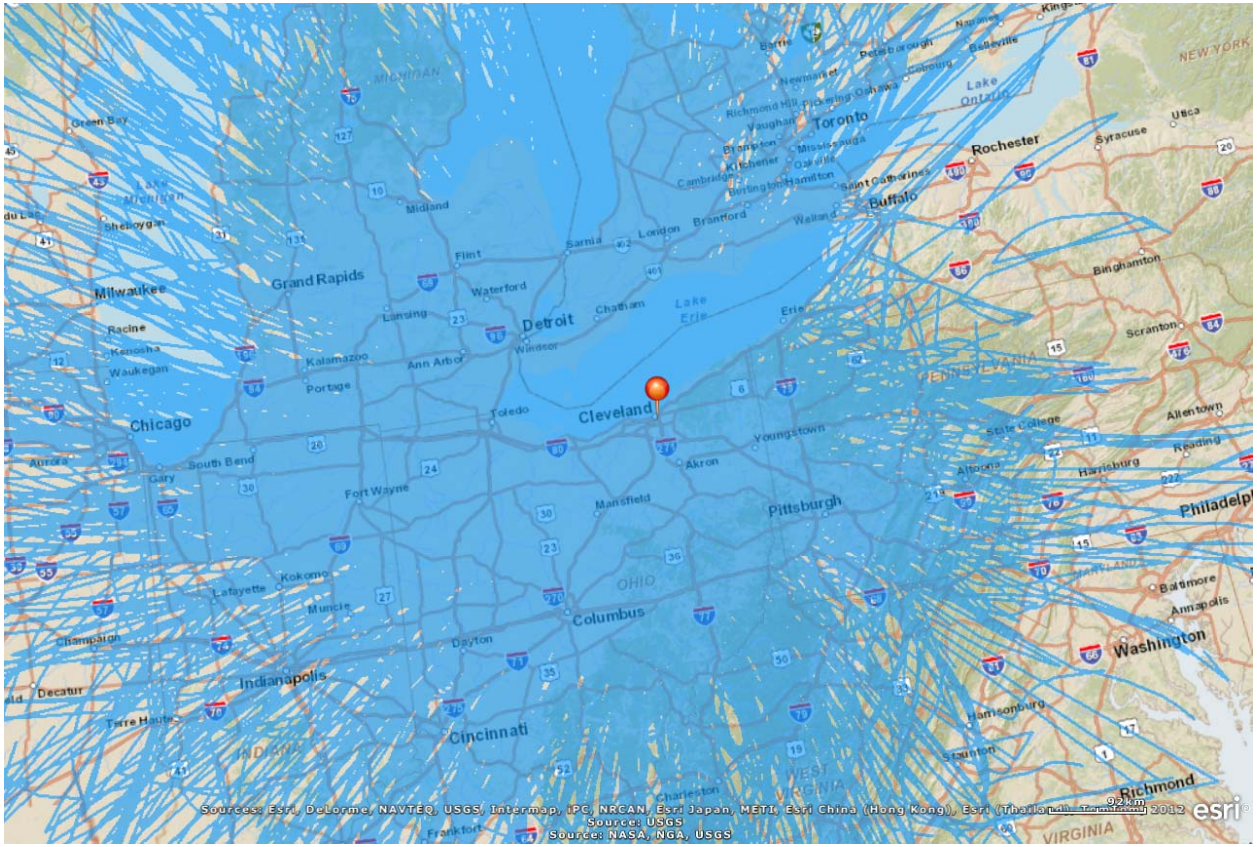


Factor 3: Meteorology – HYSPLIT

For an annual standard, however, every trajectory is important .

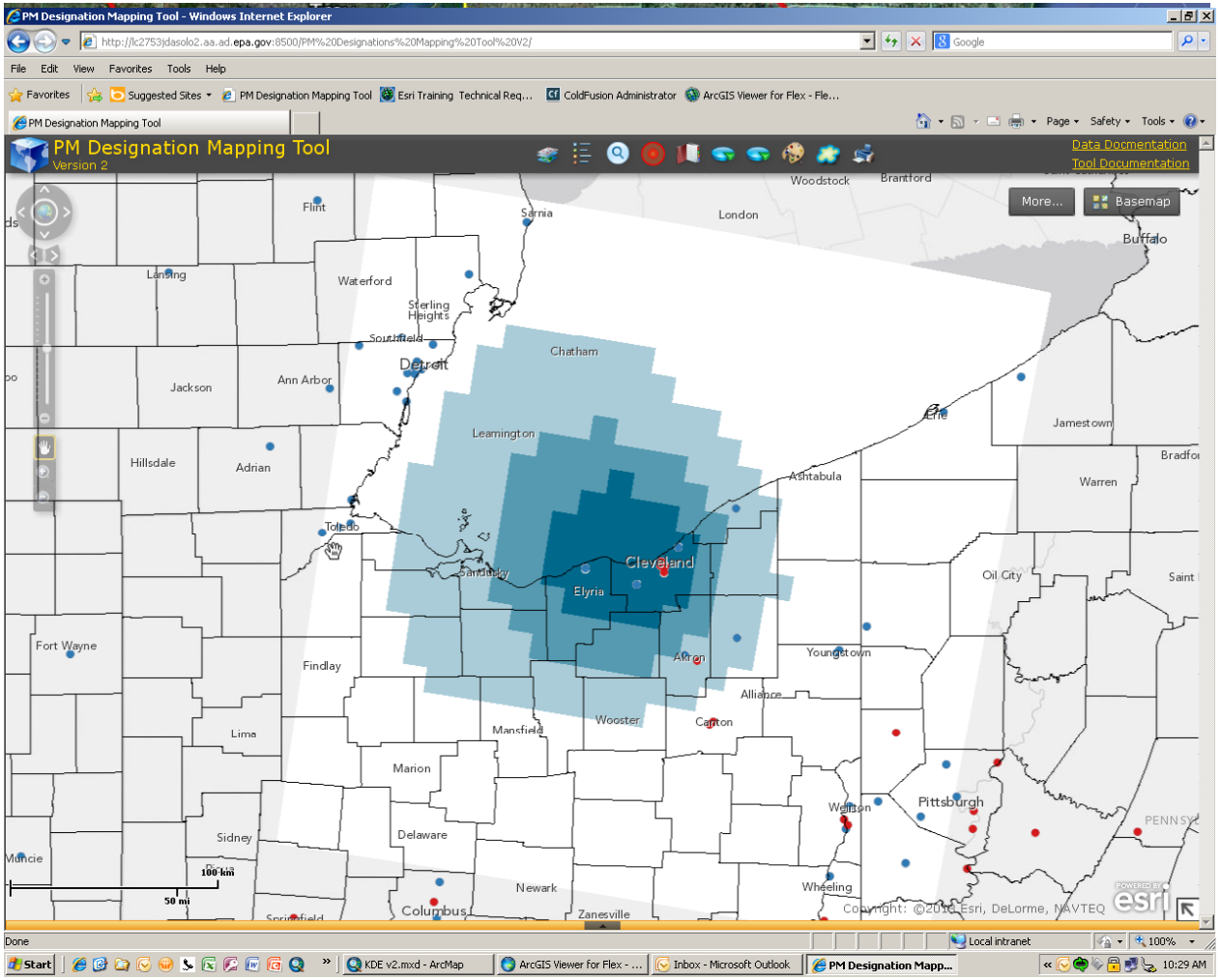
This image shows trajectories for the first quarters (Q1) of the years 2010-12.

Rather than plotting a mass of individual trajectories, a new visualization method helps analyze the same HYSPLIT results.



Factor 3: Meteorology – HYSPLIT
Kernel Density Estimation

- Statistical technique to determine the density of trajectory endpoints at a particular location usually for a grid cell.
- With a higher density value there is a greater frequency of observed trajectory endpoints within a particular grid cell.
- It can be inferred that a higher density also signifies a higher likelihood of a trajectory passing over a particular grid cell location.



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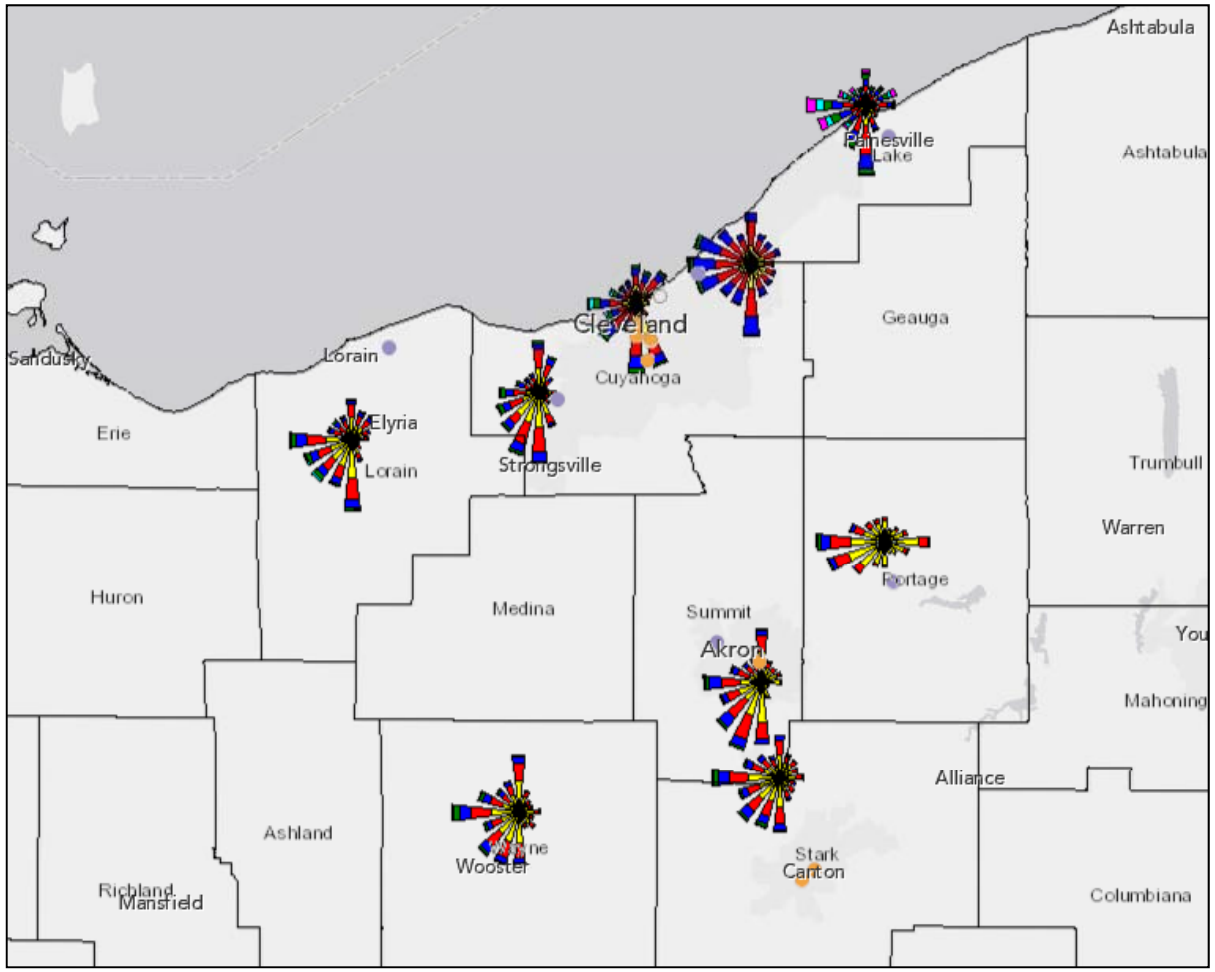
Factor 3: Meteorology – Wind roses

Wind roses have also been a useful part of meteorological analyses for designation determinations.

In this example, there is a pattern across CBSA of predominantly south to west winds, mostly at mid-level speeds of 4 to 10 m/s over the 2009-2011 design value period.

Most of the wind roses shown here suggest potential emission sources in the south-through-west upwind direction should be considered.



Assessment of Factor 3: Meteorology Information

- Influence on Cleveland monitor:
  - HYPSPLIT KDE plots and wind roses suggest greatest potential contribution of emissions from ***Cuyahoga, Lorain, Summit*** and ***Medina*** counties.
  - HYSPLIT KDE plots indicate low density value (KDE) in ***Ashtabula*** county.

- Influence on Akron monitor:
  - Wind rose data support greatest potential contribution of emissions from ***Summit***, ***Wayne, Stark, Medina, and Cuyahoga*** counties.
  - HYSPLIT trajectories and KDEs not included for Akron in this example.

Factors 4 & 5: Geography/Topography and Jurisdictional Boundaries

- There are no particular characteristics associated with geography or topography.

- Jurisdictional consideration will require further input by pertinent review authorities familiar with area.

Combined Assessment of 5 Factors (Cleveland-Akron)

County	Factor 1 Air Quality	Factor 2 Emissions	Factor 3 Met. Data	Factor 4 Geo/Topo	Factor 5 Jurisdict.
Cuyahoga					
Summit					
Lorain					
Lake					
Wayne					
Portage					
Ashtabula					
Medina					
Stark					
Geauga					

Questions? Need More Information?

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  - 919-541-5432 palma.elizabeth@epa.gov
- Pat Dolwick -- *PM Designation Process and Schedule*
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- Mark Evangelista -- *Air Quality, Meteorology, Geography/Topography*
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- Tesh Rao -- *Emissions*
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