

OVERVIEW OZONE AND PM_{2.5} CURRENT AIR QUALITY

Prepared and Presented By
Fred Dimmick and Neil Frank

With Help From
Mark Schmidt, Terence Fitz-Simons, and Tesh Rao

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Emissions, Monitoring and Analysis Division

Overview of Ozone and PM_{2.5} Air Quality

- **What are the Ozone and PM_{2.5} NAAQS?**
- **Where are the Ozone and PM_{2.5} problems ?**
- **What are the sources of atmospheric Ozone and PM_{2.5} & what chemicals make up PM_{2.5} ?**
- **What trends have been seen in recent years ?**
- **What about transport of Ozone and PM_{2.5} ?**

Most Recent Ozone and PM Standards

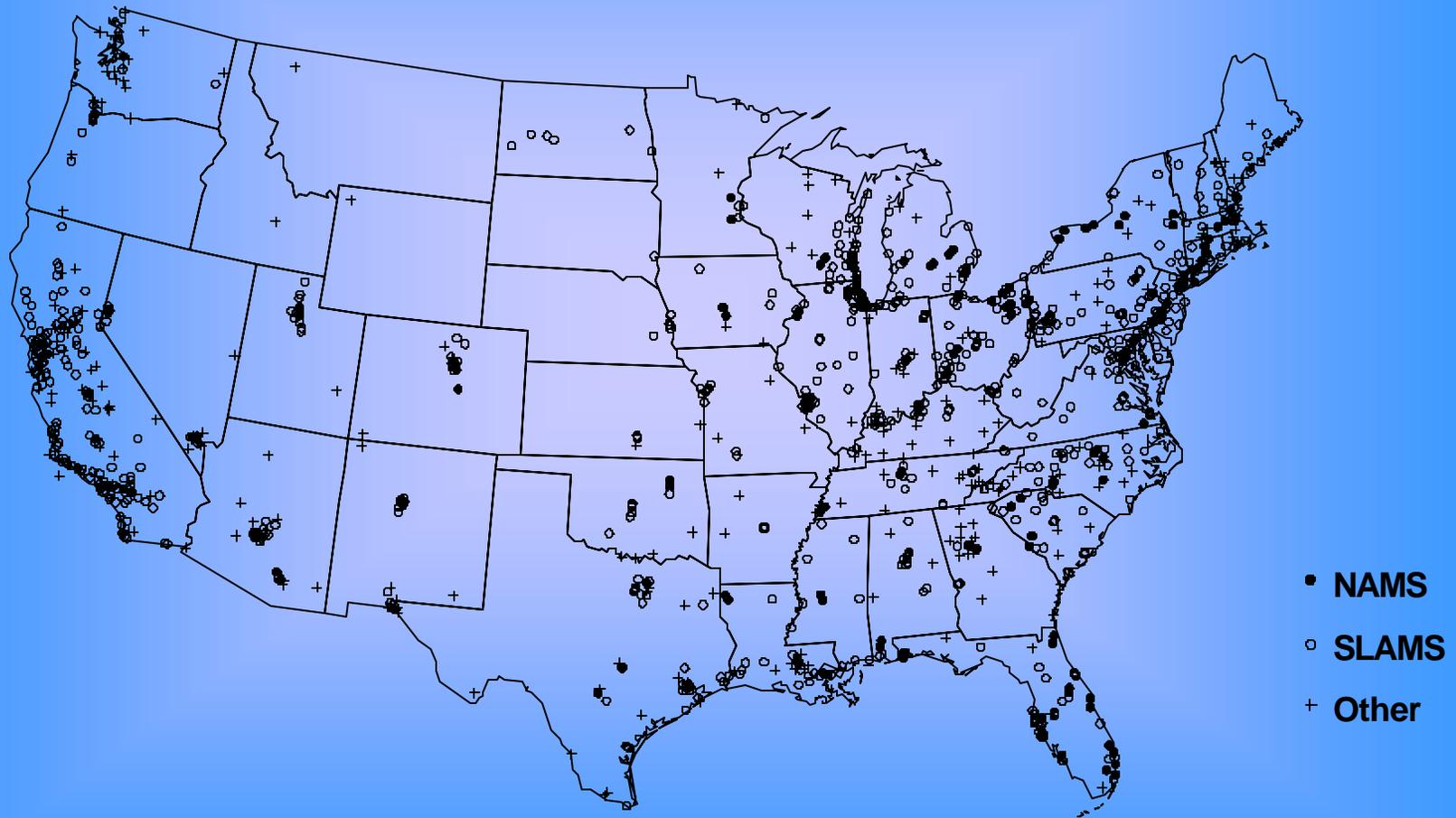
- 8-hr Ozone (1997)
 - Form: 4th daily max
 - Level = 0.08 ppm
 - Attain: 3-year average 4th daily max < 0.085 ppm
- Annual PM_{2.5} (1997)
 - Form: Annual Arithmetic Mean
 - Level: 15.0 ug/m³
 - Attain: 3-year average < 15.05
- 24-hr PM_{2.5} (1997)
 - Form: 98th percentile
 - Level = 65 ug/m³
 - Attain: 3-year average 98th percentile < 65.5 ug/m³

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We also have a regional haze rule (1999)

Federal, State, Tribal, and Local Monitoring of Ozone Has Been Extensive



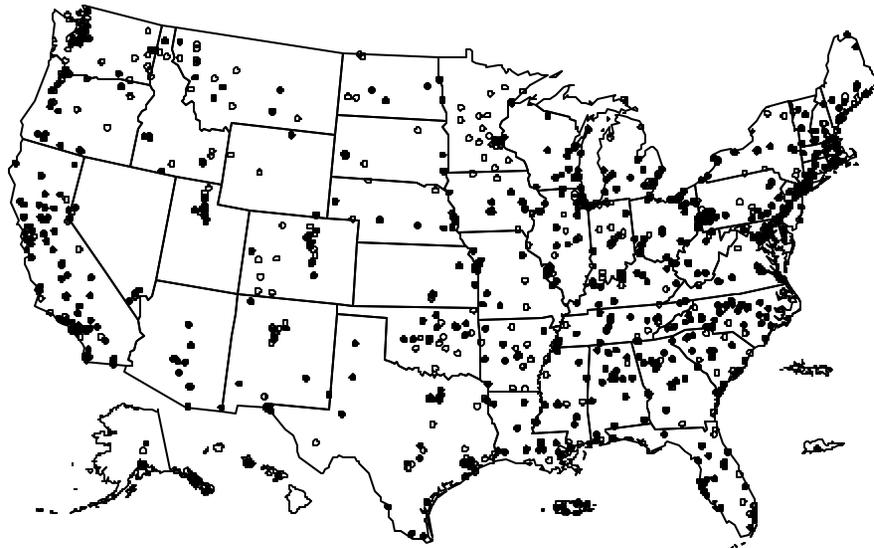
Ozone Monitoring Network (1999)

PM_{2.5} networks are very extensive

Monitoring for mass and chemical composition

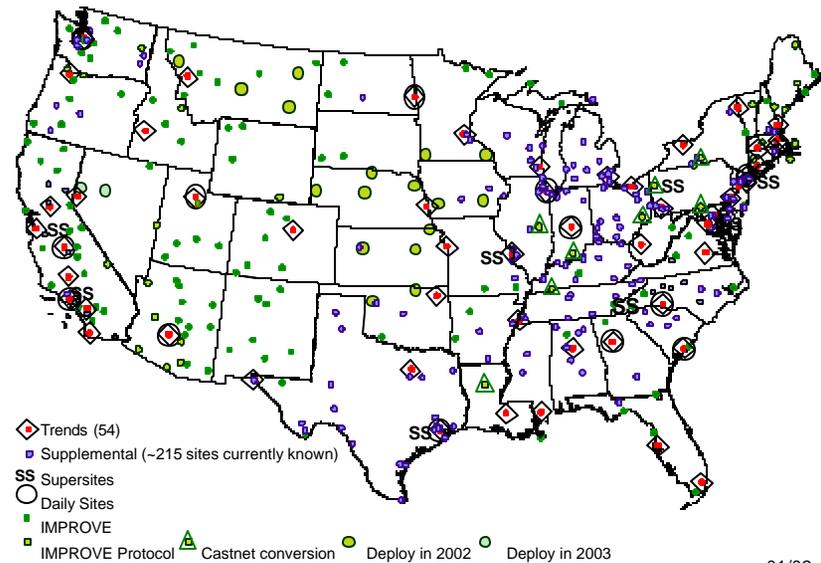
1999-2001 PM_{2.5} Monitoring Sites

Data from AQS 7/8/02. Sites that operated anytime 1999-2001 (n = 1202).



- Operated all 12 quarters [763]
- Incomplete; did not operate all 12 quarters [439]

Current/Planned Urban & Rural PM_{2.5} Speciation Networks



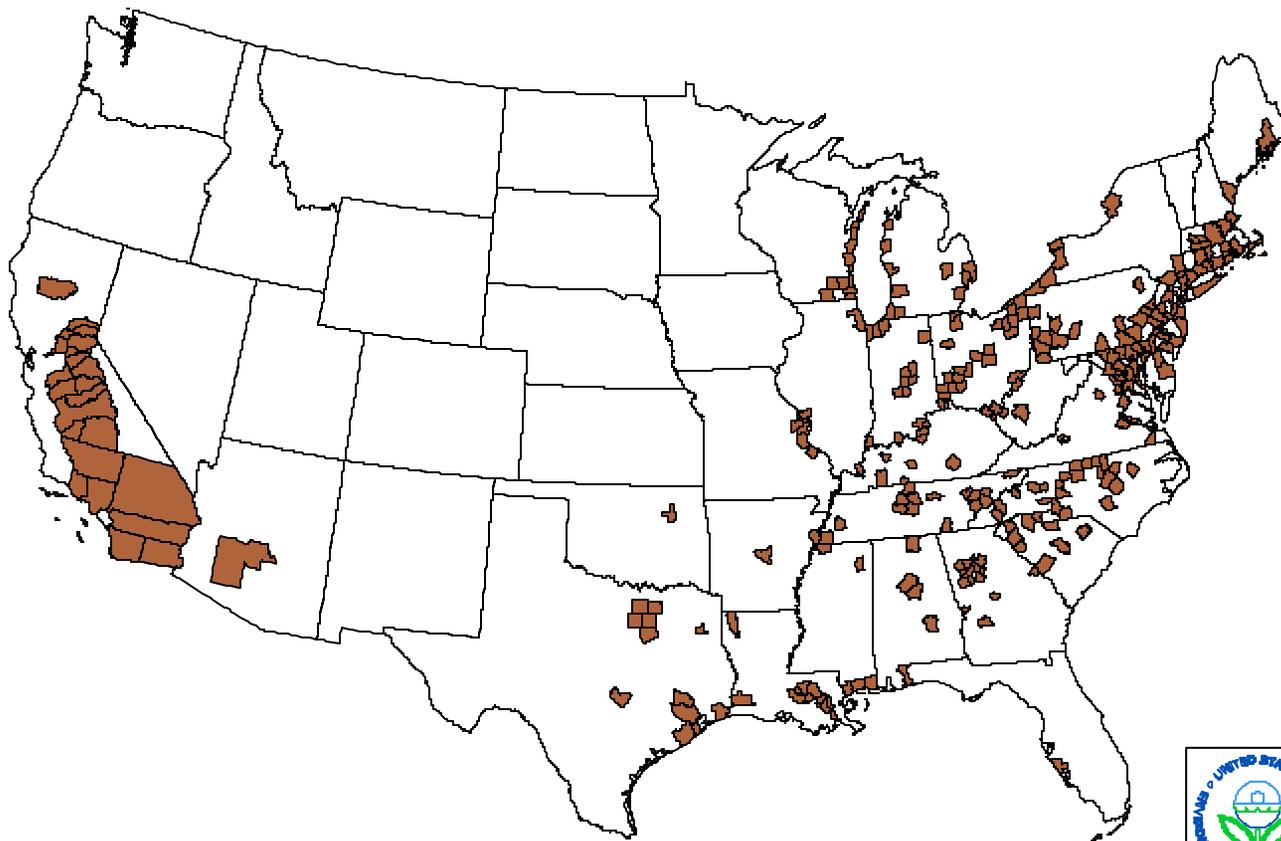
- ◇ Trends (54)
- Supplemental (~215 sites currently known)
- SS Supersites
- Daily Sites
- IMPROVE
- ▲ Castnet conversion
- Deploy in 2002
- Deploy in 2003

WHERE DO WE FIND OZONE, PM2.5 AND HAZE PROBLEMS

- ... across the nation
- ... urban areas – AQI levels
- ... rural areas – haze and welfare O3 effects
- ... urban – rural differences for PM2.5

Levels exceeding 8-hr O₃ NAAQS are found in CA, AZ, TX and many areas in the Eastern Half of the US

Counties Violating 8-hour Ozone (1999-2001)



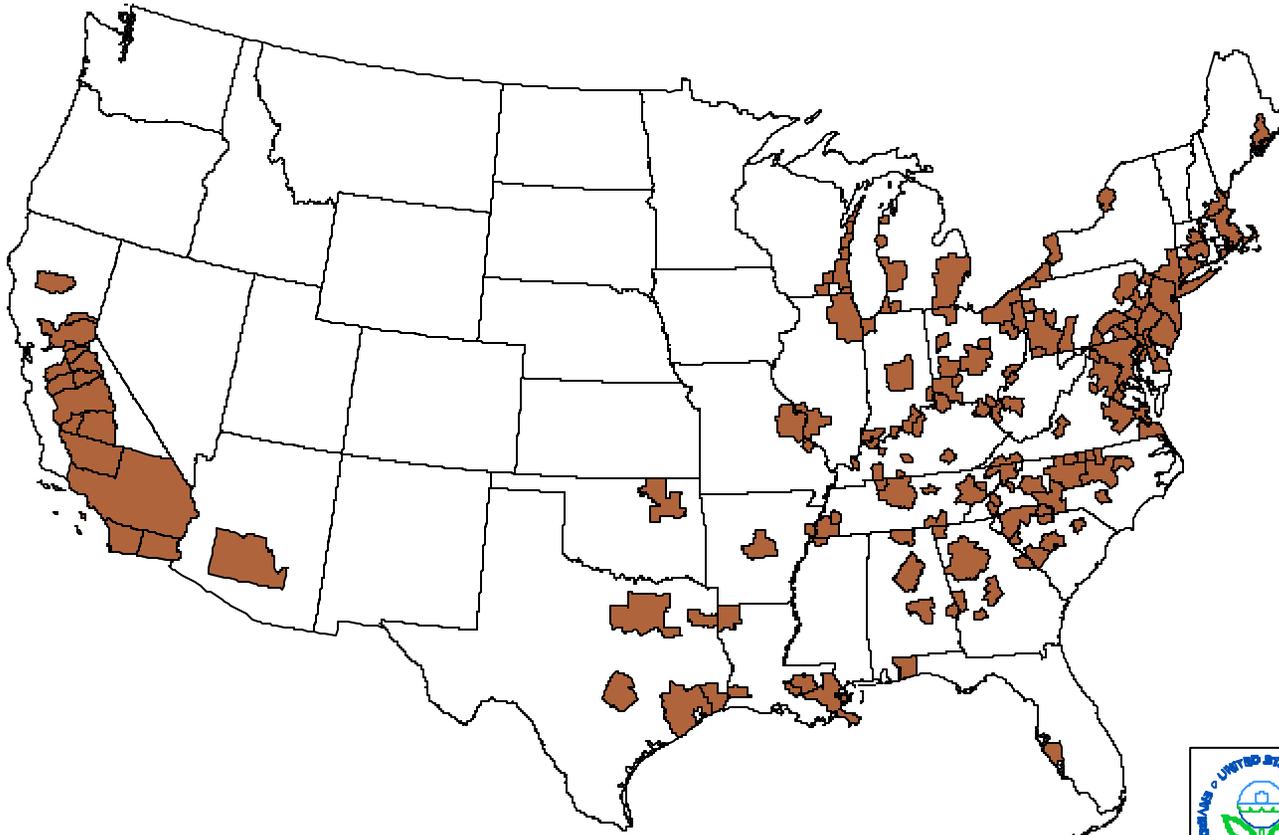
291 counties total population: 110,895,870



AQTAG

Adjacent metropolitan areas may contribute to elevated ozone levels

CMSA->MSA->County Violating 8-hour Ozone (1999-2001)



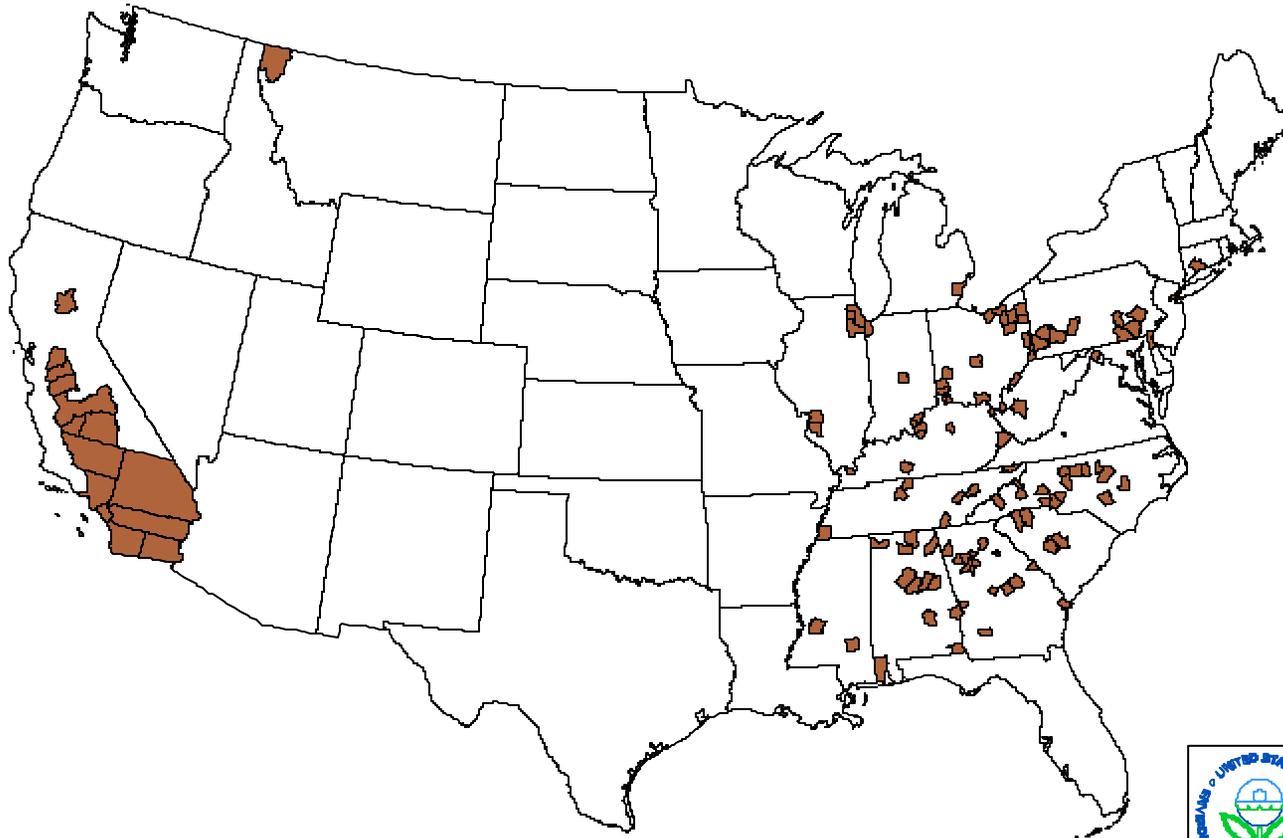
142 areas total population: 152,353,765



AQTAG

Levels exceeding PM2.5 NAAQS are found in CA, MT and many areas in the Eastern Half of the US

Counties Violating 8-hour PM2.5 (1999-2001)



129 counties total population: 65,185,812

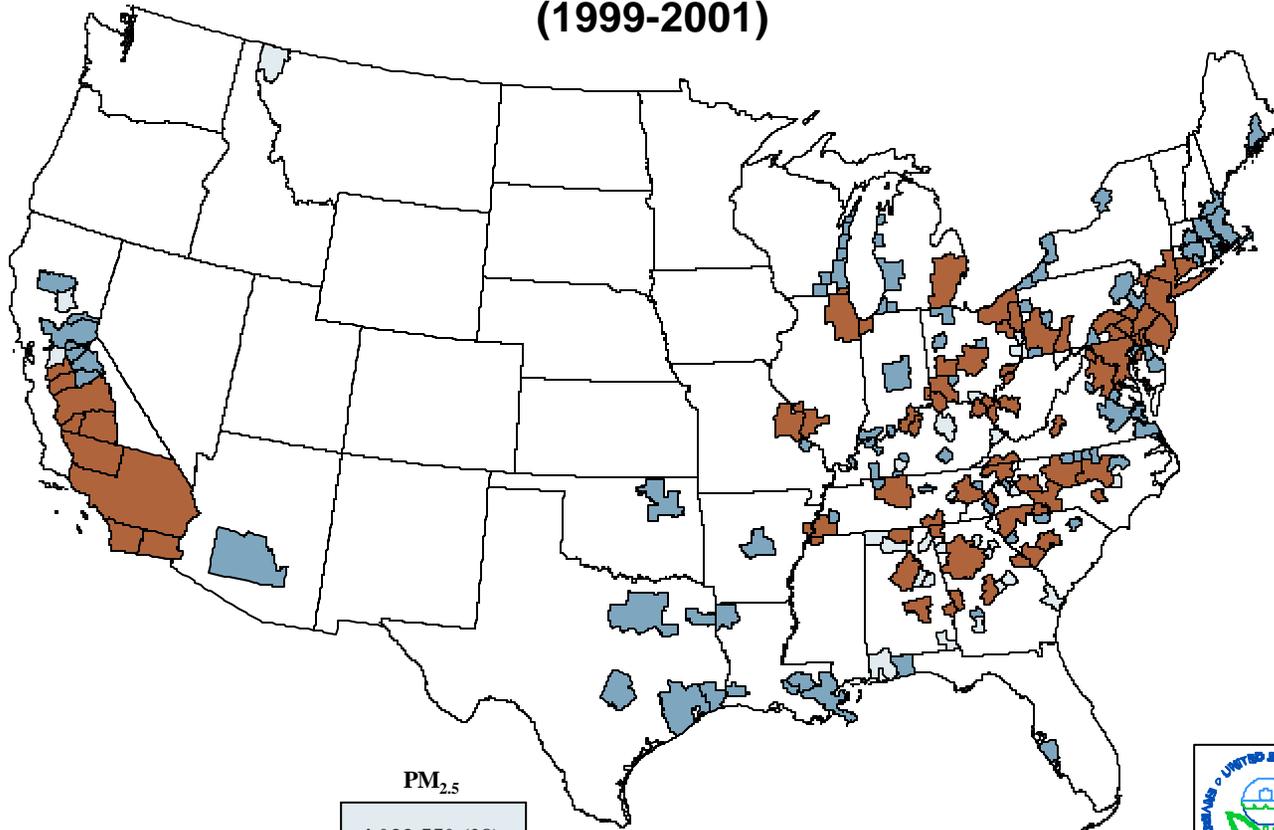


AQTAG

Data from AQS (7/02)

Together, Elevated Ozone and PM_{2.5} Occurs in Many Areas

CMSA->MSA->Counties Violating 8-hour Ozone and PM_{2.5} (1999-2001)



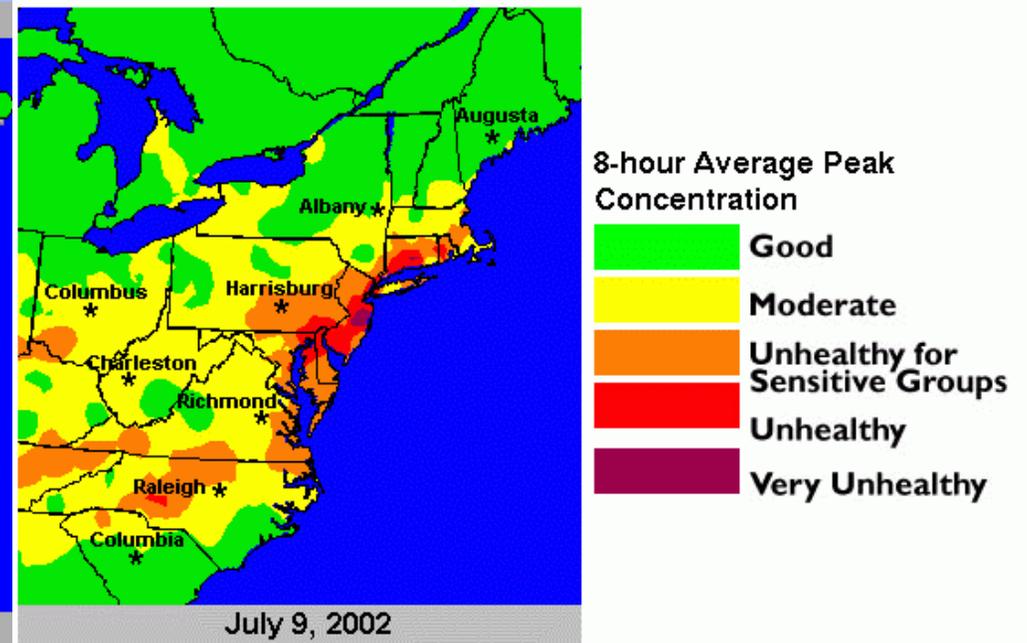
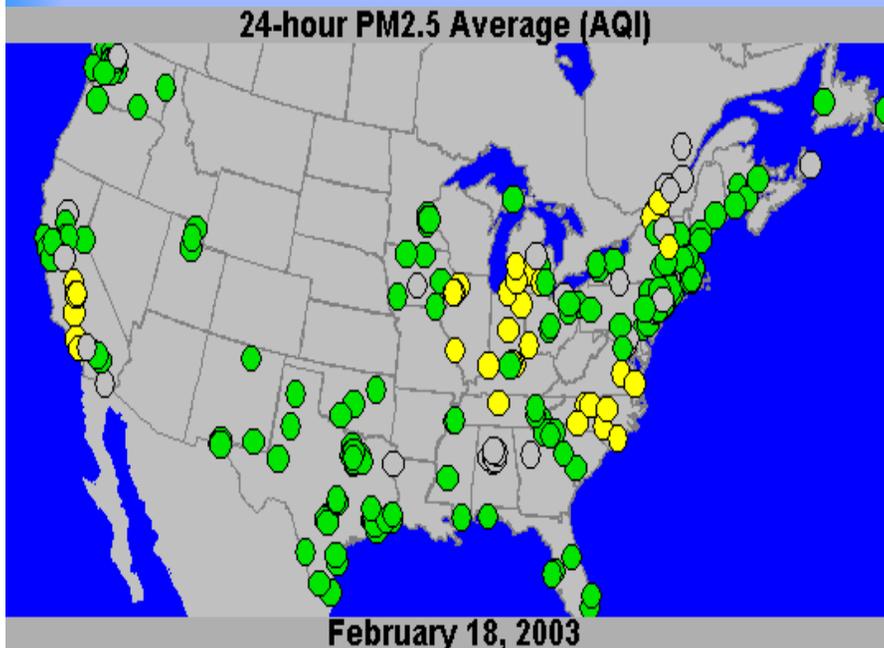
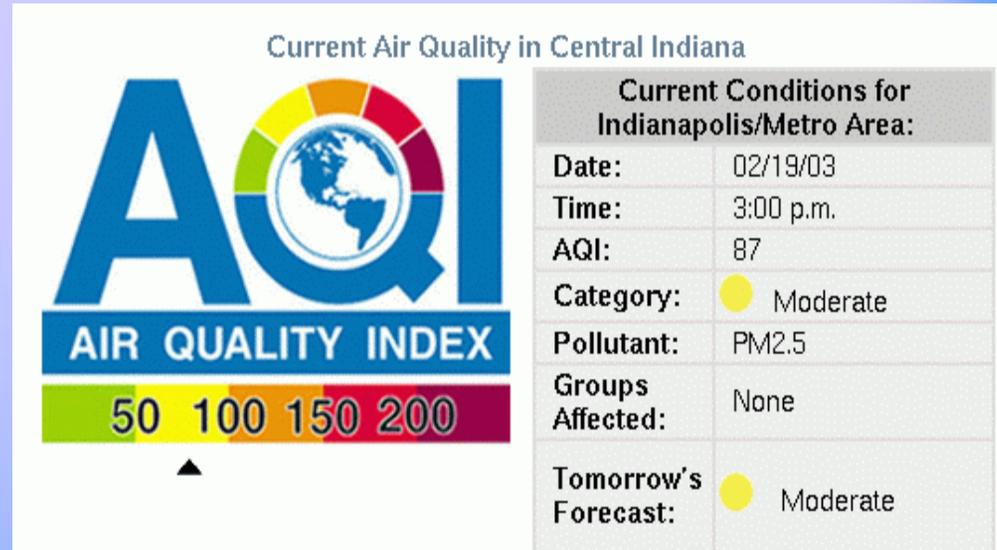
| | PM _{2.5} | |
|-------|--------------------|---------------------|
| Ozone | 46,307,103 (89) | 106,046,662 (46) |



AQTAG

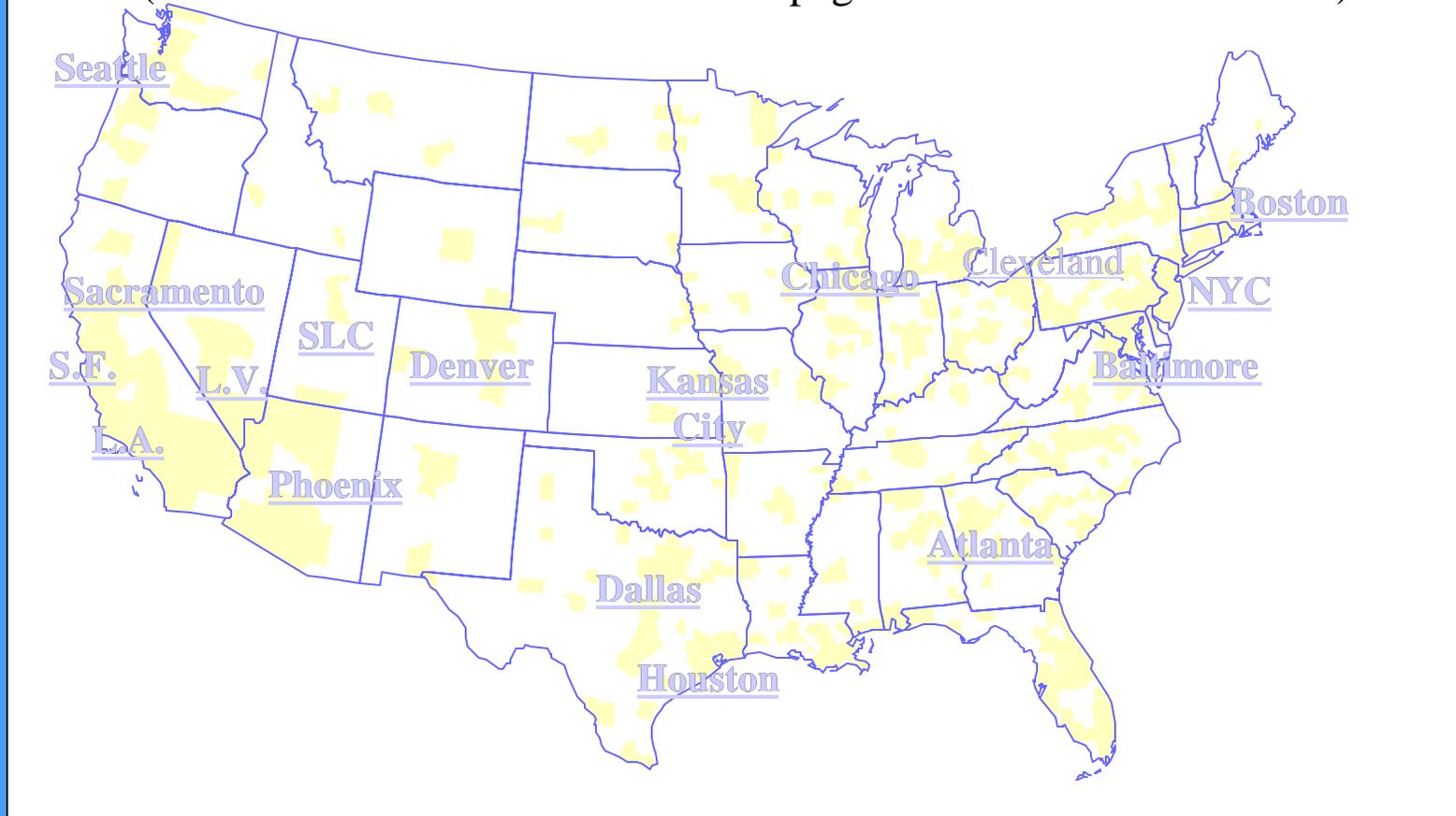
Air Quality Index

AQI = Simple metric of daily air quality for criteria pollutants

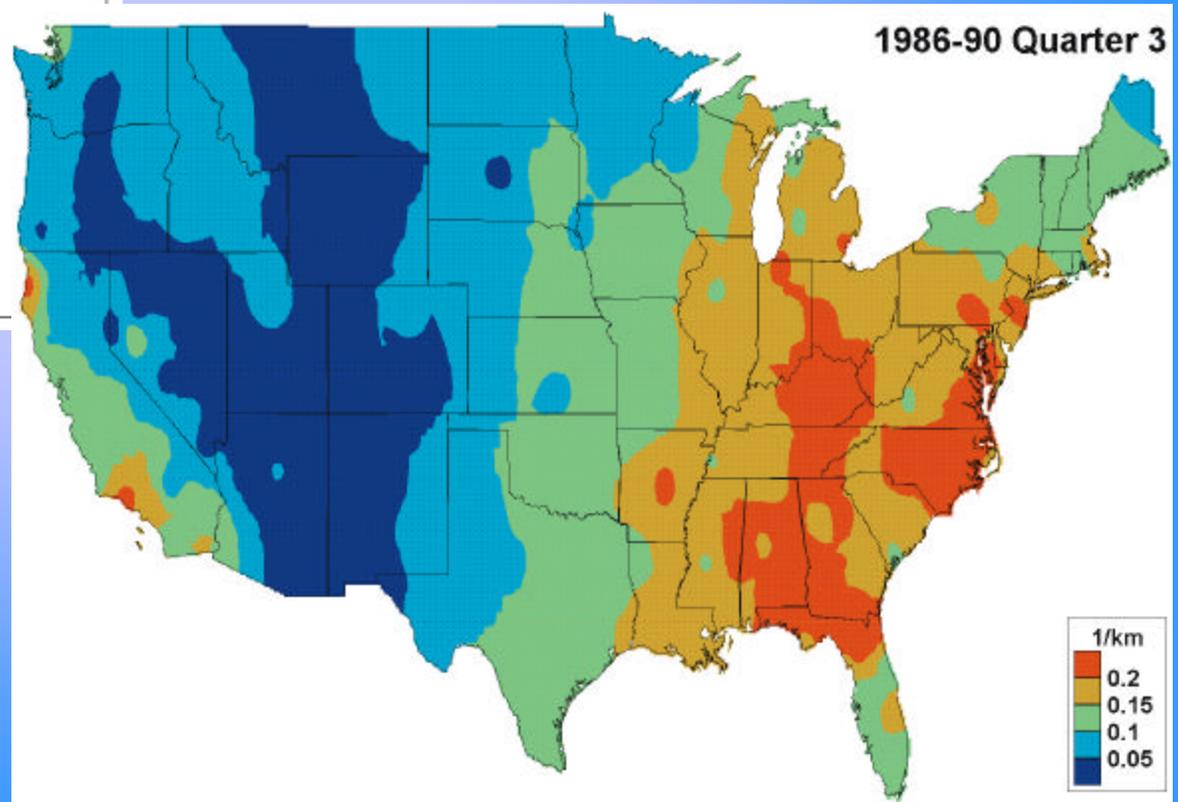
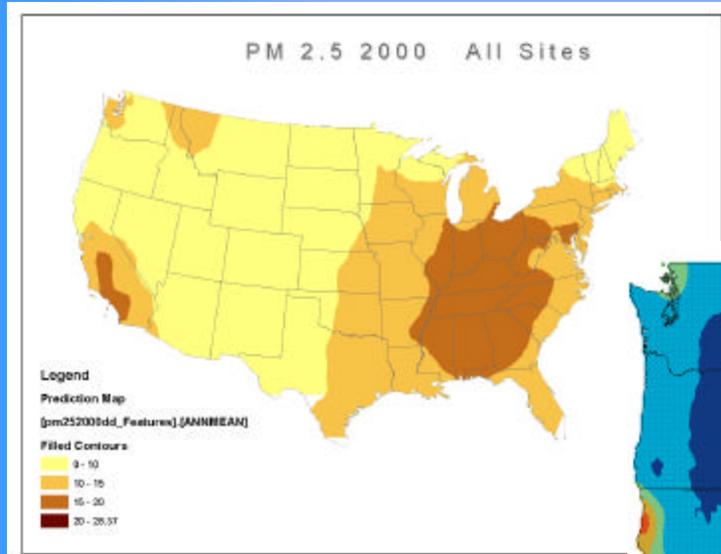


Lets look at the distribution of AQI days throughout the year for different cities and compare PM2.5 with Ozone daily air quality

(Links don't work in PDF version – pages are located at end of file)



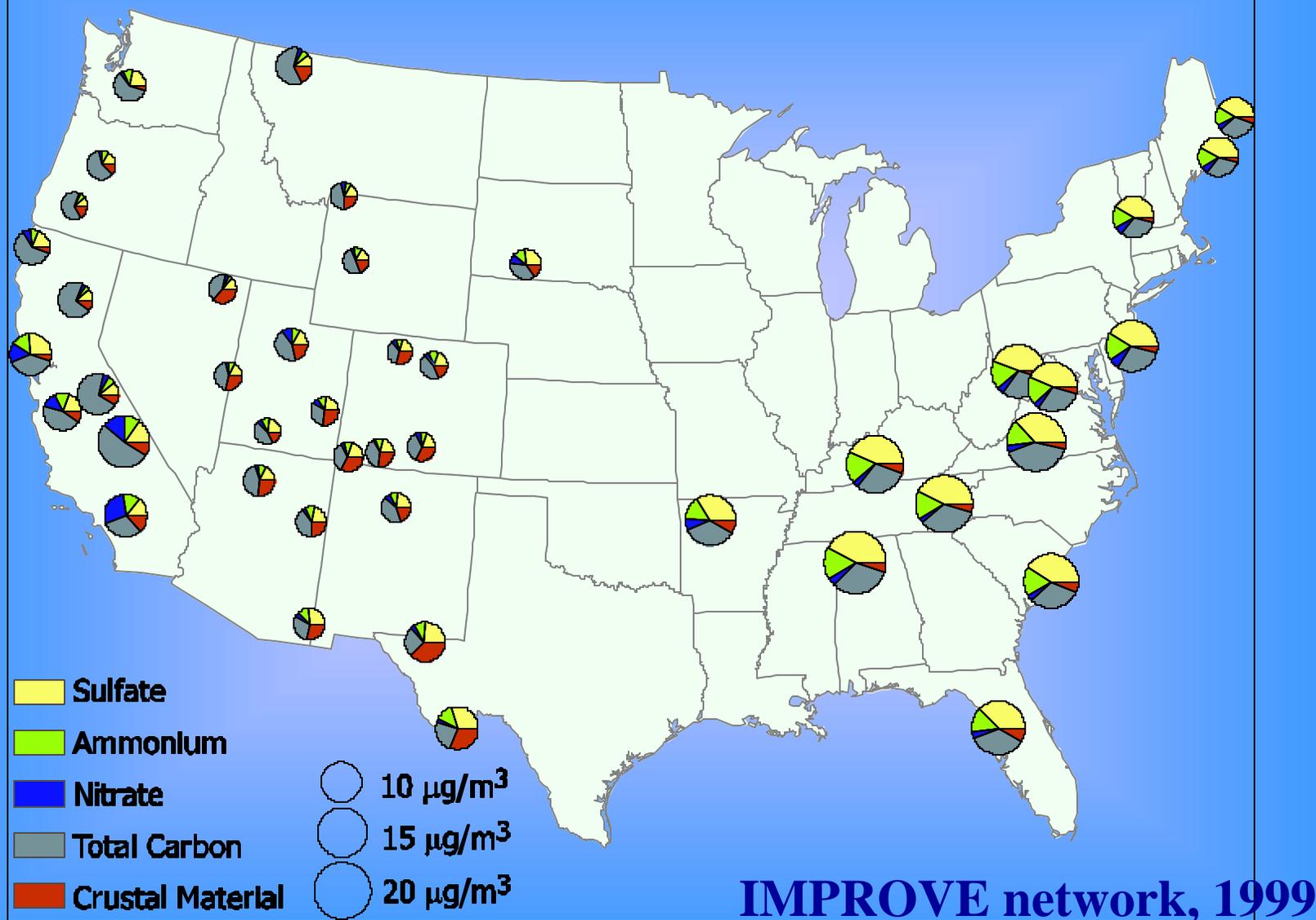
Elevated PM_{2.5} Causes Reduced Visibility in East and Along Southern West Coast



75th percentile light extinction coefficient from airport visual data

Ambient PM_{2.5} Composition in Rural Areas

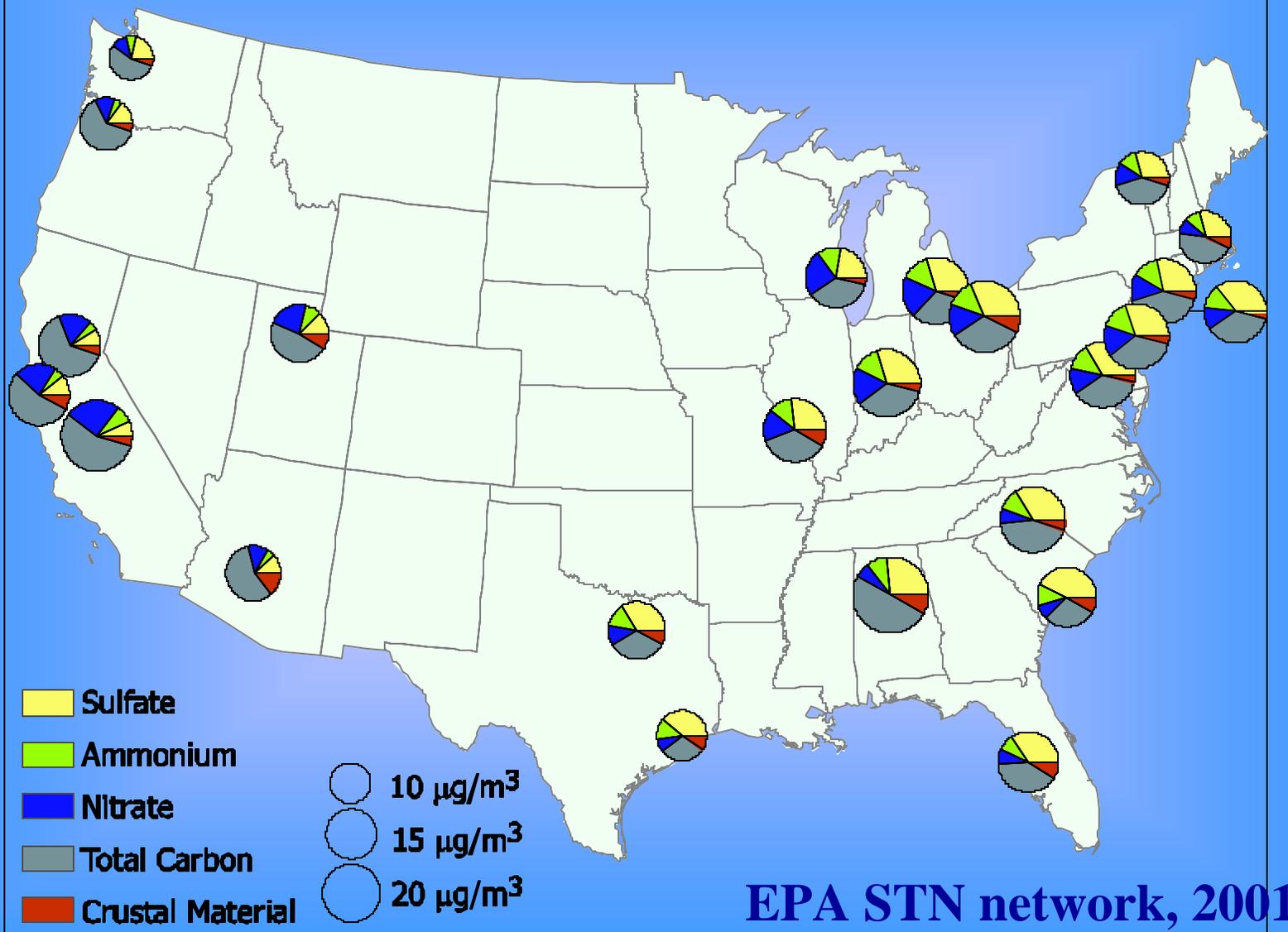
SO₄ and associated NH₄ are prevalent in Rural Eastern PM_{2.5}



From: Latest Findings on National Air Quality, 2001 Status and Trends

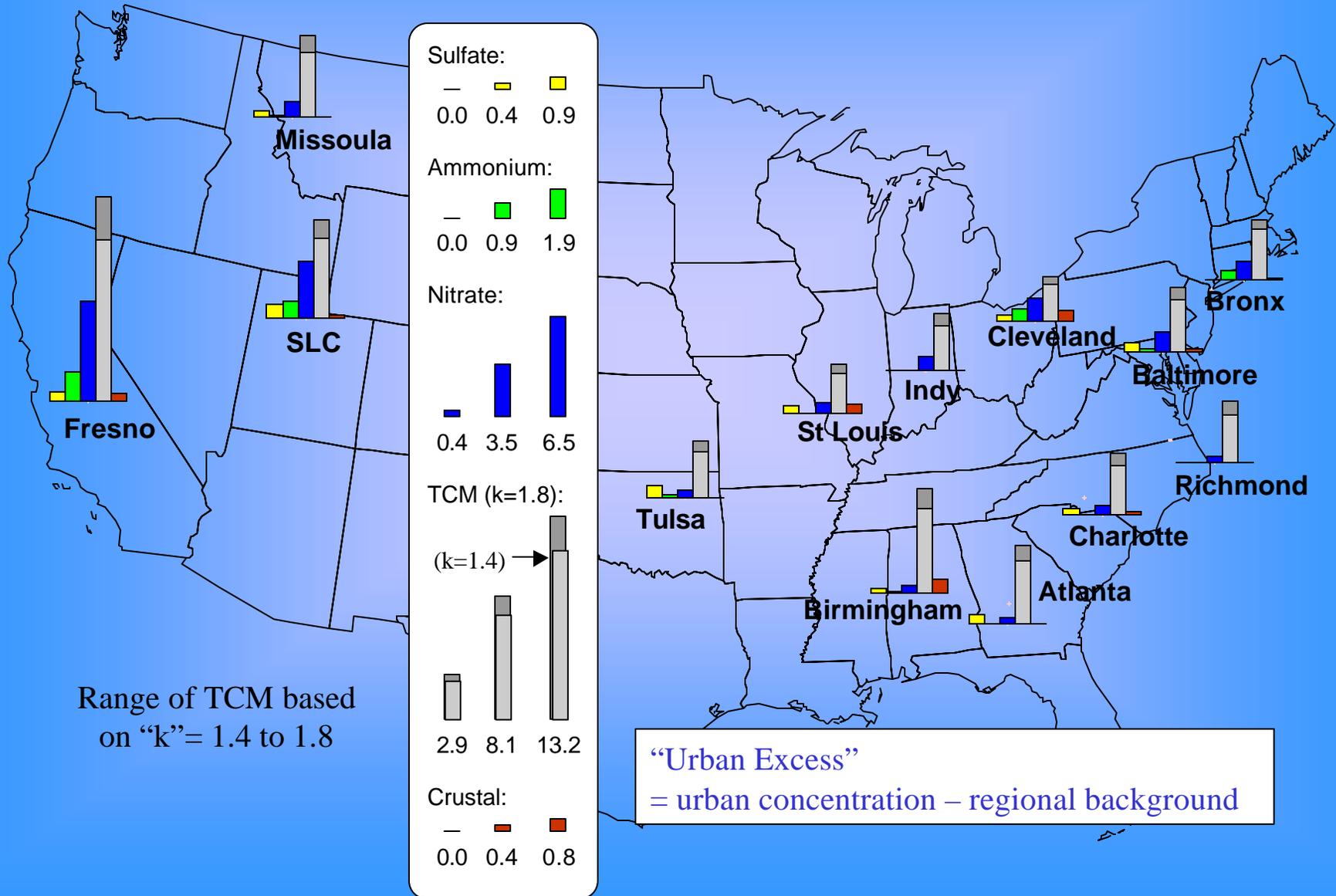
Ambient PM_{2.5} Composition in Urban Areas

More Carbon and Nitrates in Urban Areas vs. Rural Areas



From: Latest Findings on National Air Quality, 2001 Status and Trends

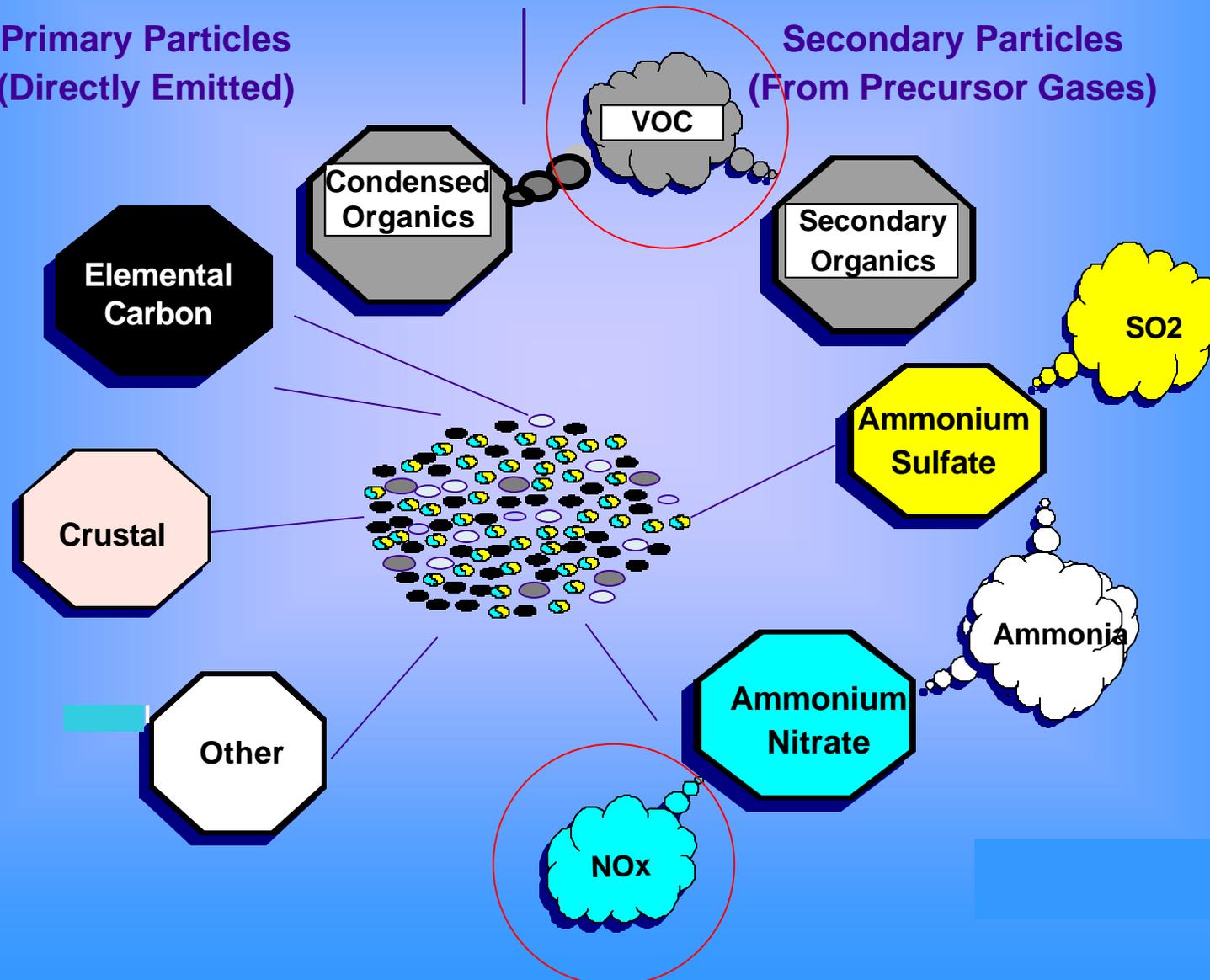
Ambient Urban Excess PM2.5 Concentrations for 13 Example Areas



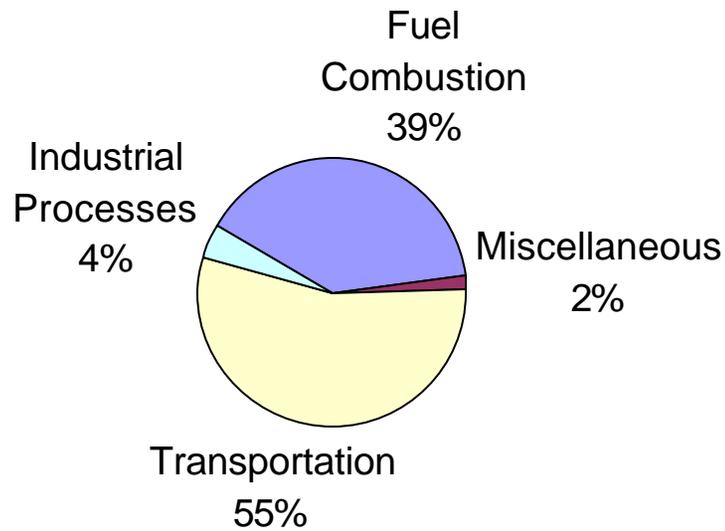
What Emission Sources Are Major Contributors to Ozone and PM_{2.5} ?

Primary Particles
(Directly Emitted)

Secondary Particles
(From Precursor Gases)

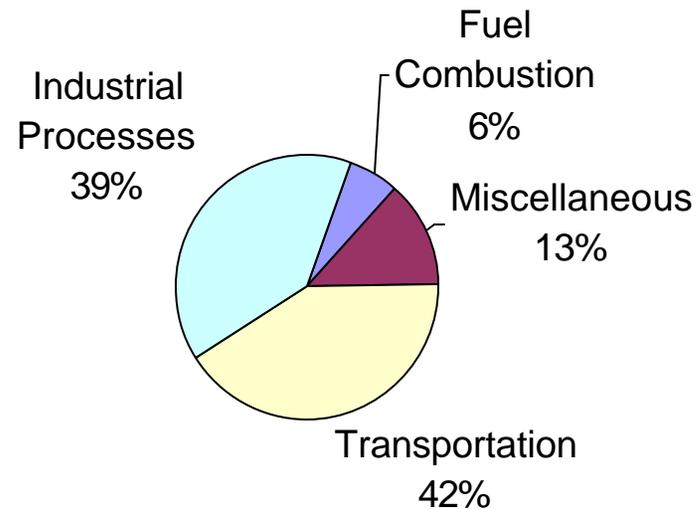


Sources of VOC and NO_x Contribute to Ozone Formation



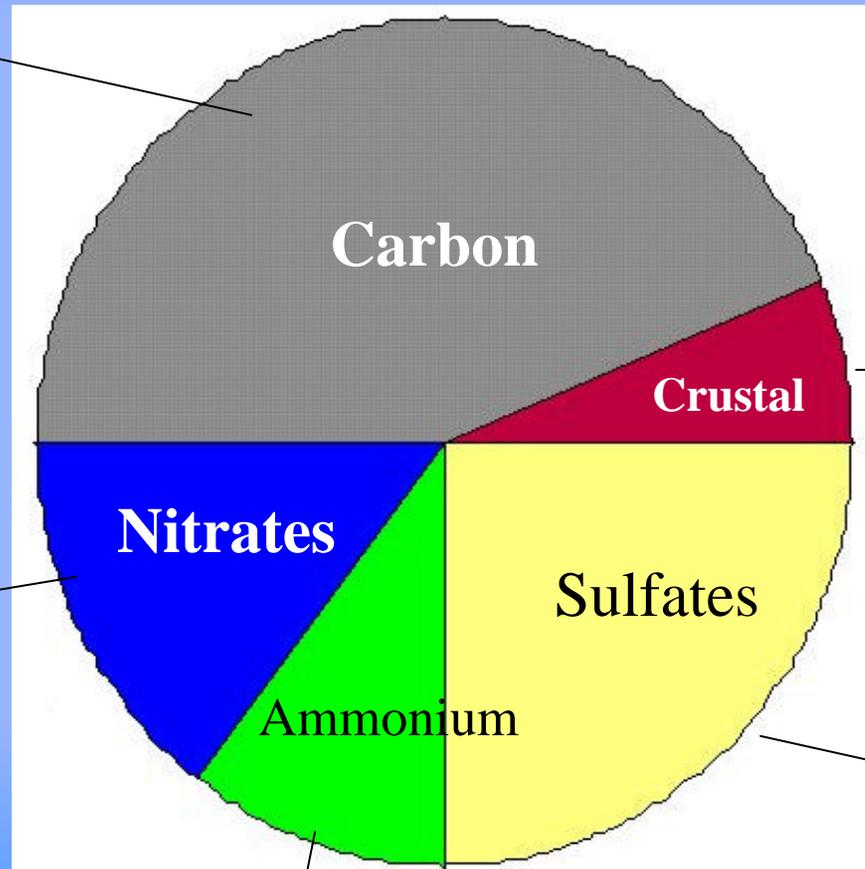
NO_x Emissions

VOC Emissions



Automobiles, power generation, and other sources contribute to PM2.5 levels

Cars, trucks, heavy equipment, wild fires, waste burning, and biogenics (VOCs, direct PM)



Dust from road and construction

Power Generation (SO₂)

Cars, trucks, and power generation (NO_x)

Fertilizers and Animal Feed Operations (in combination with NO_x/SO_x sources)

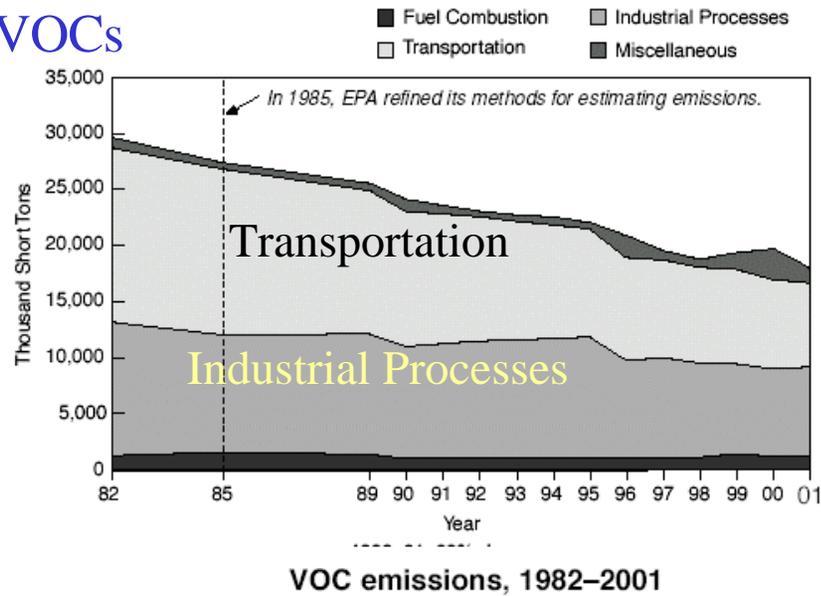
Trends

- What trends have we seen in ozone and PM_{2.5}?
- And in the main pollutants that lead to ozone and PM-2.5?

**Notes: Long history of ozone measurements
Ambient monitoring data from CASNET and
IMPROVE networks provide ample trends for
visibility. Current urban mass and speciation data is
limited with respect to trends for PM_{2.5}.**

VOC and NO_x Emissions Explain Ozone Trends

VOCs



NO_x

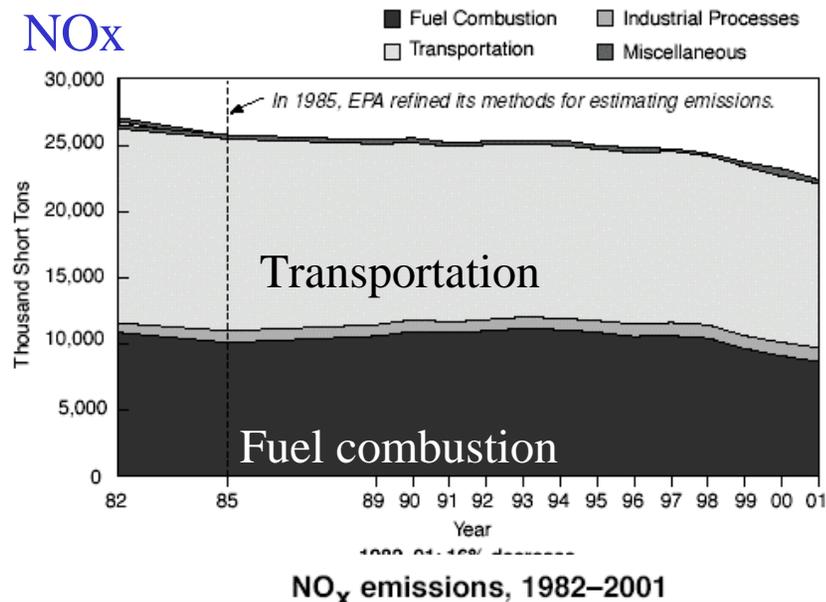
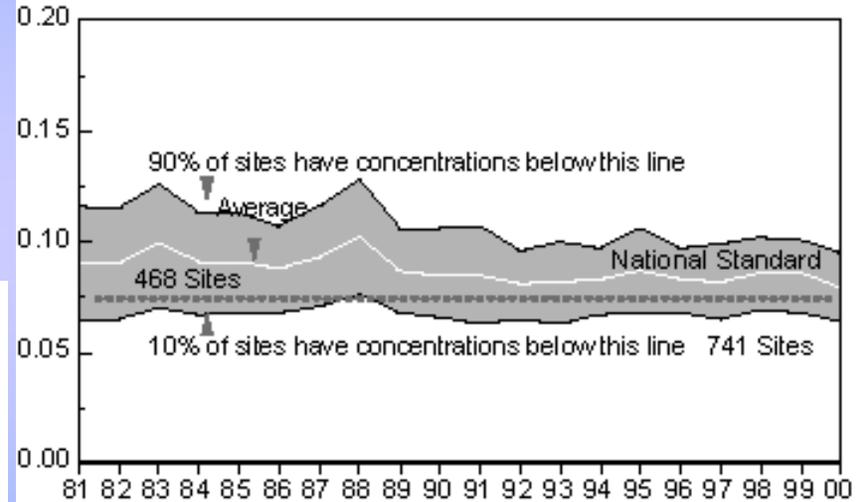


Figure 2-23. Trend in 4th-highest daily 8-hour O₃ concentrations, 1981-2000.

Ozone Air Quality, 1981-2000

Annual 4th Daily 8-Hour Max Concentration, ppm

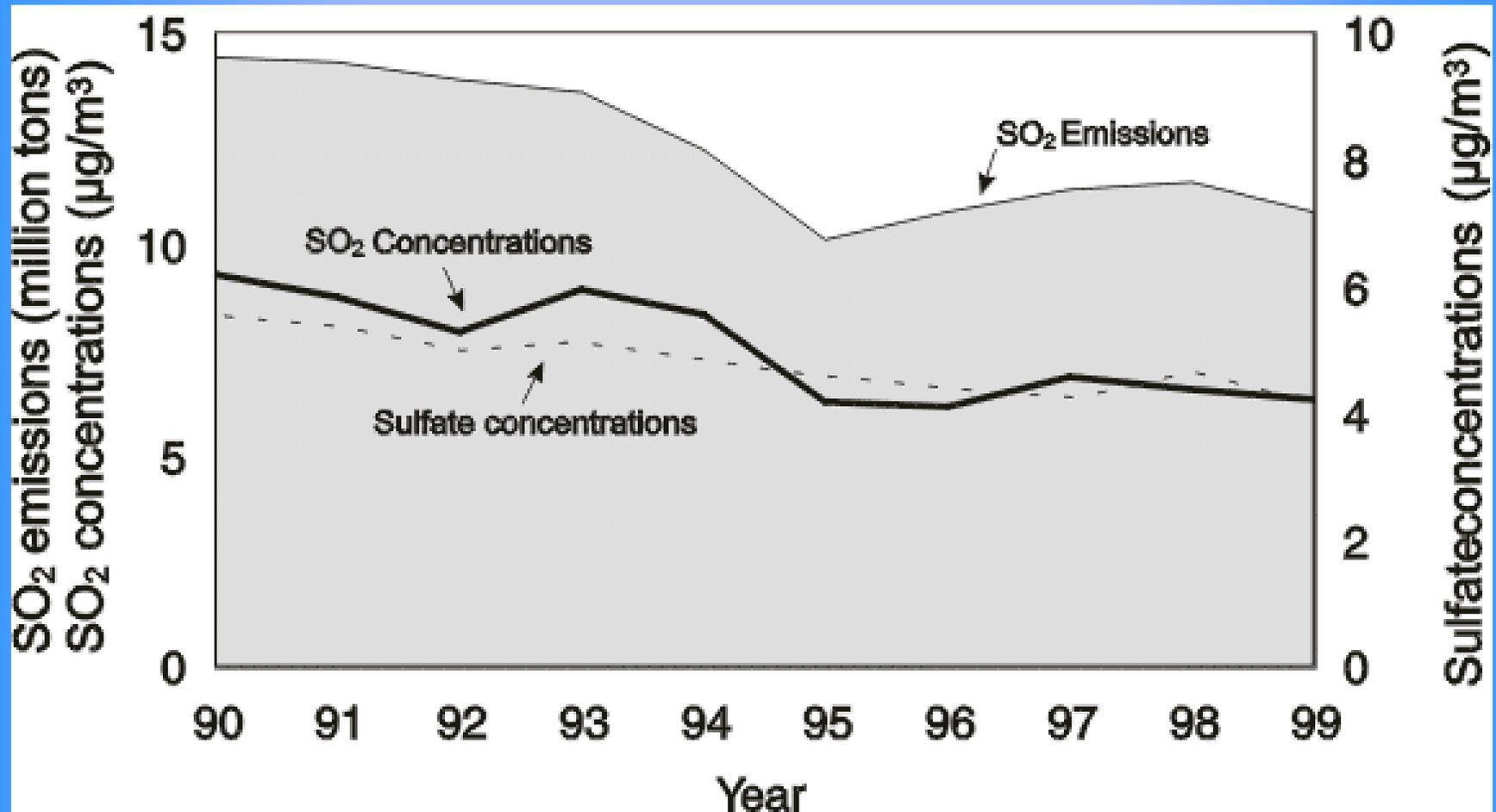
8-hr O₃



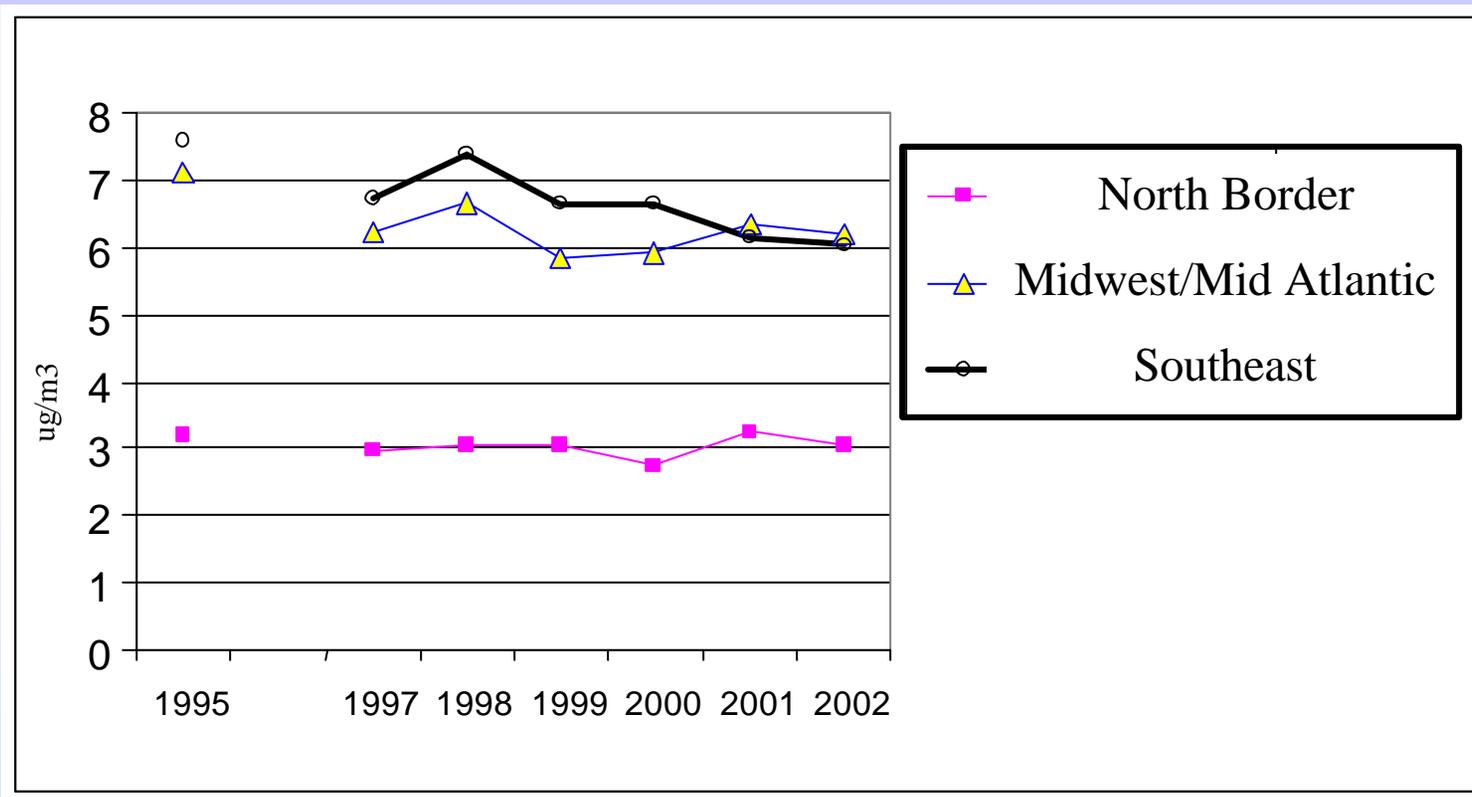
8-hour
1981-00: 12% decrease
1991-00: 6% decrease
1999-00: 7% decrease

SO₄ in the east track SO₂ emissions from power plants

(sulfates are one of the largest component of PM_{2.5} in the East)



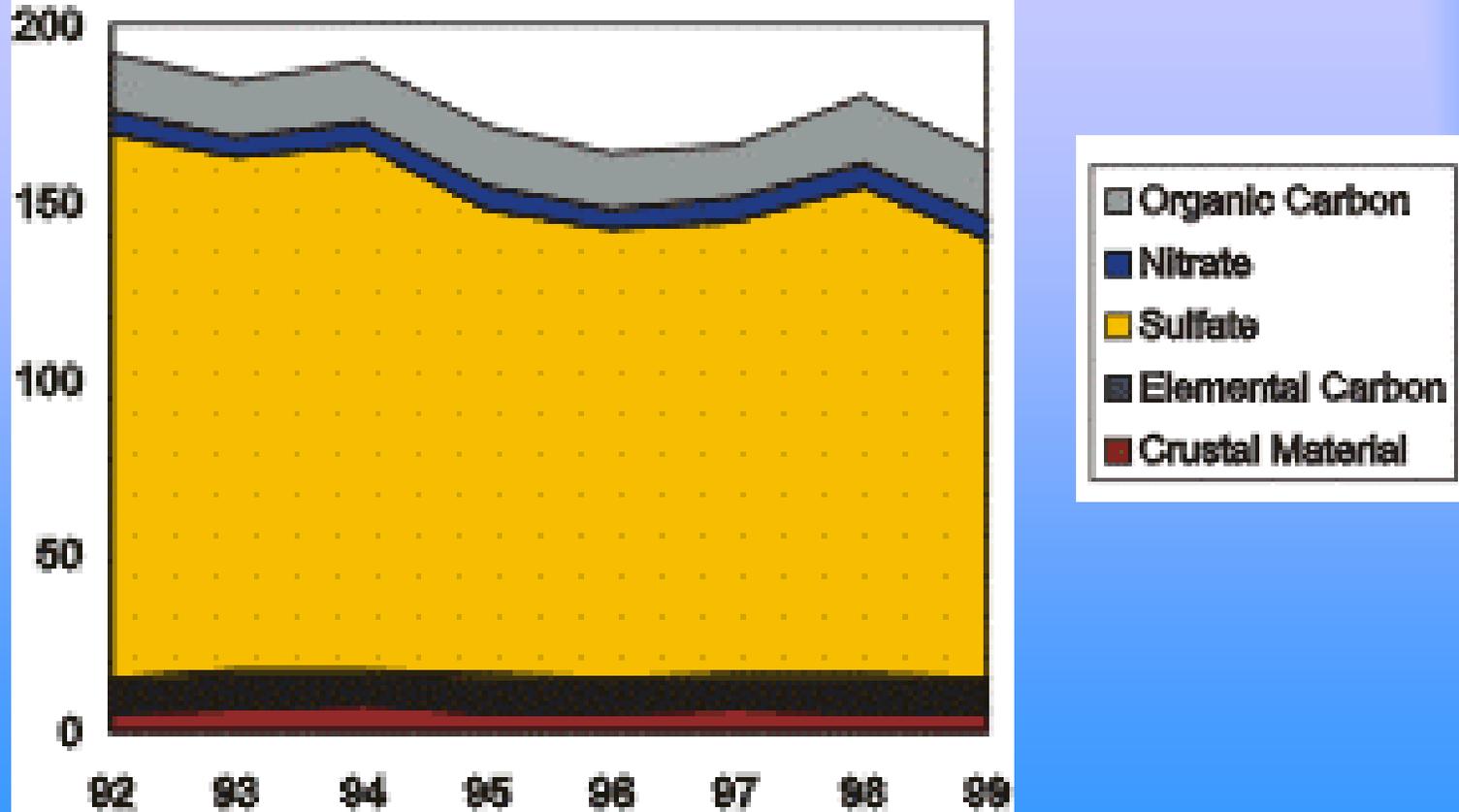
Sulfate Reductions Continue But Vary Across Eastern US



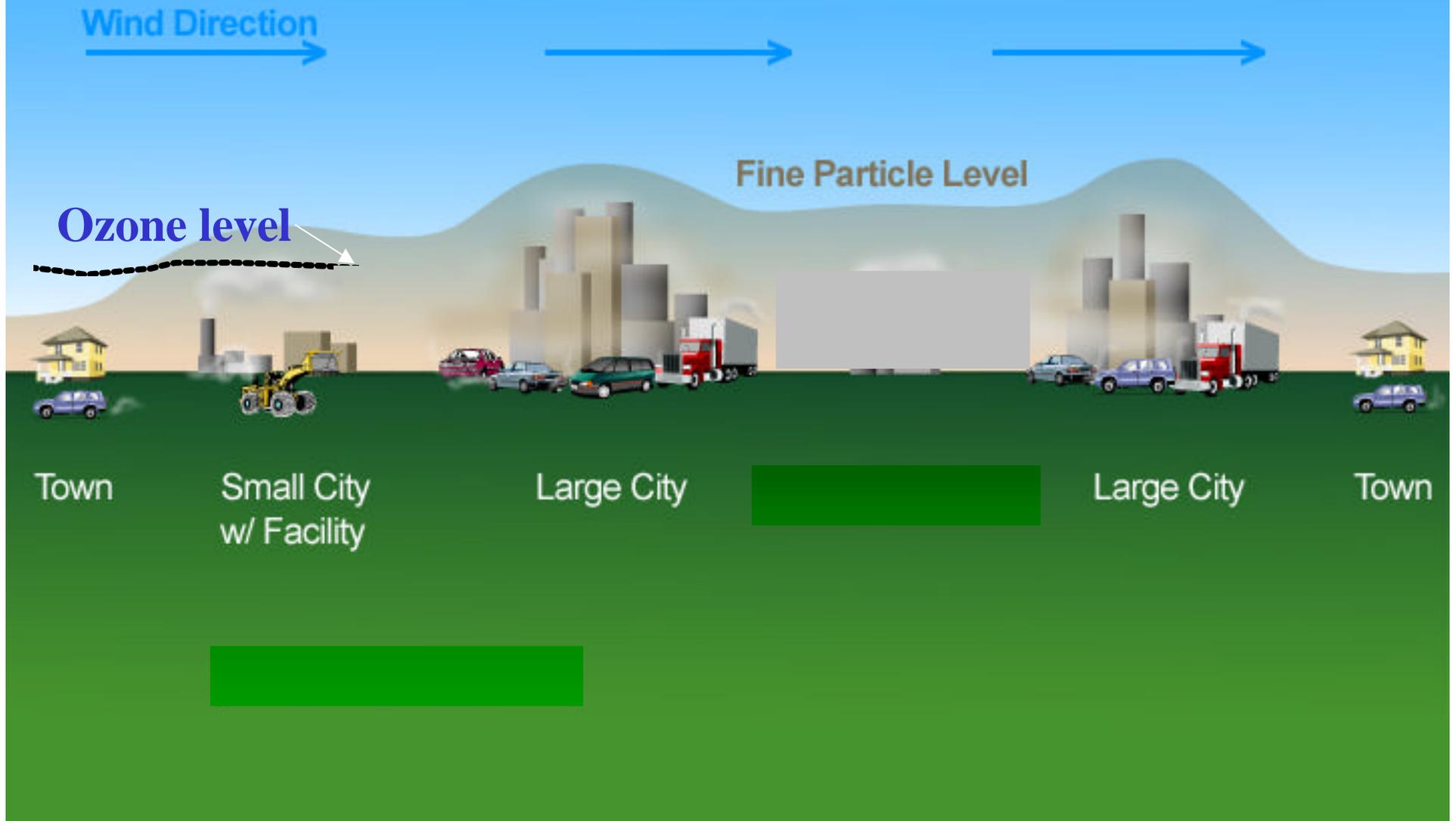
Data from CASTNET

Trends in PM2.5 species translate into trends for regional haze

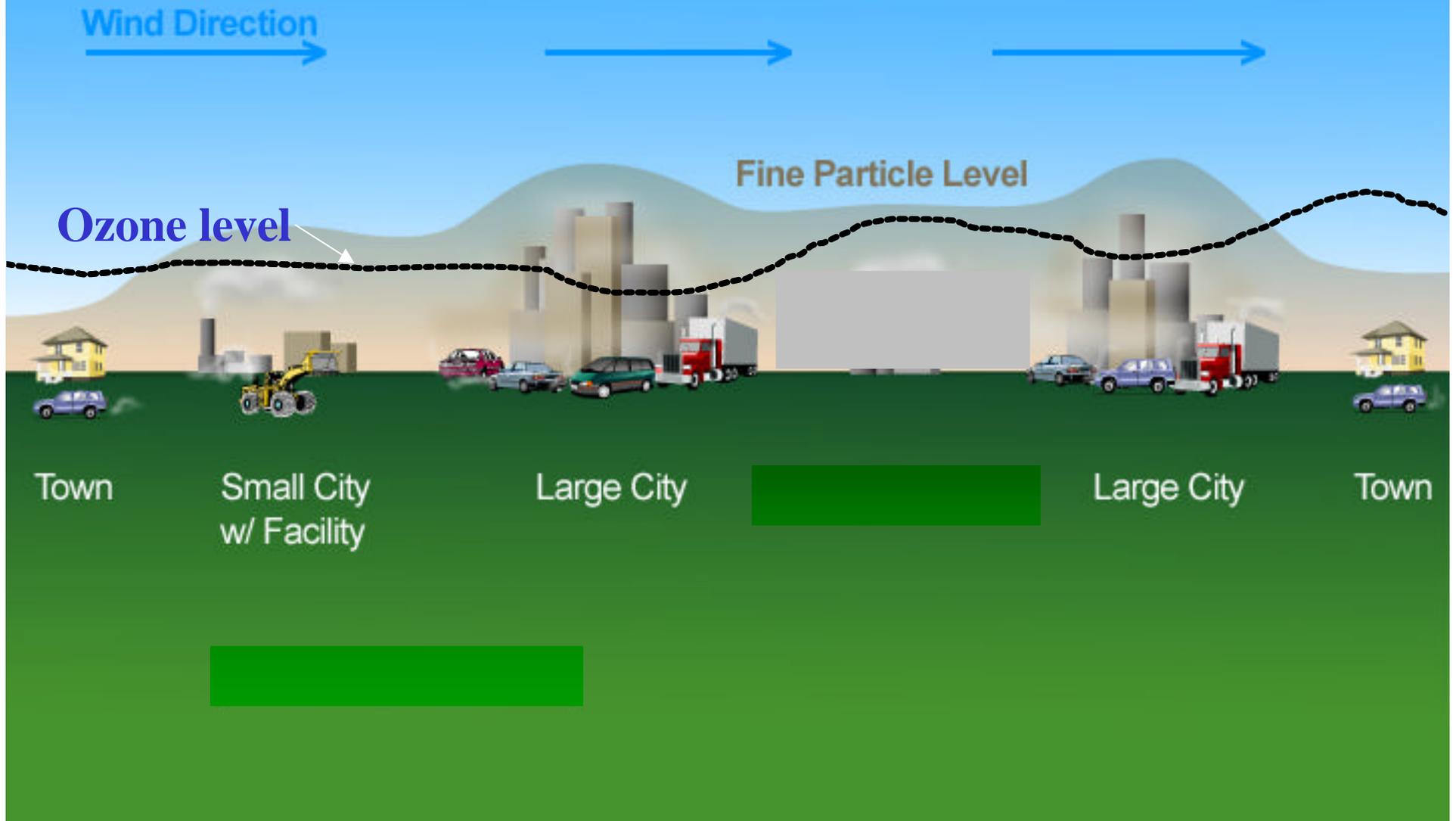
Light Extinction in 10 Eastern Class 1 Areas
for Haziest 20 % of Days



Air Pollutants That Cause or Contribute To Elevated Ozone and PM_{2.5} Can Be Transported Long Distances



Air Pollutants That Cause or Contribute To Elevated Ozone and PM_{2.5} Can Be Transported Long Distances



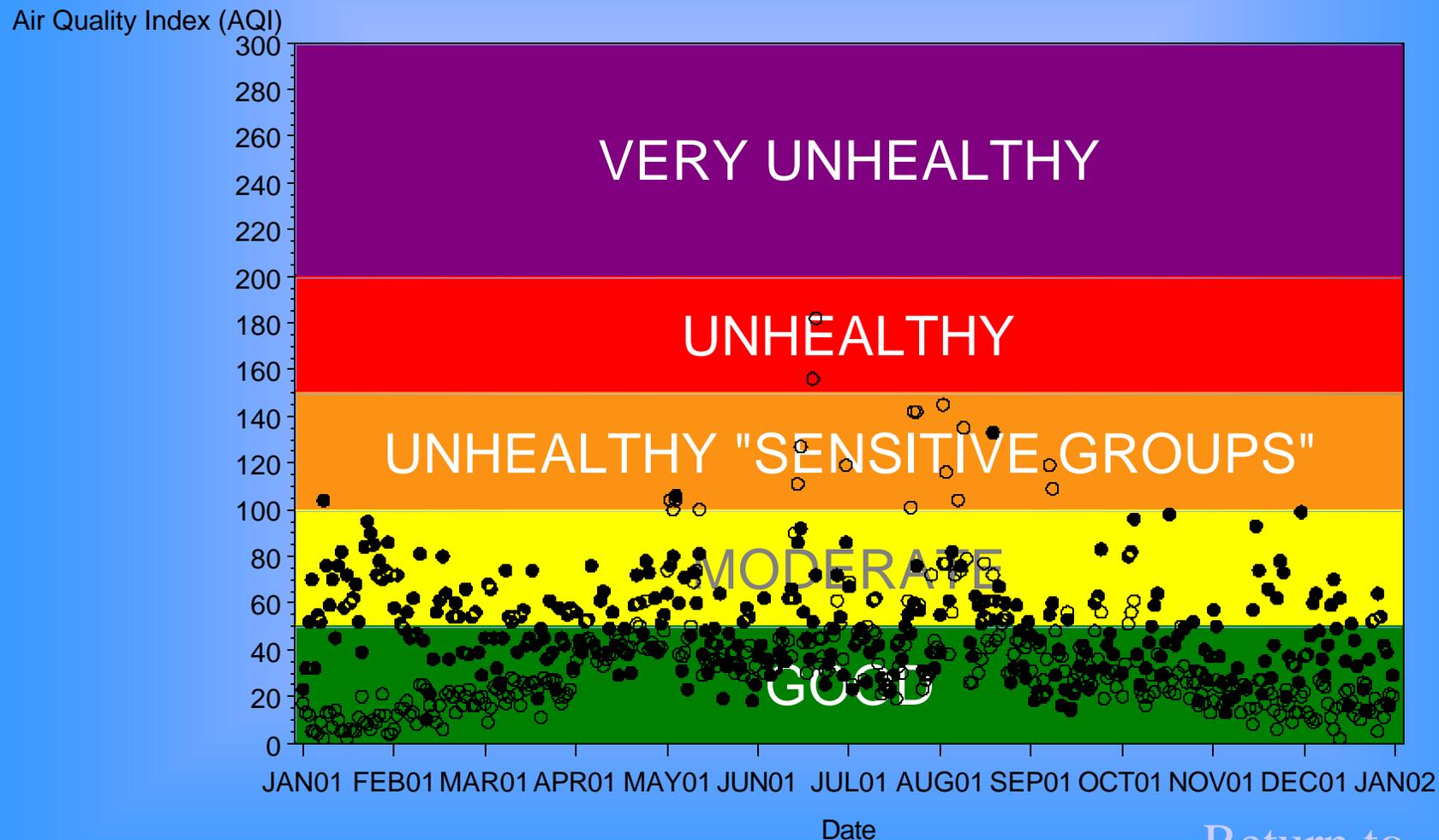
OVERALL MESSAGE

- Elevated levels of 8-hr O₃ and annual PM_{2.5}
 - in Southern California and Eastern US
 - more areas for ozone
- PM_{2.5} is a complex problem – daily PM_{2.5} and haze problems in addition to high annual levels
 - Many chemicals make up PM_{2.5}/haze problem and come from various sources
 - Sulfates (power generation) and carbon biggest contributors
- Clear skies / transport rule will help with Ozone and PM_{2.5}
- Local emission controls will be needed for most persistent problem areas

End of Presentation

AQI Levels for PM2.5 Are Elevated Like Ozone But Occur In The Winter As Well As Summer

MSA=1120 MSA_NAME=BOSTON, MA-NH

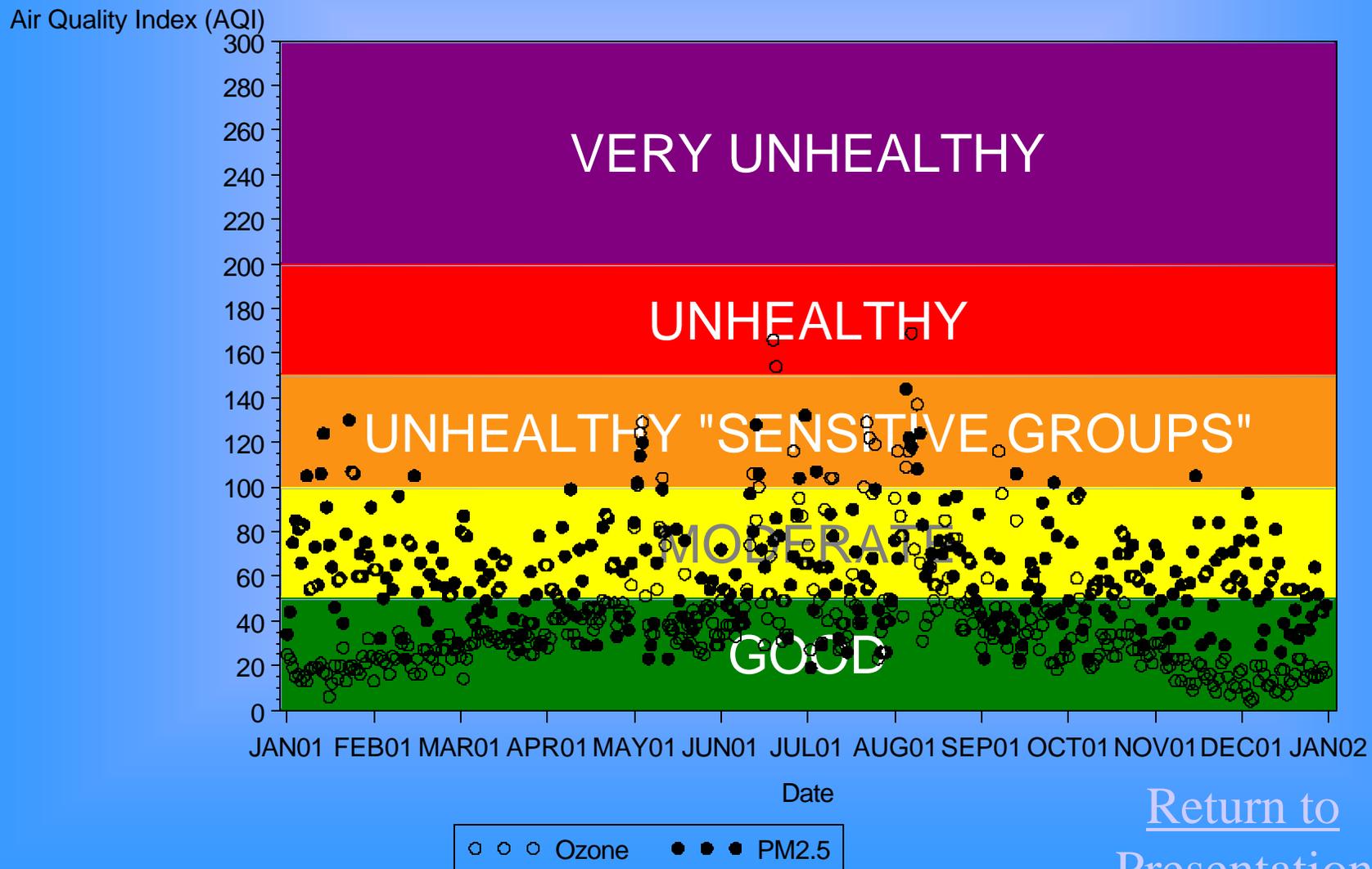


○ ○ ○ Ozone ● ● ● PM2.5

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AQI Levels for PM2.5 Are Elevated Like Ozone But Occur In The Winter As Well As Summer

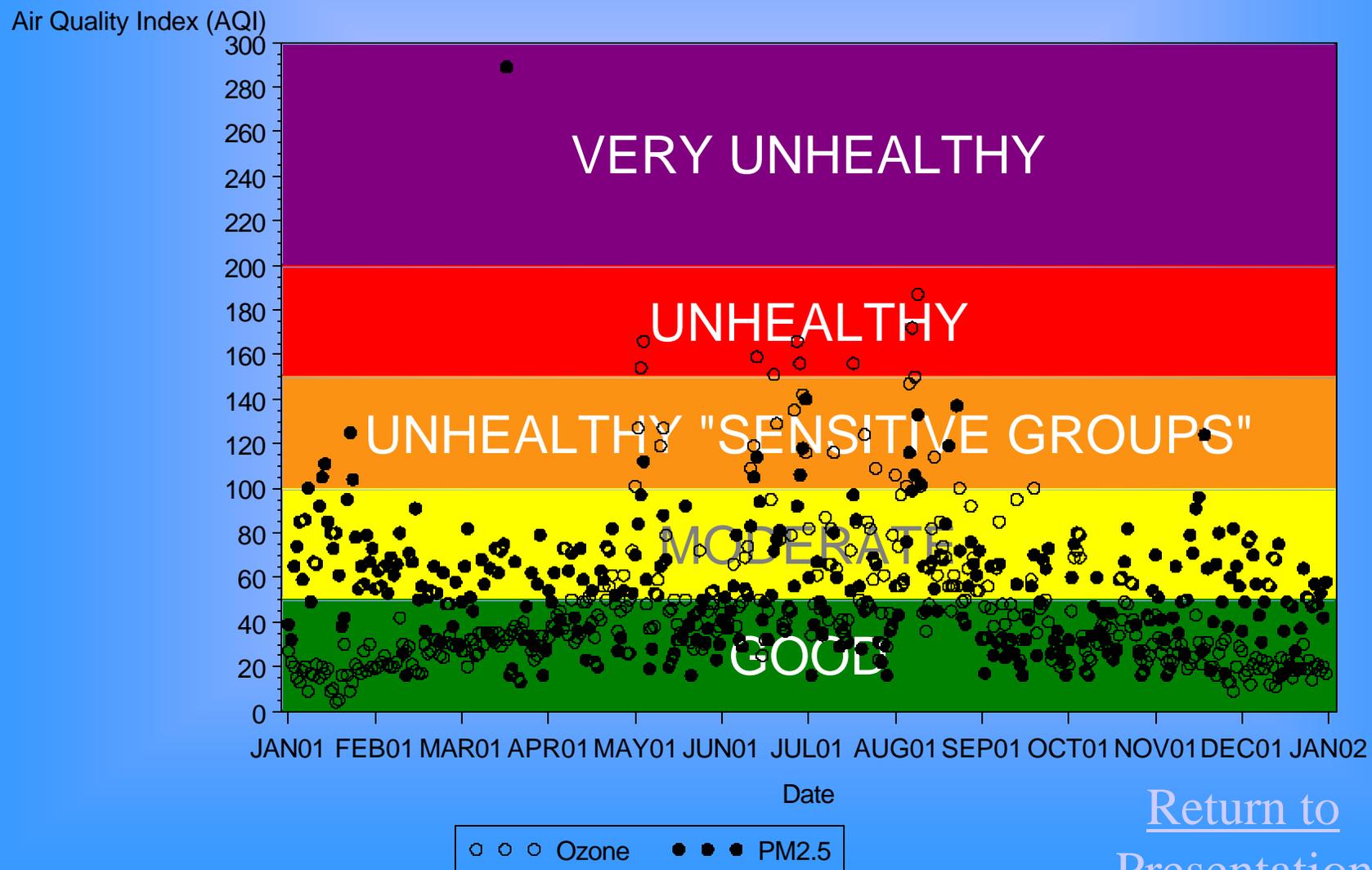
MSA=5600 MSA_NAME=NEW YORK, NY



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AQI Levels for PM2.5 Are Elevated Like Ozone But Occur In The Winter As Well As Summer

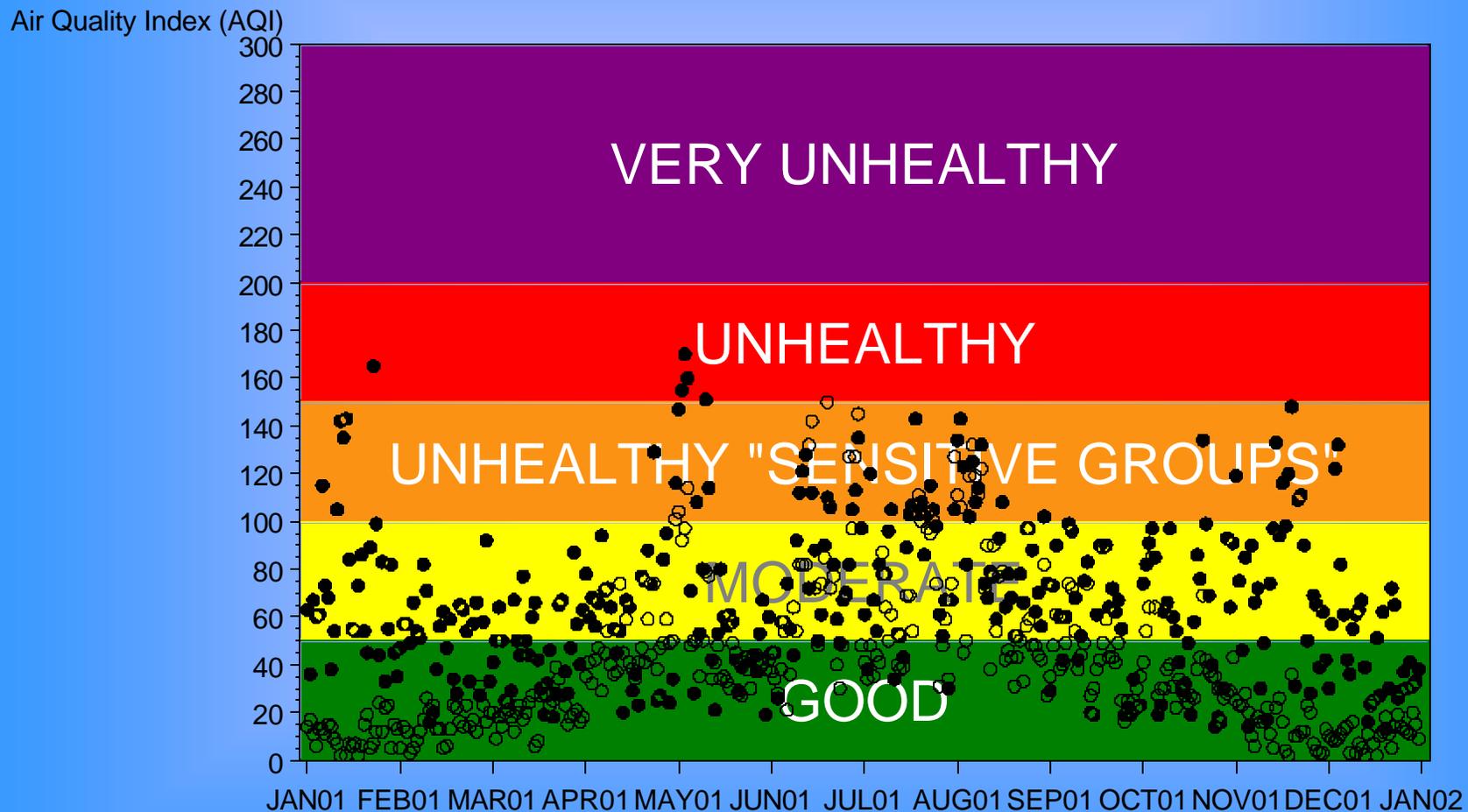
MSA=6160 MSA_NAME=PHILADELPHIA, PA-NJ



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AQI Levels for PM2.5 Are Elevated Like Ozone But Occur In The Winter As Well As Summer

MSA=6280 MSA_NAME=PITTSBURGH, PA

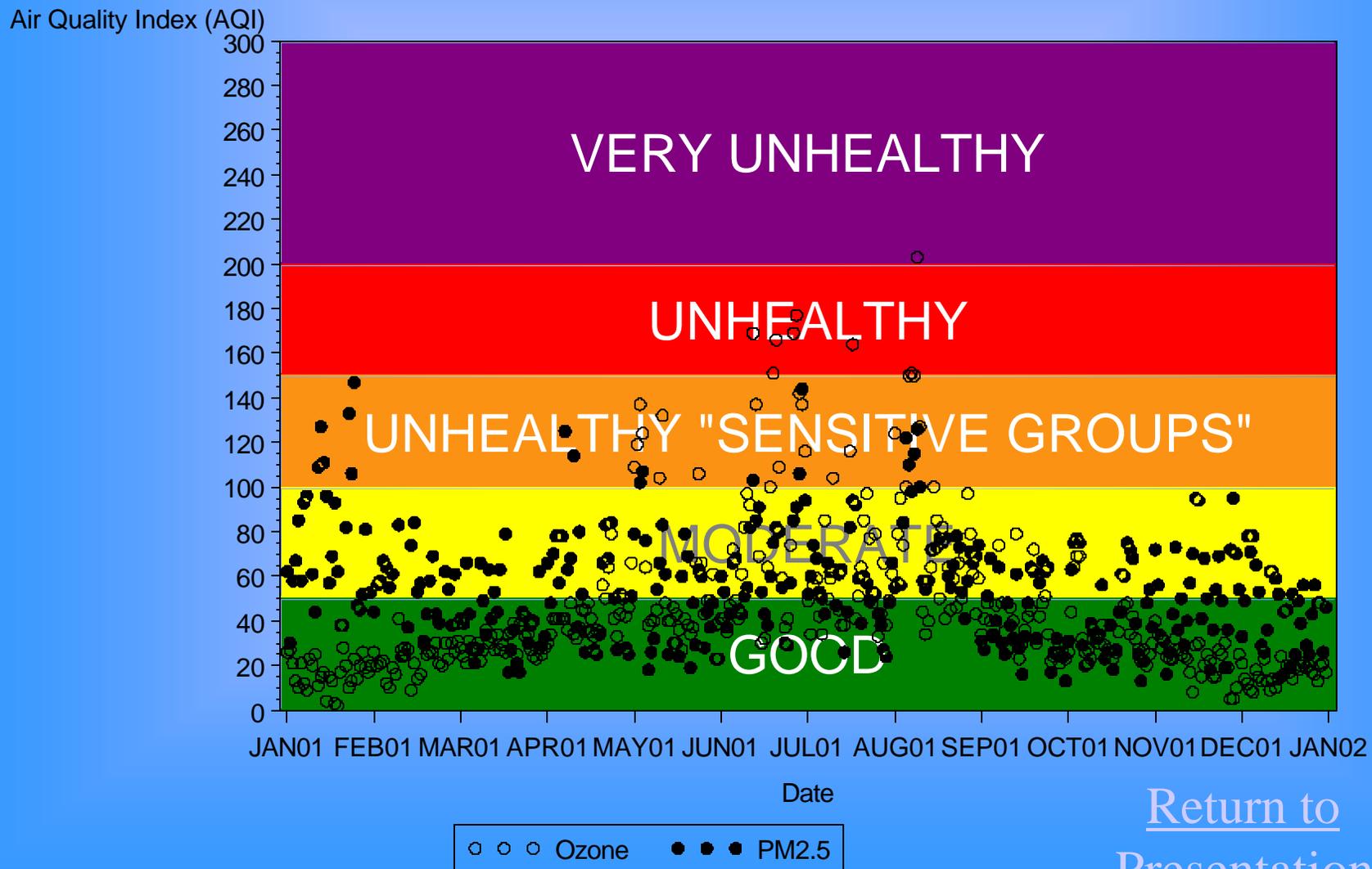


○ ○ ○ Ozone ● ● ● PM2.5

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AQI Levels for PM2.5 Are Elevated Like Ozone But Occur In The Winter As Well As Summer

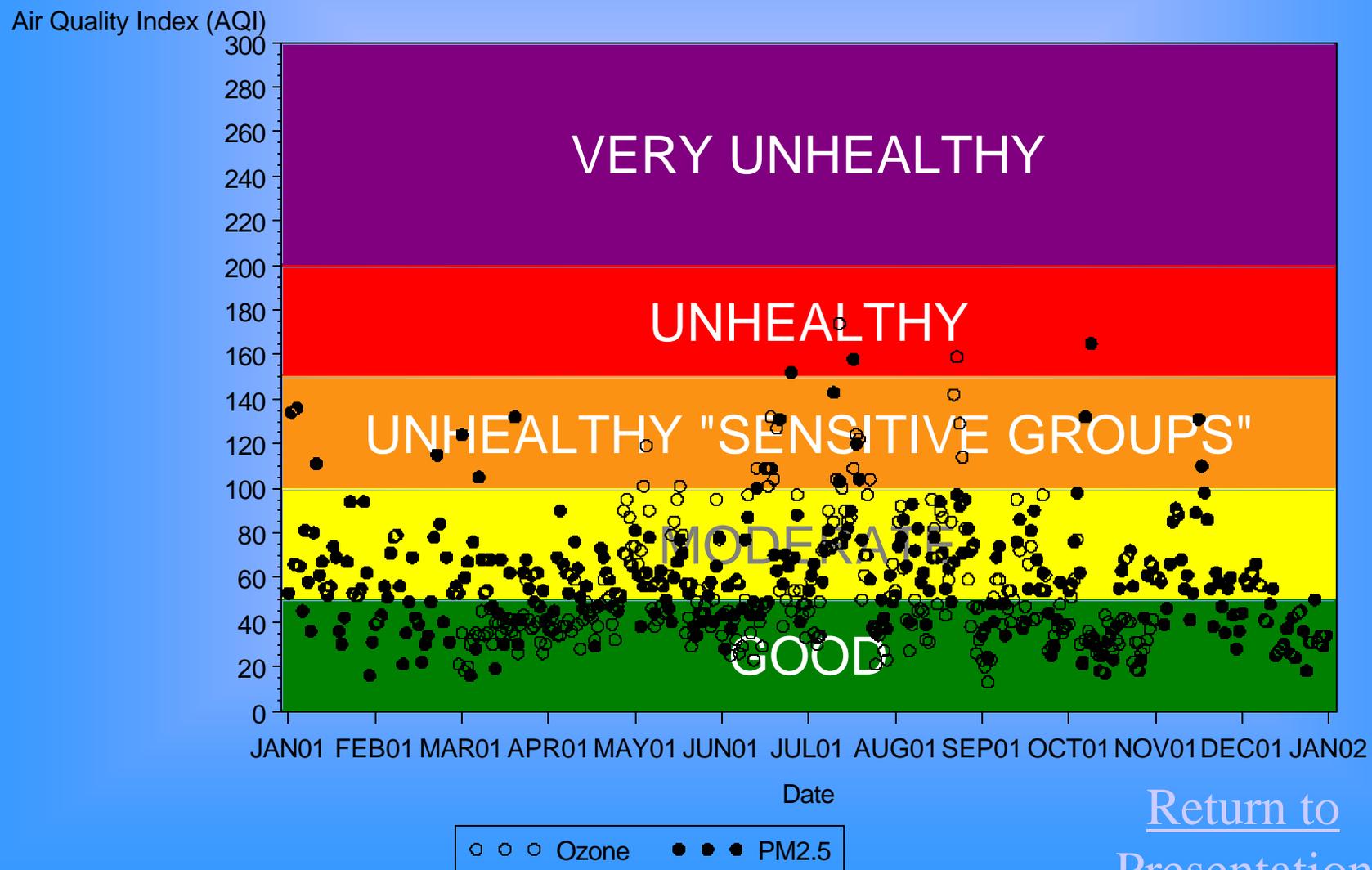
MSA=0720 MSA_NAME=BALTIMORE, MD



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AQI Levels for PM2.5 Are Elevated Like Ozone But Occur In The Winter As Well As Summer

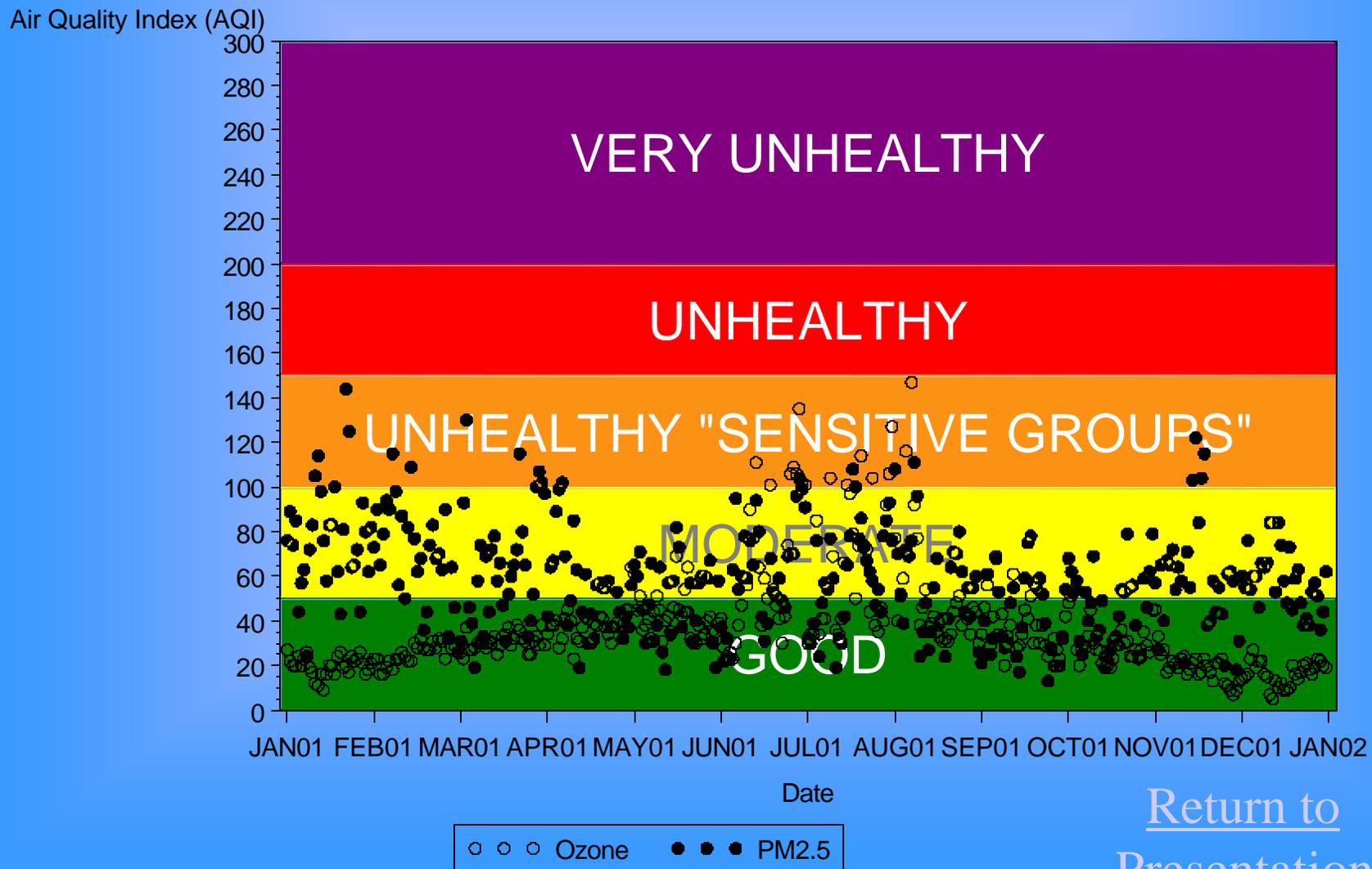
MSA=0520 MSA_NAME=ATLANTA, GA



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AQI Levels for PM2.5 Are Elevated Like Ozone But Occur In The Winter As Well As Summer

MSA=1600 MSA_NAME=CHICAGO, IL

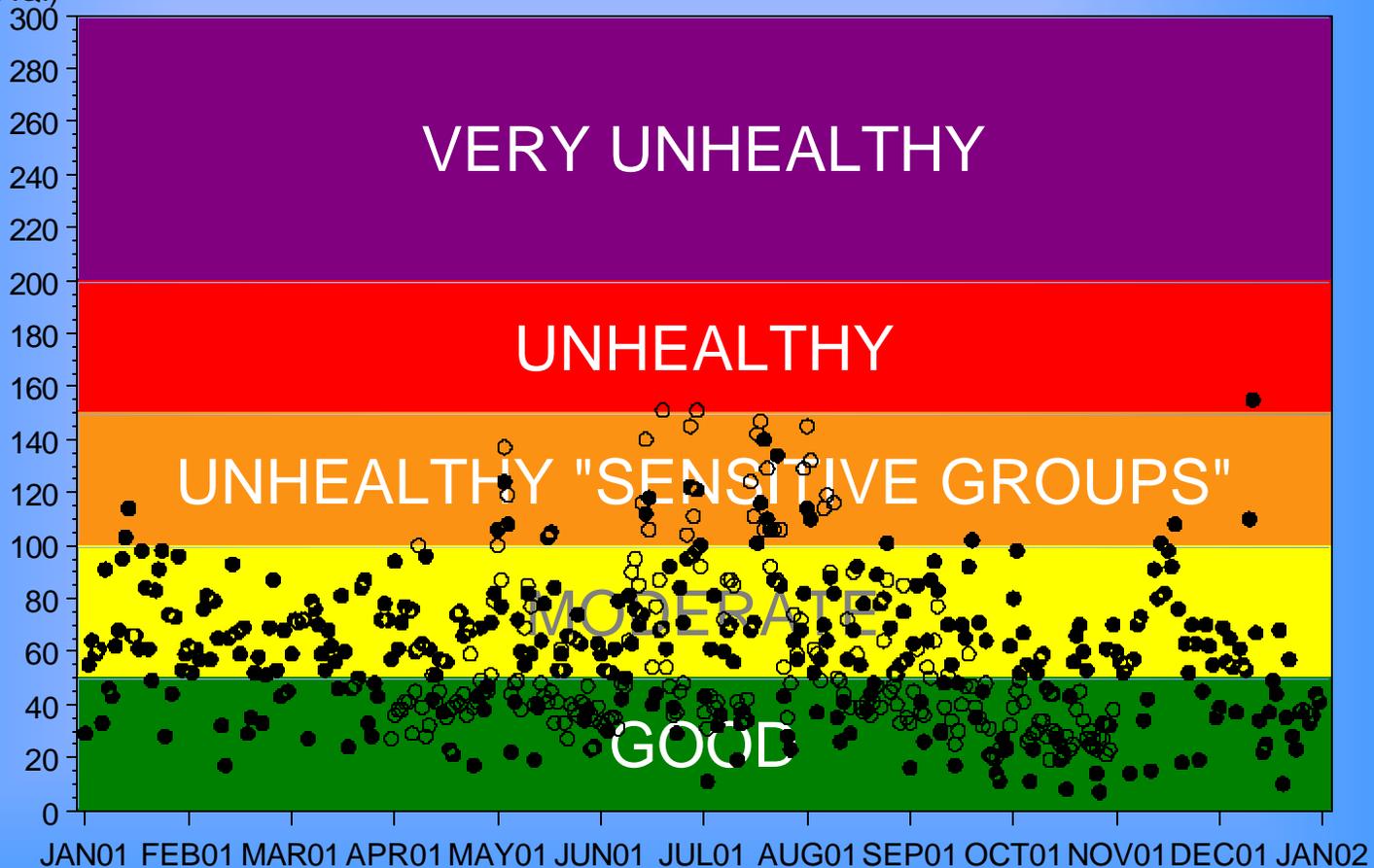


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AQI Levels for PM2.5 Are Elevated Like Ozone But Occur In The Winter As Well As Summer

MSA=1680 MSA_NAME=CLEVELAND-LORAIN-ELYRIA, OH

Air Quality Index (AQI)

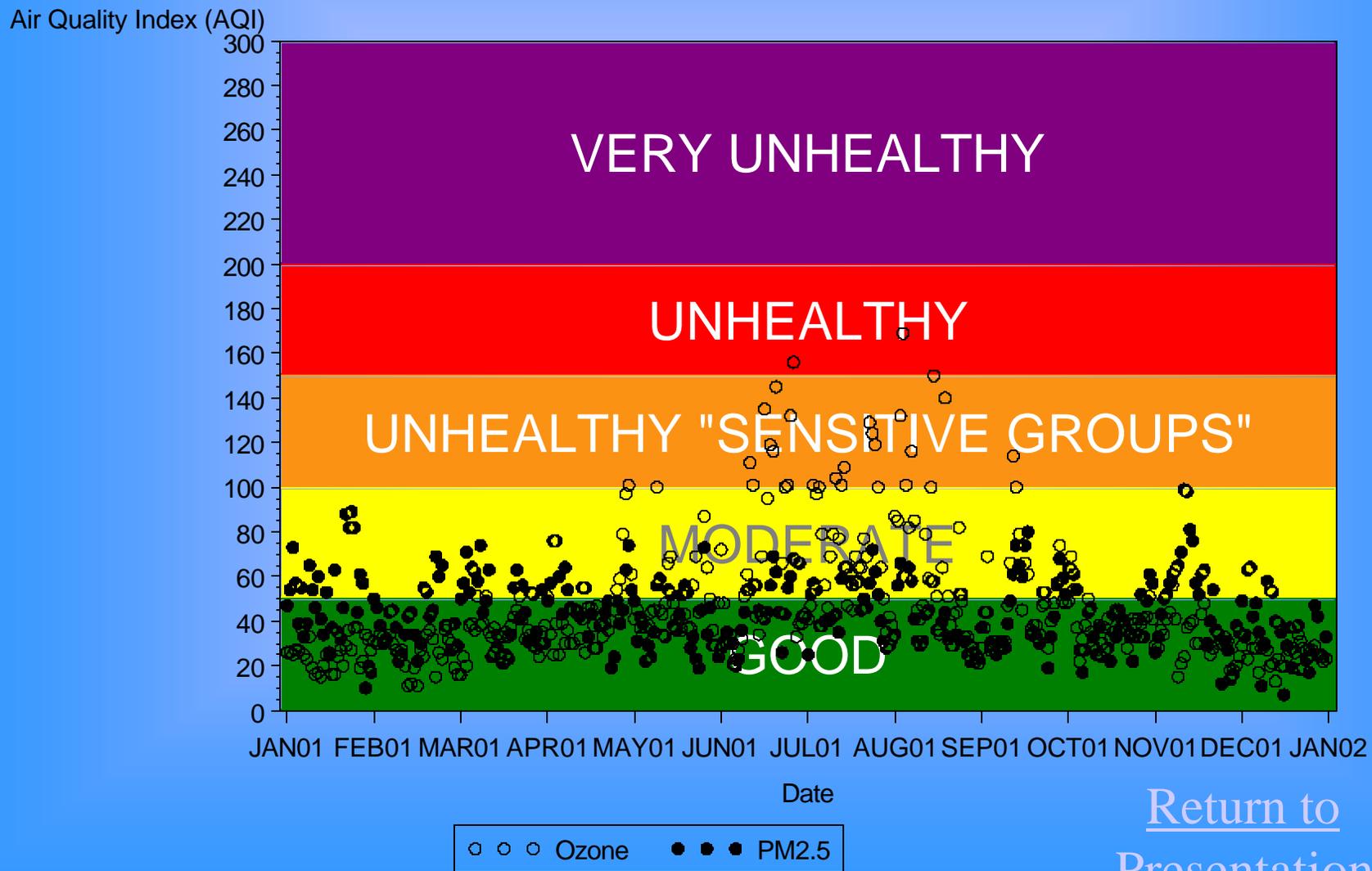


○ ○ ○ Ozone ● ● ● PM2.5

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AQI Levels for PM2.5 are moderate throughout the year and are not elevated like O3

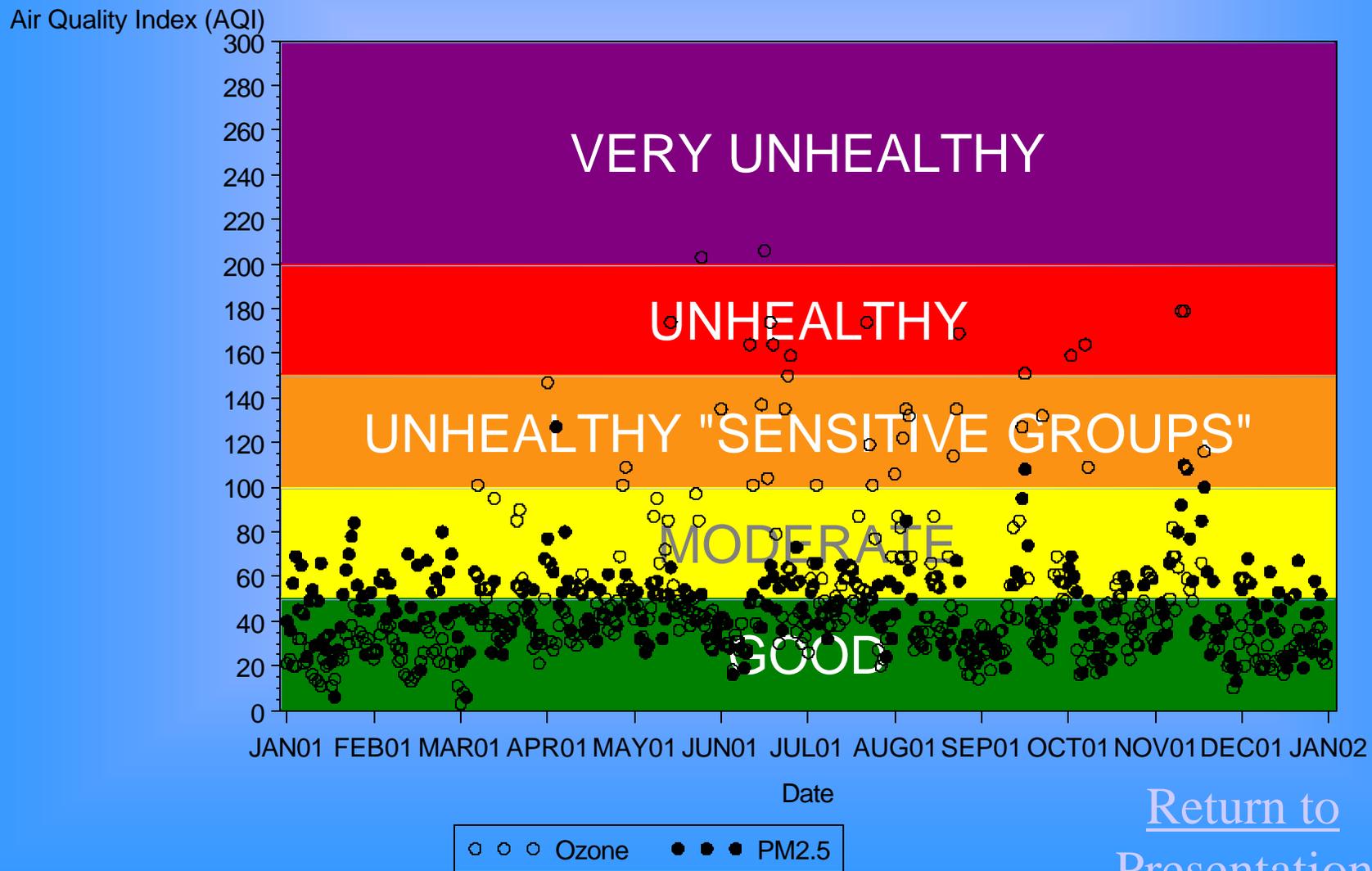
MSA=1920 MSA_NAME=DALLAS, TX



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AQI Levels for PM2.5 are only occasionally elevated, unlike Ozone

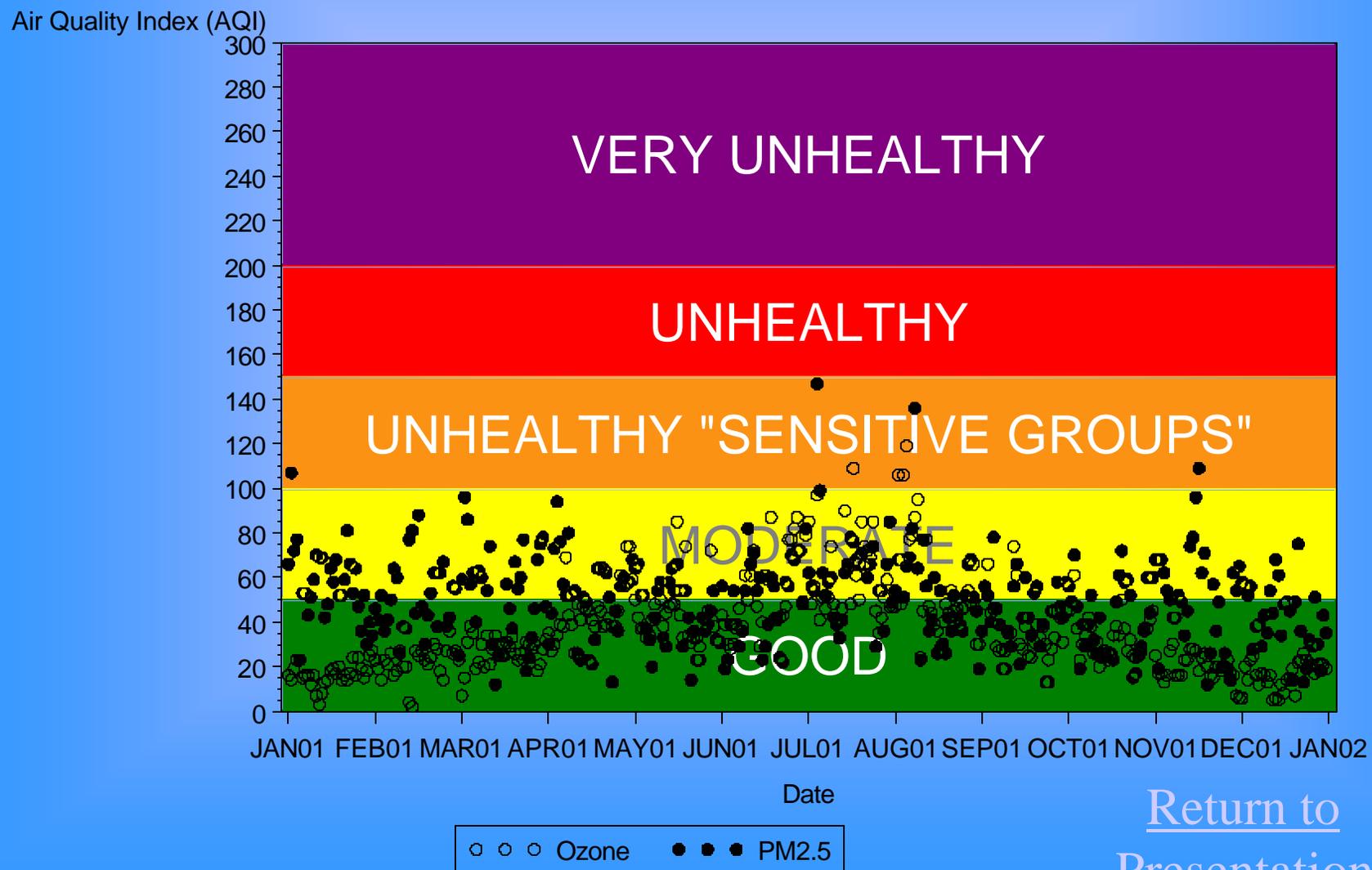
MSA=3360 MSA_NAME=HOUSTON, TX



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AQI Levels for PM2.5 Can Be More Elevated Than Ozone And Can Occur In The Winter As Well As Summer

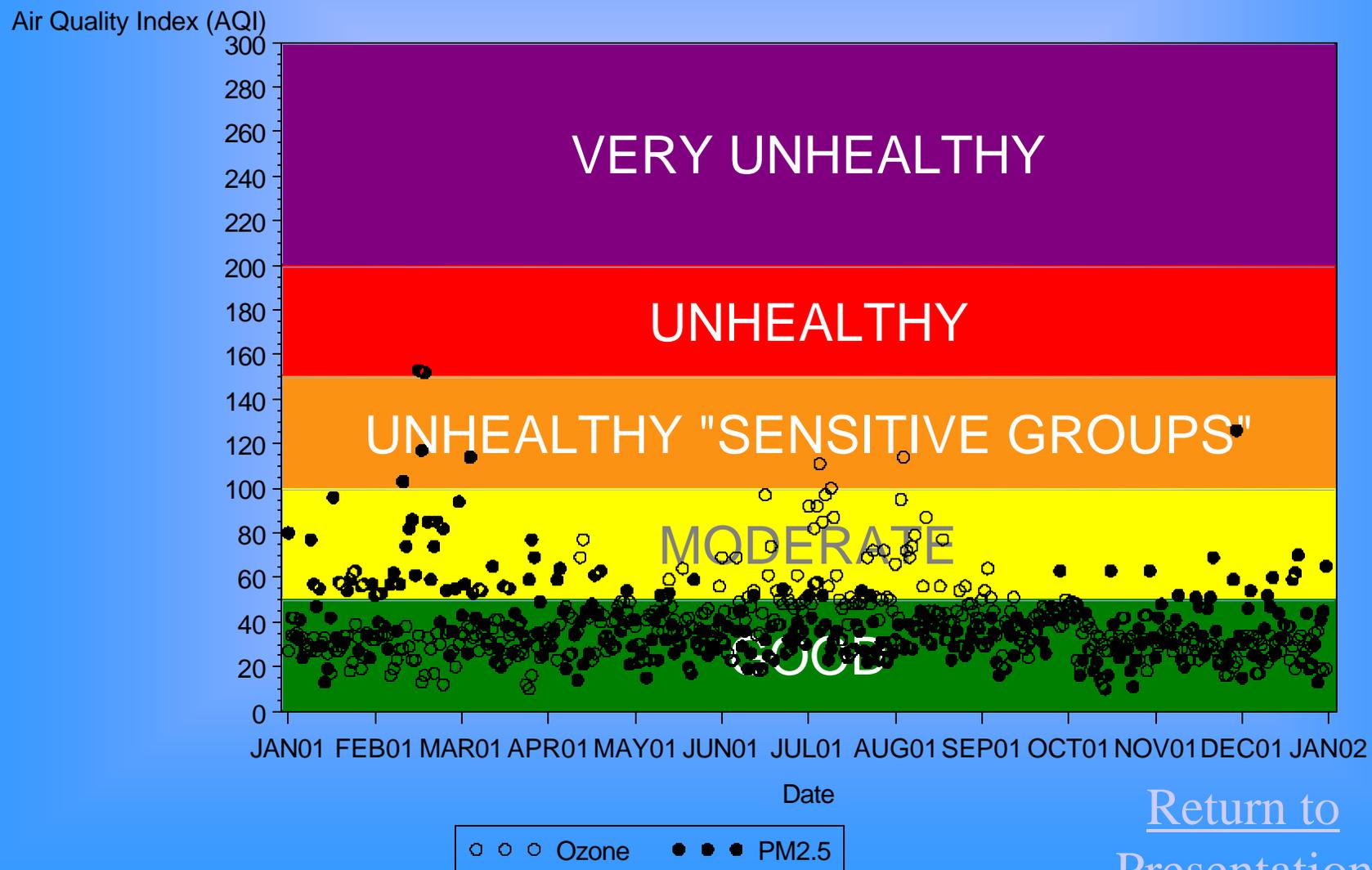
MSA=3760 MSA_NAME=KANSAS CITY, MO-KS



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AQI Levels for PM2.5 Are Elevated Like Ozone But Can Occur In The Winter Instead of the Summer

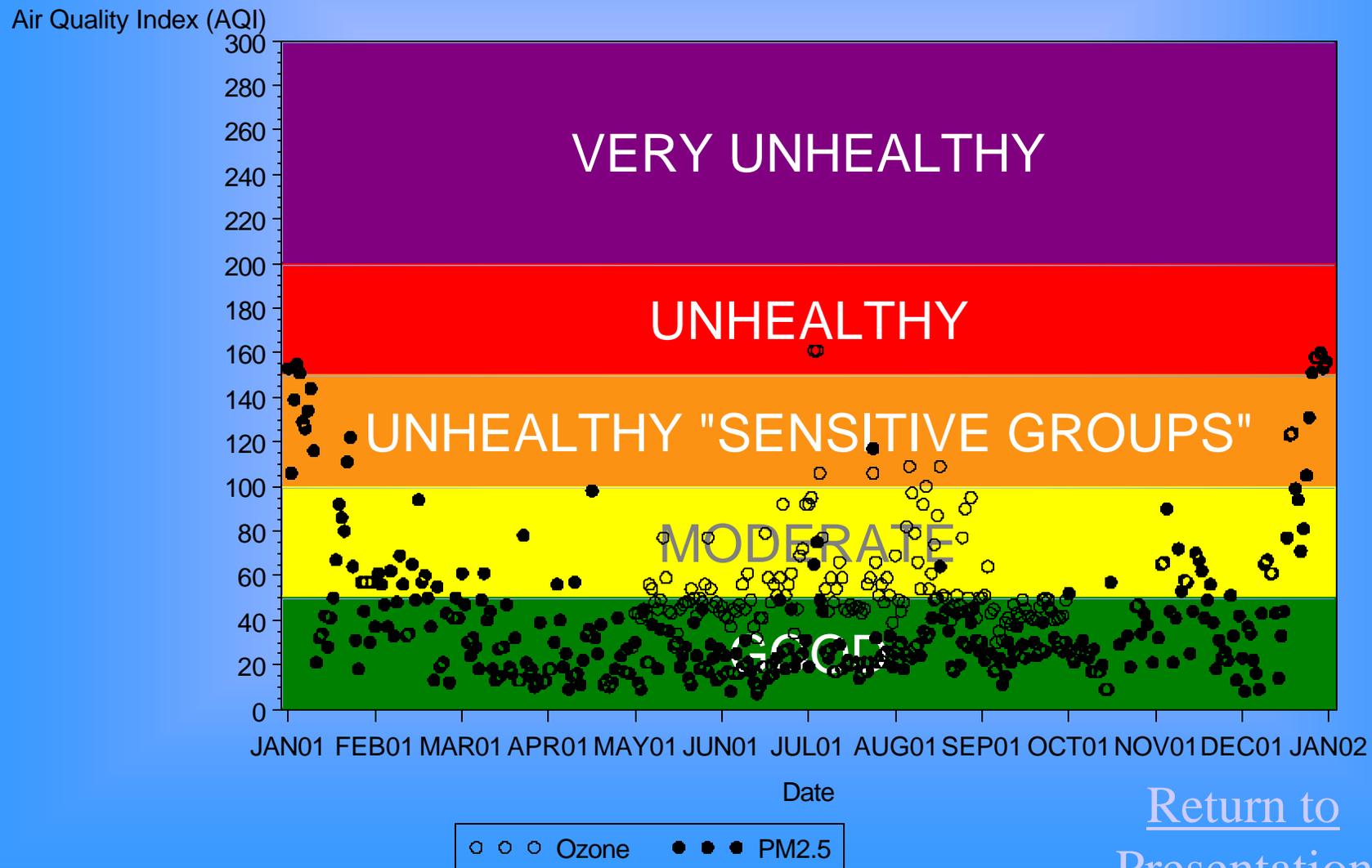
MSA=2080 MSA_NAME=DENVER, CO



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AQI Levels for PM2.5 Are Elevated Like Ozone But Can Occur In The Winter In Addition to the Summer

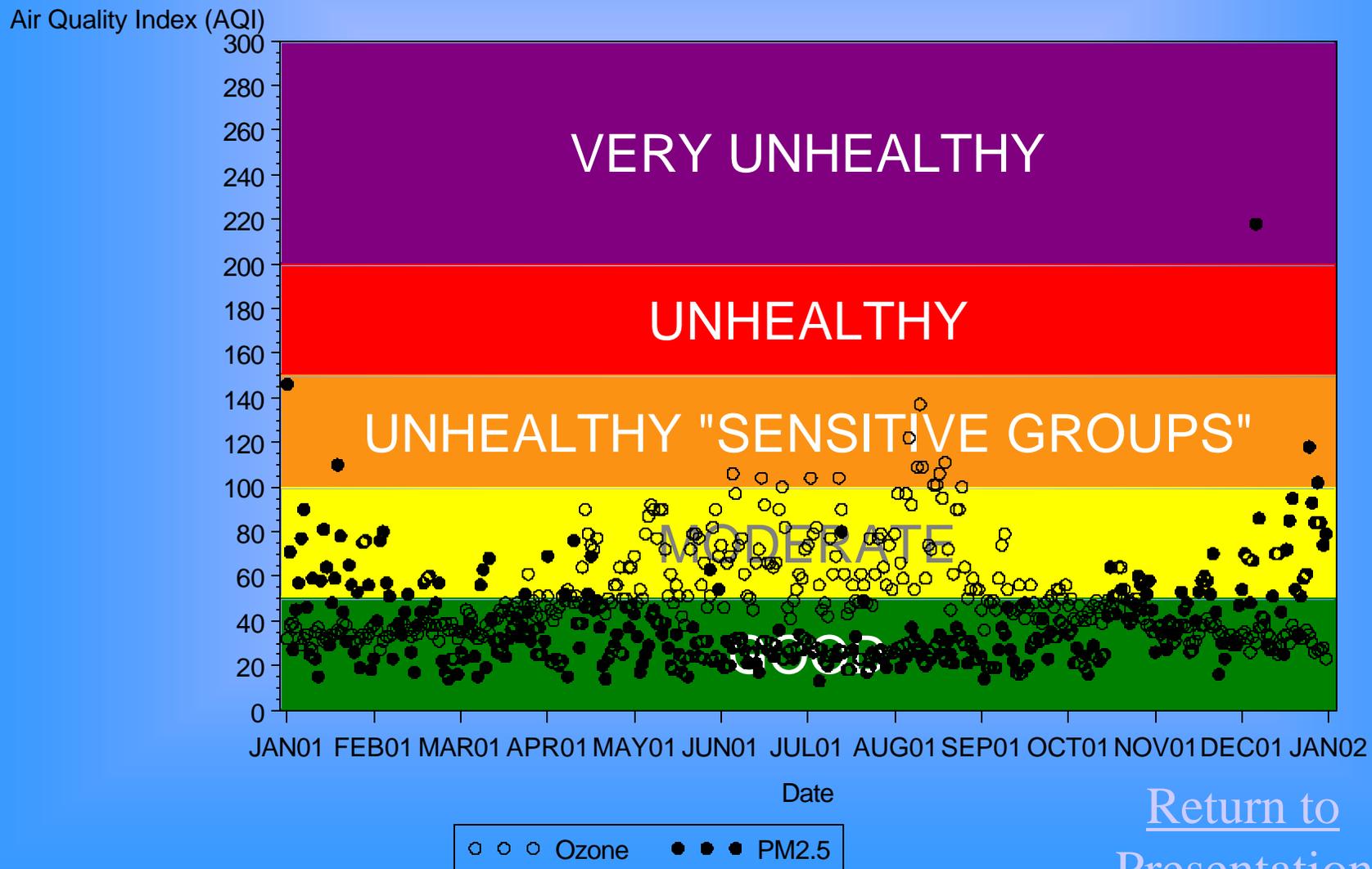
MSA=7160 MSA_NAME=SALT LAKE CITY-OGDEN, UT



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AQI Levels for PM2.5 Are Elevated Like Ozone But Can Occur In The Winter Instead of the Summer

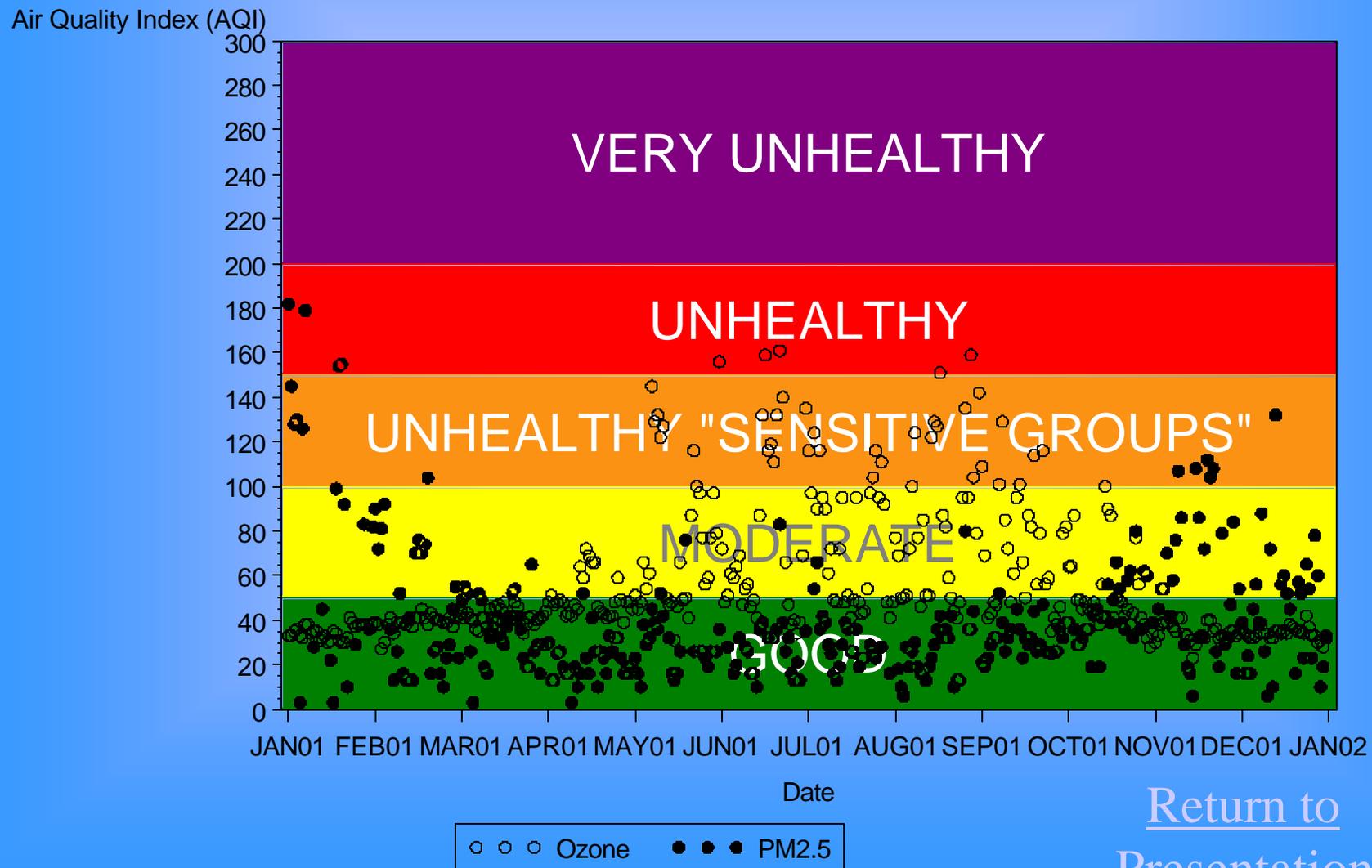
MSA=6200 MSA_NAME=PHOENIX-MESA, AZ



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AQI Levels for PM2.5 Are Elevated Like Ozone But Can Occur In The Winter Instead of the Summer

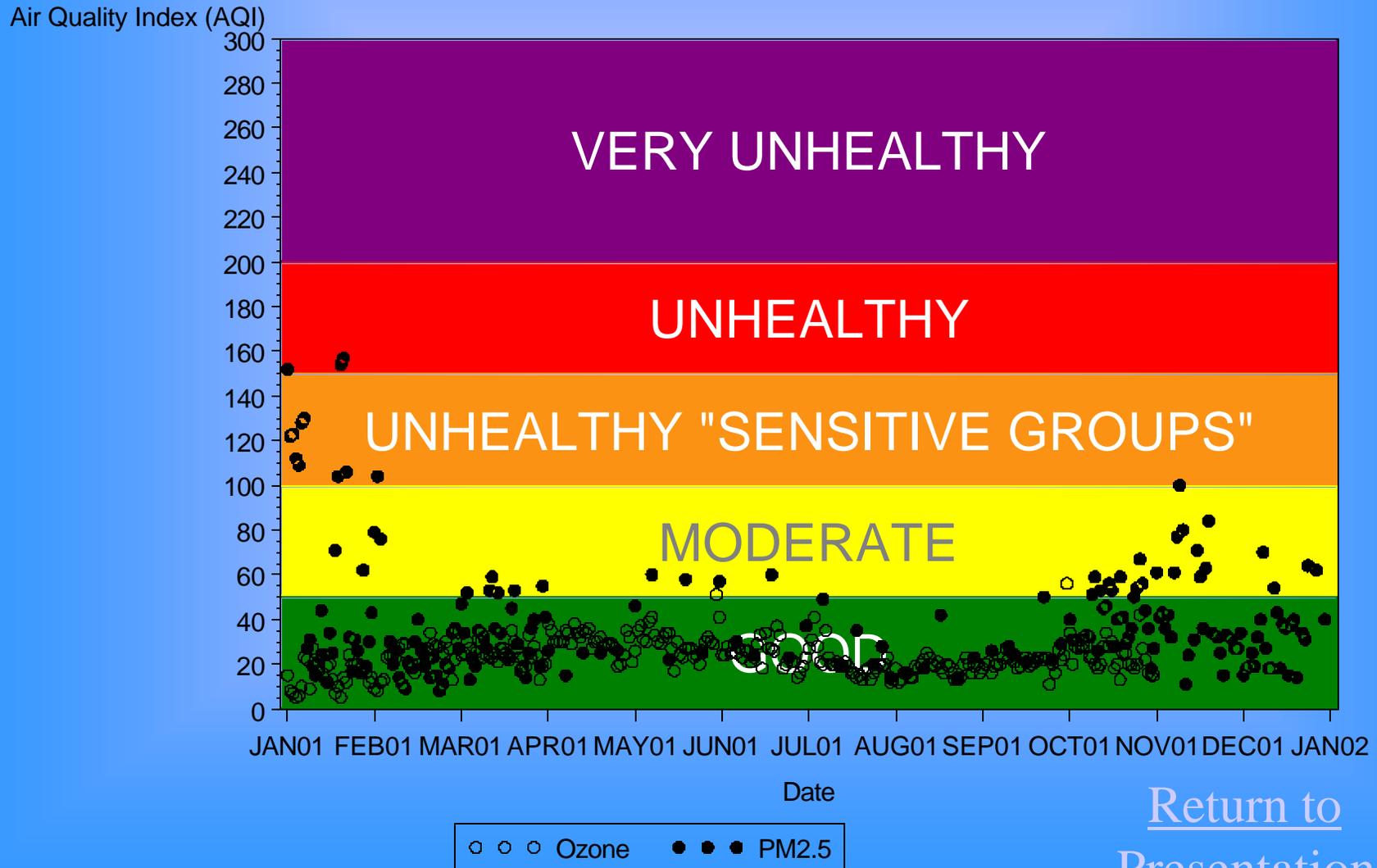
MSA=6920 MSA_NAME=SACRAMENTO, CA



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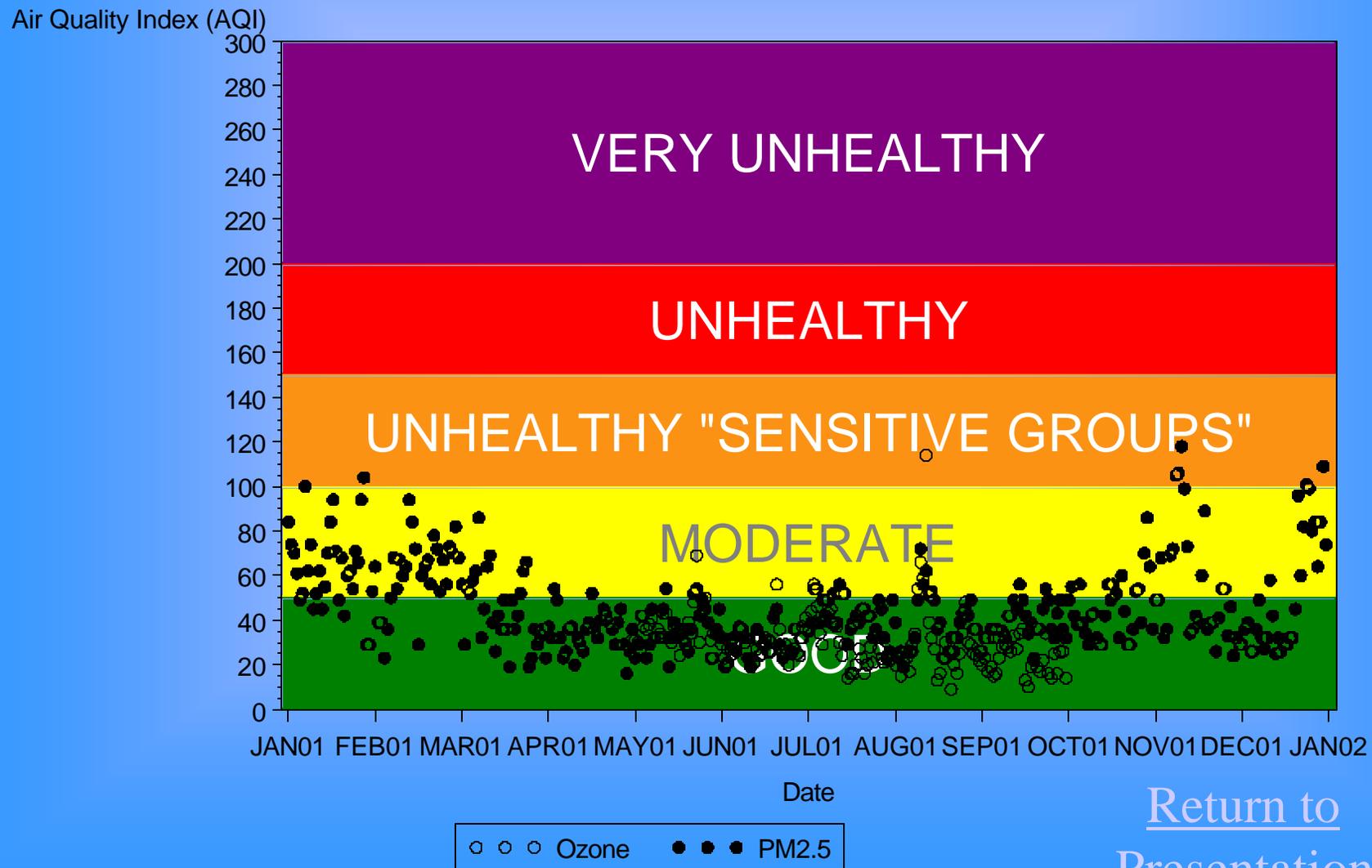
AQI Levels for PM2.5 Are Elevated In Areas Where Ozone Has Not Been Elevated

MSA=7360 MSA_NAME=SAN FRANCISCO, CA



AQI Levels for PM2.5 Are Elevated Like Ozone But Can Occur In The Winter Instead of the Summer

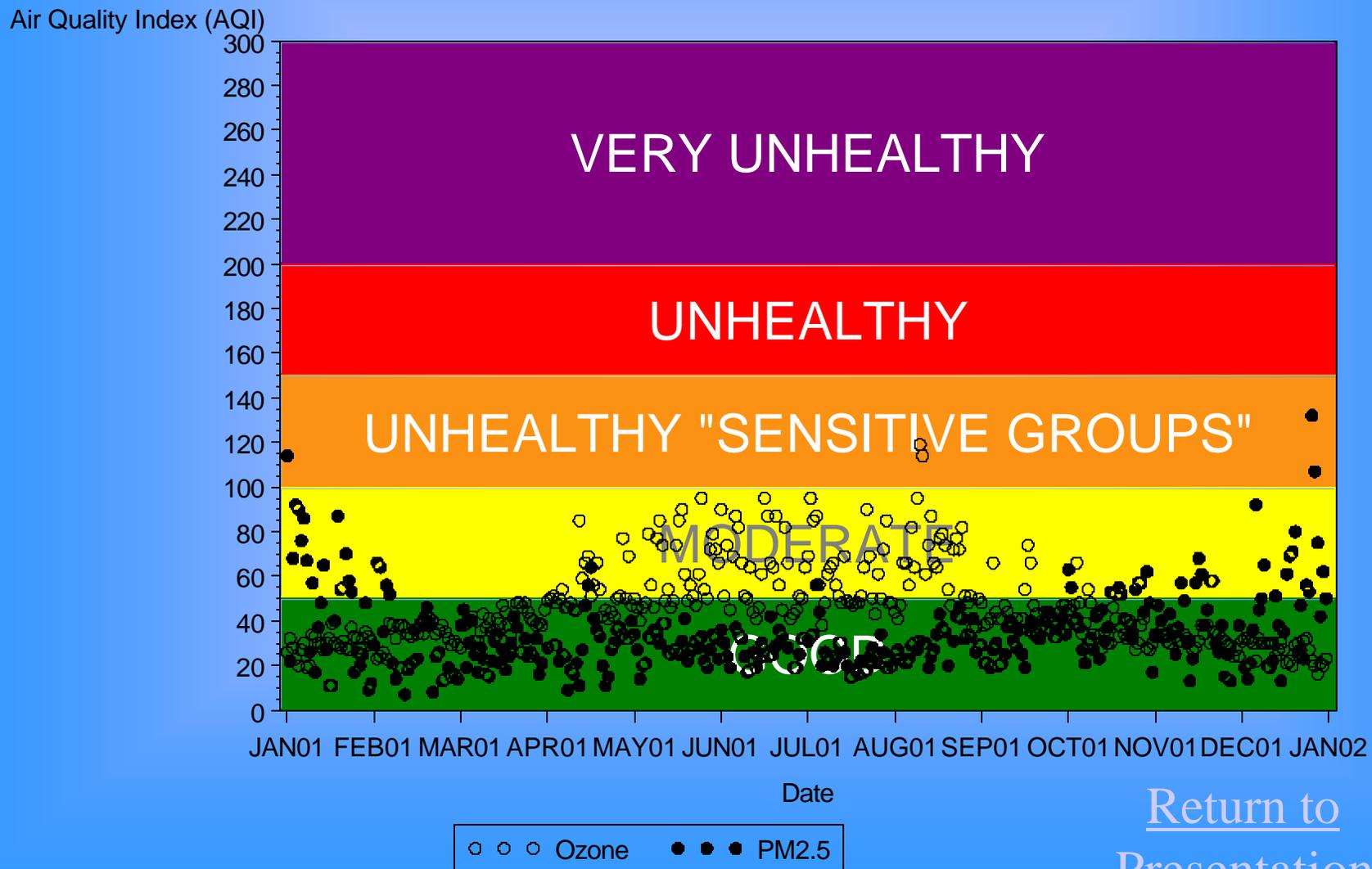
MSA=7600 MSA_NAME=SEATTLE-BELLEVUE-EVERETT, WA



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AQI Levels for PM2.5 Are Elevated Like Ozone But Can Occur In The Winter Instead of the Summer

MSA=4120 MSA_NAME=LAS VEGAS, NV-AZ



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AQI Levels for PM2.5 Are Elevated Like Ozone And Can Be Higher in Fall and Winter

MSA=4480 MSA_NAME=LOS ANGELES-LONG BEACH, CA

Air Quality Index (AQI)



○ ○ ○ Ozone ● ● ● PM2.5

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