

Real-time Air Quality Mapping for the South Coast Air Basin



**Kevin Durkee, Mark Bassett, Chris Nelson,
Sang-Mi Lee & Joseph Cassmassi**

South Coast Air Quality Management District
Diamond Bar, California

kdurkee@aqmd.gov

Outline

- South Coast AQMD jurisdiction overview
- Web Mapping AQI – examples, issues & potential solutions
- Real-time PM2.5 issues
 - BAM Adjustment to FRM
 - Fog/Humidity Issue

SCAQMD Information

- SCAQMD jurisdiction:
 - the South Coast Air Basin
 - Orange County and the non-desert portions of Los Angeles, Riverside and San Bernardino Counties
 - part of Salton Sea and Mojave Desert Air Basins
 - Coachella Valley (SSAB)
 - portion of desert Riverside County (MDAB)
- SCAQMD provides forecasts for the Antelope Valley APCD & Mojave Desert AQMD
- 45 Forecast Areas total





South Coast Air Quality Management District

South Coast Air Basin:

- 10,743 square miles
- 16 million people
- 11 million gasoline vehicles
- 300,000 diesel vehicles

MDAB

SCAB

MDAB

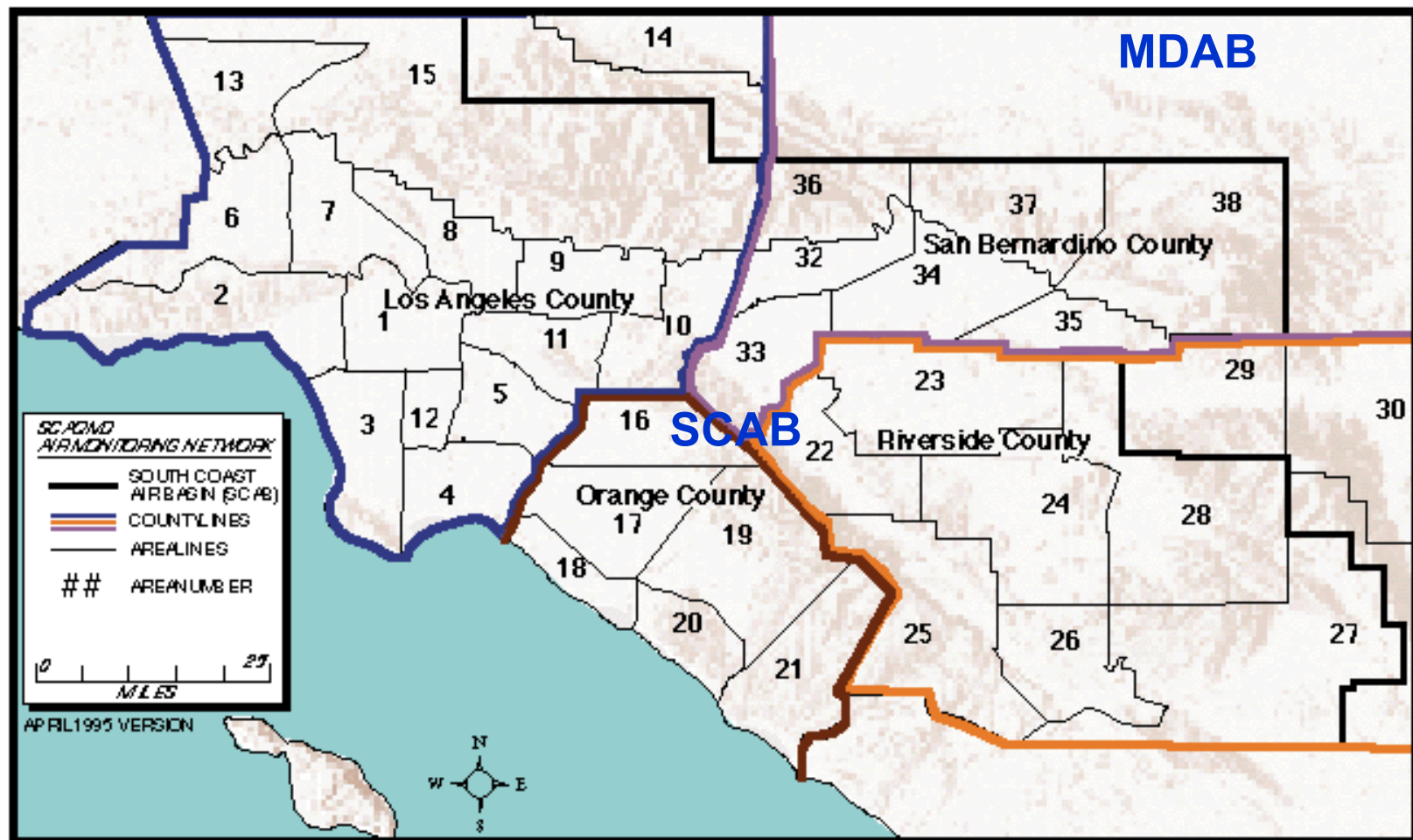
SSAB



*Not Shown: San Clemente Island

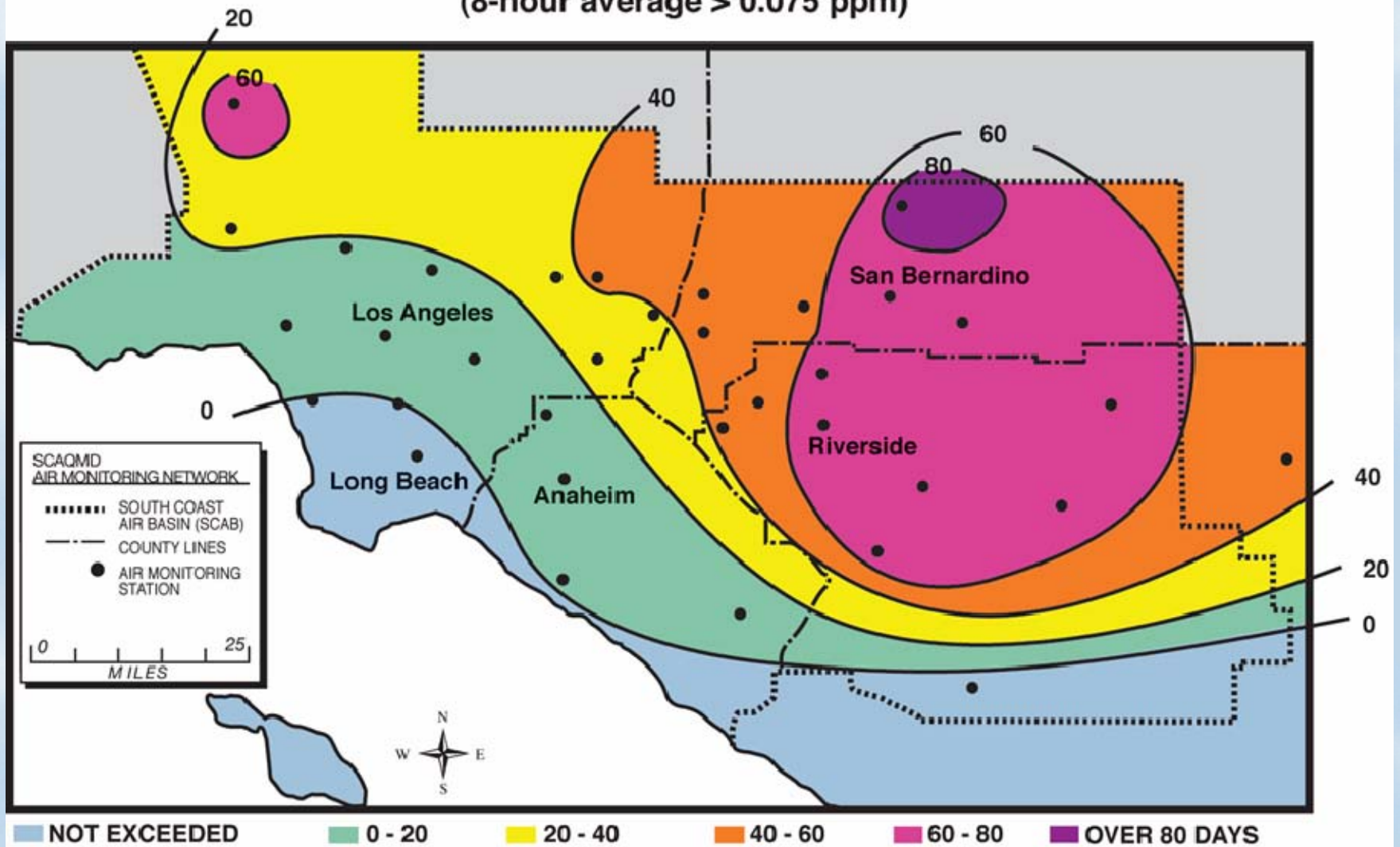
Copyright 1999 by Sierra W

Forecast for 45 Source-Receptor Areas



OZONE – 2008

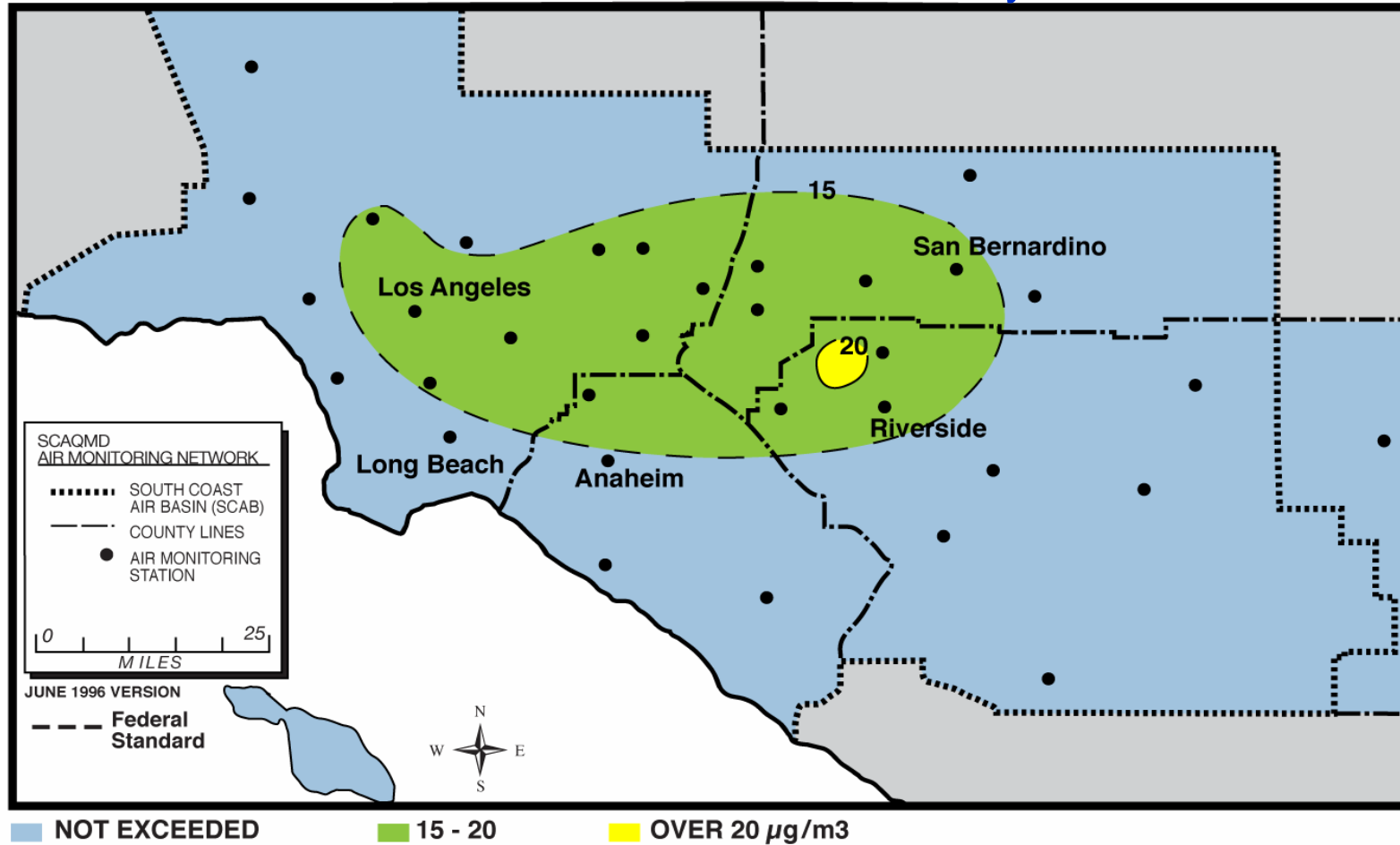
Number of Days Exceeding the Federal Standard (8-hour average > 0.075 ppm)



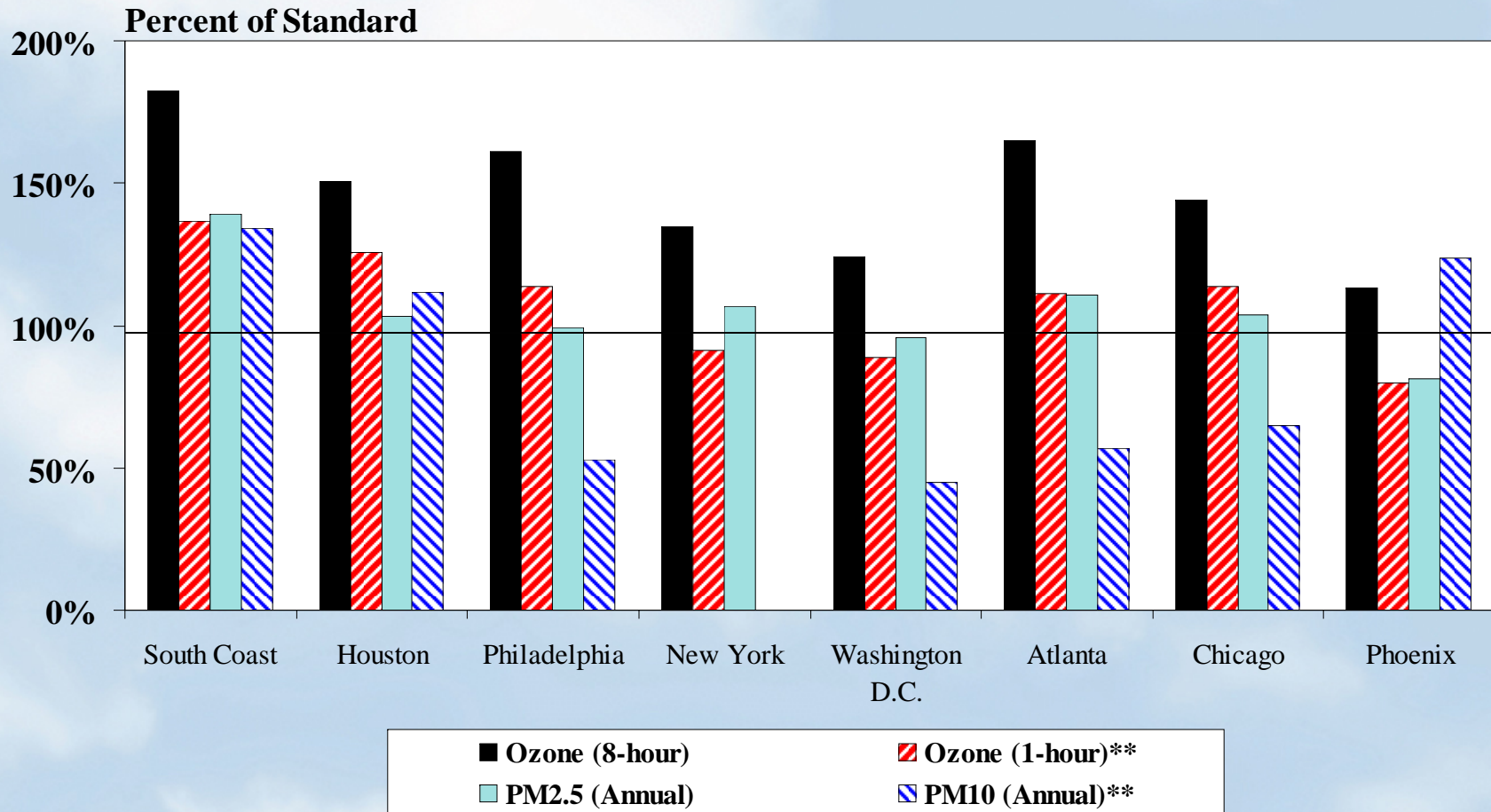
PM2.5 – 2007

Annual Arithmetic Mean, $\mu\text{g}/\text{m}^3$
(Federal Standard = $15 \mu\text{g}/\text{m}^3$)

Exceeded 24-Hr PM2.5 NAAQS ON 48 days in 2007



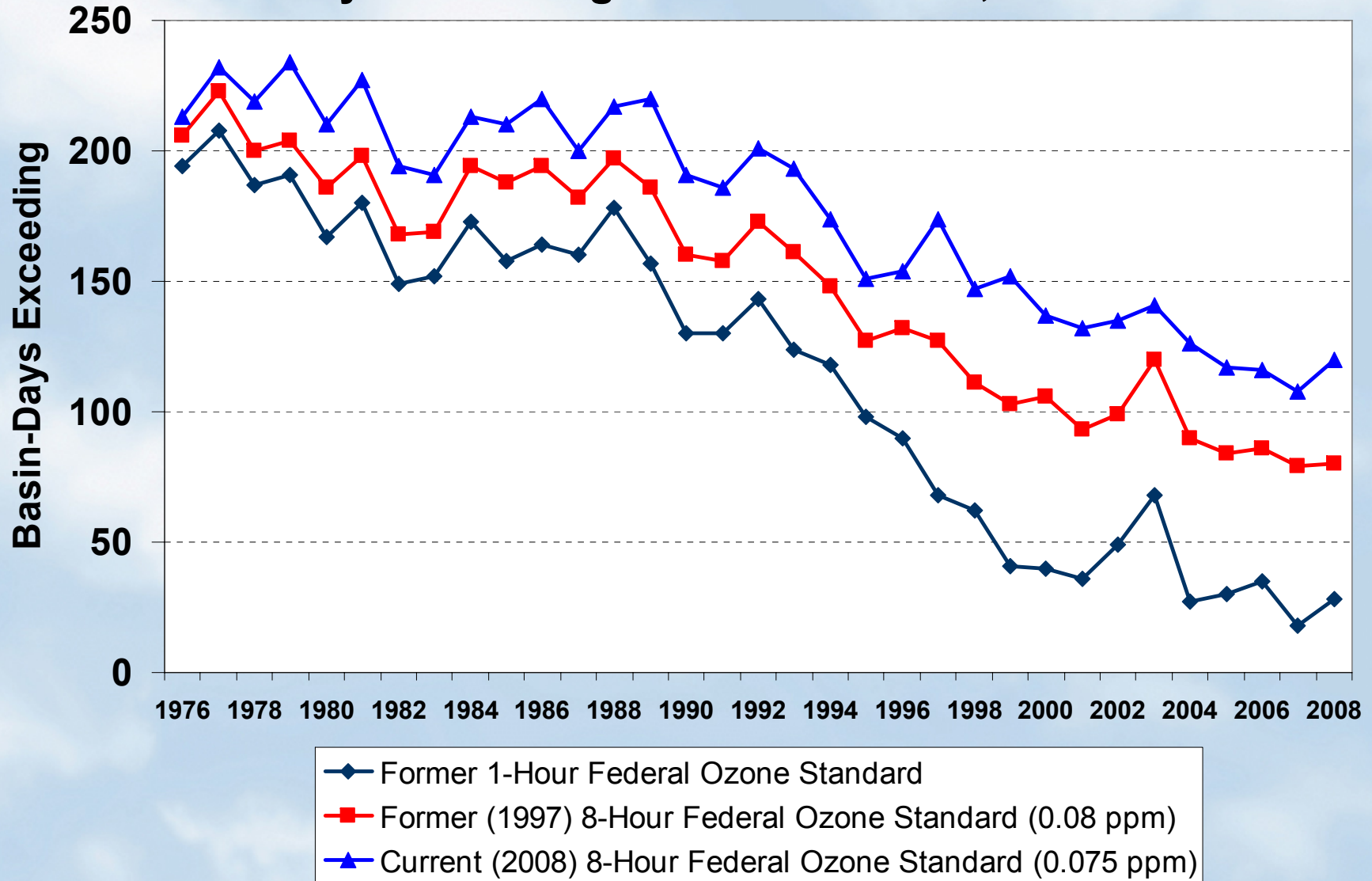
2007 South Coast Air Basin Air Quality Compared to Other U.S. Cities



** Based on the former standards.

South Coast Air Basin

Days Exceeding Ozone Standards, 1976-2008





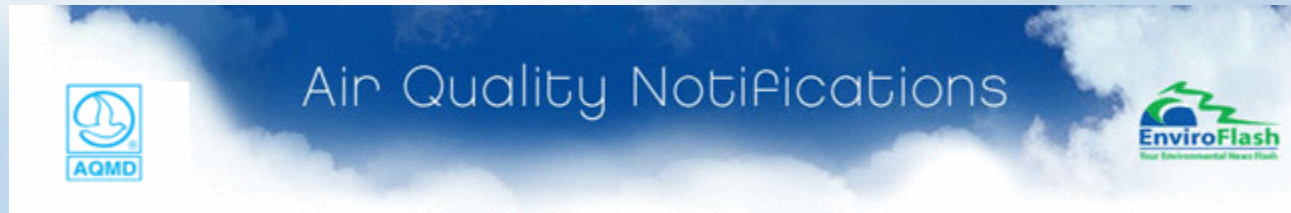
Criteria Pollutant Measurements

- Ozone 30 stations
- Carbon Monoxide 26 stations
- Nitrogen Dioxide 25 stations
- PM10 11 continuous (TEOM & BAM)
21 FRM
- PM2.5 9+ continuous (BAM)
20 FRM
4 Portable (eBAM)

SCAQMD AQ Data Accessibility Goals

- Improve Public Accessibility to AQ data and forecasts
 - Had longstanding effective programs
 - Large wildfire events in 2007 highlighted the need to improve
- Improve Agency Response and Forecasting of Events
- Provide Routine AQ Forecasts
 - SCAQMD Website, Email & FAX systems
 - EPA AIRNow & EnviroFlash
- Provide Real-Time Data & Episode Alerts:
 - AIRNow
 - EnviroFlash (exceedance alerts coming soon?)
 - Media Releases
 - SCAQMD Website → New Web Map

EnviroFlash for 45 Forecast Areas



Forecast for Pomona Walnut Vly, CA

Today and Tomorrow's Forecast

Thursday, Jan 29:	54 AQI	Moderate	Yellow	Particle Pollution (2.5 microns)
Friday, Jan 30:	52 AQI	Moderate	Yellow	Particle Pollution (2.5 microns)

This is a pilot program for issuing South Coast Air Quality Management District air quality forecasts through the EPA EnviroFlash System.

Current air quality readings and forecasts for the entire air basin can be obtained from the AQMD web page at <http://www.aqmd.gov/smog> or our automated voice recording system at (800) 288-7664.

SCAQMD Monitoring area map: <http://www.aqmd.gov/map/MapAQMD2.pdf>

Please send any questions or comments to: Mr. Kevin Durkee, Phone: (909) 396-3168, E-Mail: kdurkee@aqmd.gov

SCAQMD AQI Web Mapping

- Map Max AQI
 - Ozone (1- & 8-Hr), PM2.5, PM10, CO & NO2
- Map by longstanding Source-Receptor Areas (~45 Forecast Areas)
- Initial Web Map on-line mid-2008 using Microsoft Virtual Earth platform
- Switched to faster server during November 2008 wildfires
 - huge volume of web hits
 - 140,000 requests/day is average
 - 815,000 requests/day average for the fire week
 - 1.5 Million requests on Monday, March 17, 2008
- Continuing to make improvements

SCAQMD Home Page

<http://www.aqmd.gov/>

AIRNet - Microsoft Internet Explorer provided by AQMD

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites Media Print Copy Paste

Address <http://airnet.aqmd.gov/> Go Links

Google Search 30 blocked Check AutoLink AutoFill Options



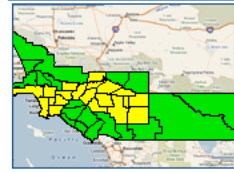
South Coast Air Quality Management District
Cleaning the air that we breathe...

Home | Inside AQMD | Community | Business | Technology | Health & Education | Governing Board

Español | 中文 | 한국어

Air Quality Forecast/Advisories

[Current Hourly Air Quality](#)



Daily Forecast:

[Today](#) [Tomorrow](#) [PDF version](#)

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- [AQMD Newsroom](#)
- [Budgets/Audited Financial Reports](#)
- [Calendar of Events](#)
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- [Certification Programs/Certified Equip...](#)

AQMD is the air pollution control agency for all of Orange County and the urban portions of Los Angeles, Riverside and San Bernardino counties, the smoggiest region of the U.S. We are committed to protecting the health of residents, while remaining sensitive to businesses.



Carl Moyer Funds Available for Diesel Engine Cleanup
Deadline May 1, 2009 at 1pm


Headlines



AQMD News: Agency and states win victory over weak soot health standards
Feb. 24, 2009 - The South Coast Air Quality Management District along with 17 states and cities has won a major legal victory over lax Bush Administration standards for fine soot pollution that failed to protect public health. [More](#)



Lawn Mower Exchange Registration Begins April 22



AQMD News: Governing Board members to host meet-and-greet at historic Mission Inn
Feb. 25, 2009 - The public is invited to discuss air pollution issues and solutions with AQMD board members and staff.



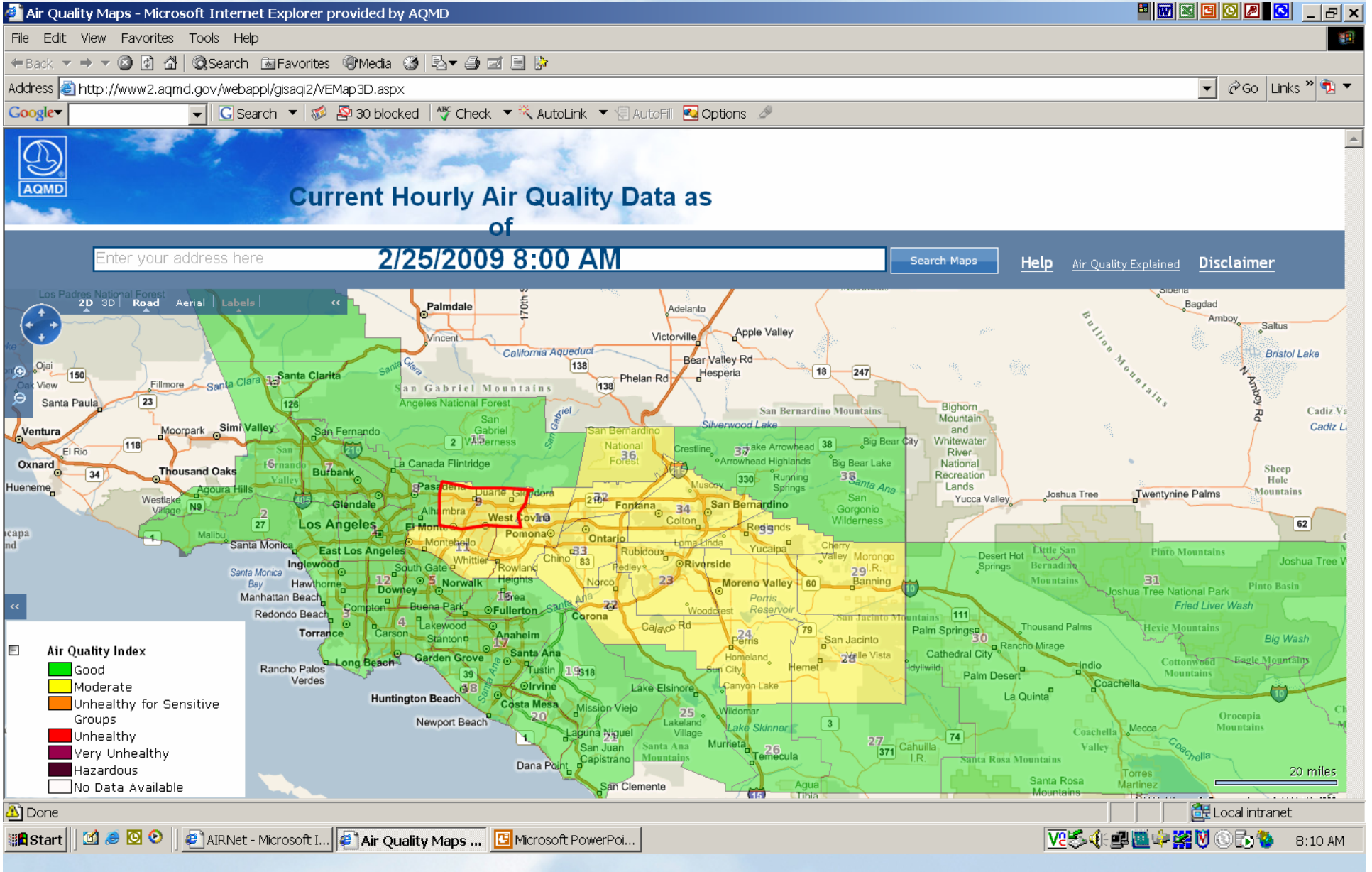
AQMD forms

- [Agenda Tracking](#)
- [Program Websites](#)
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- [Publications & Manuals](#)
- [Employee Interest](#)
- [Employee Timecard](#)

Done Local Intranet

Start Durkee_NAQC200... AIRNet - Microso... 12:55 PM

Hourly Current AQI



Zoom & Mouse-Over Details

Air Quality Maps - Microsoft Internet Explorer provided by AQMD

File Edit View Favorites Tools Help

Address <http://www.2.aqmd.gov/webappl/gisaq2/VEMap3D.aspx>

Search 30 blocked Check AutoLink AutoFill Options

Current Hourly Air Quality of

2/25/2009 8:00 AM

Enter your address here

Air Quality Readings

Area Number	9
Area Name	East San Gabriel Valley
AQI Category	Moderate
AQI Value	55
Pollutant	Fine Particulate Matter (PM2.5) - 24 Hr Average
Reading Date Time	2/25/2009 8:00:00 AM
	East San Gabriel Valley 1
	East San Gabriel Valley 2

Search Maps Help Air Quality Explained Disclaimer

1 miles

Done

Start AIRNet - Microsoft I... Air Quality Maps ... AQMapping.ppt

Local intranet 8:15 AM

Air Quality Forecasts

Air Quality Maps - Microsoft Internet Explorer provided by AQMD

File Edit View Favorites Tools Help

Address http://www2.aqmd.gov/webappl/gisaq2/VEMap3D.aspx?query=Forecast_Tomorrow_Prod

Google Search 30 blocked Check AutoLink AutoFill Options

Tomorrow's Air Quality Forecast for 2/27/2009

Enter your address here [Search Maps](#) [Help](#) [Air Quality Explained](#) [Disclaimer](#)

Air Quality Index

- Good
- Moderate
- Unhealthy for Sensitive Groups
- Unhealthy
- Very Unhealthy
- Hazardous
- No Data Available

Microsoft Virtual Earth™

Done, but with errors on page. Local intranet

Start AQMapping.ppt Air Quality Maps - M... 12:28 PM

Map Implementation Issues

- Proxy assumptions needed to map source-receptor areas with no monitoring stations
- Backward looking 8-hour ozone and 24-hour PM averages not responsive enough
- How to handle missing data?
- Want mapped data to be health protective and representative

Implementation

- Currently using regression equations for a “mid-point” 8-hour ozone estimate from 1-hour average
 - These work well but should be revisited
- Initially using backward-looking 24-hour average for PM_{2.5} and PM₁₀
- Regression equations not as well-suited to PM 24-hour averages
- Needed a “mid-point” surrogate method for 24-hour PM averages

Mid-Point 24-Hour Average (Conroy Method)

- $MID24 = (12 \times C_{12} + 12 \times C_4) / 24$
 - where C_{12} = 12-Hour Running Average PM
 - C_4 = 4-Hour Running Average PM
- Uses normal AQI cutpoints
- Can be used year round
- Makes mapped PM AQI more responsive to fires
- AIRNow uses a modified version of this method using an “adjusted” 4-Hour average
- To be more health protective, SCAQMD plans to use the higher AQI from the Conroy and the 24-Hour Running Average (18 observations minimum) for the real-time reported AQI.

Wildfire Smoke

A Guide for Public Health Officials

Revised July 2008



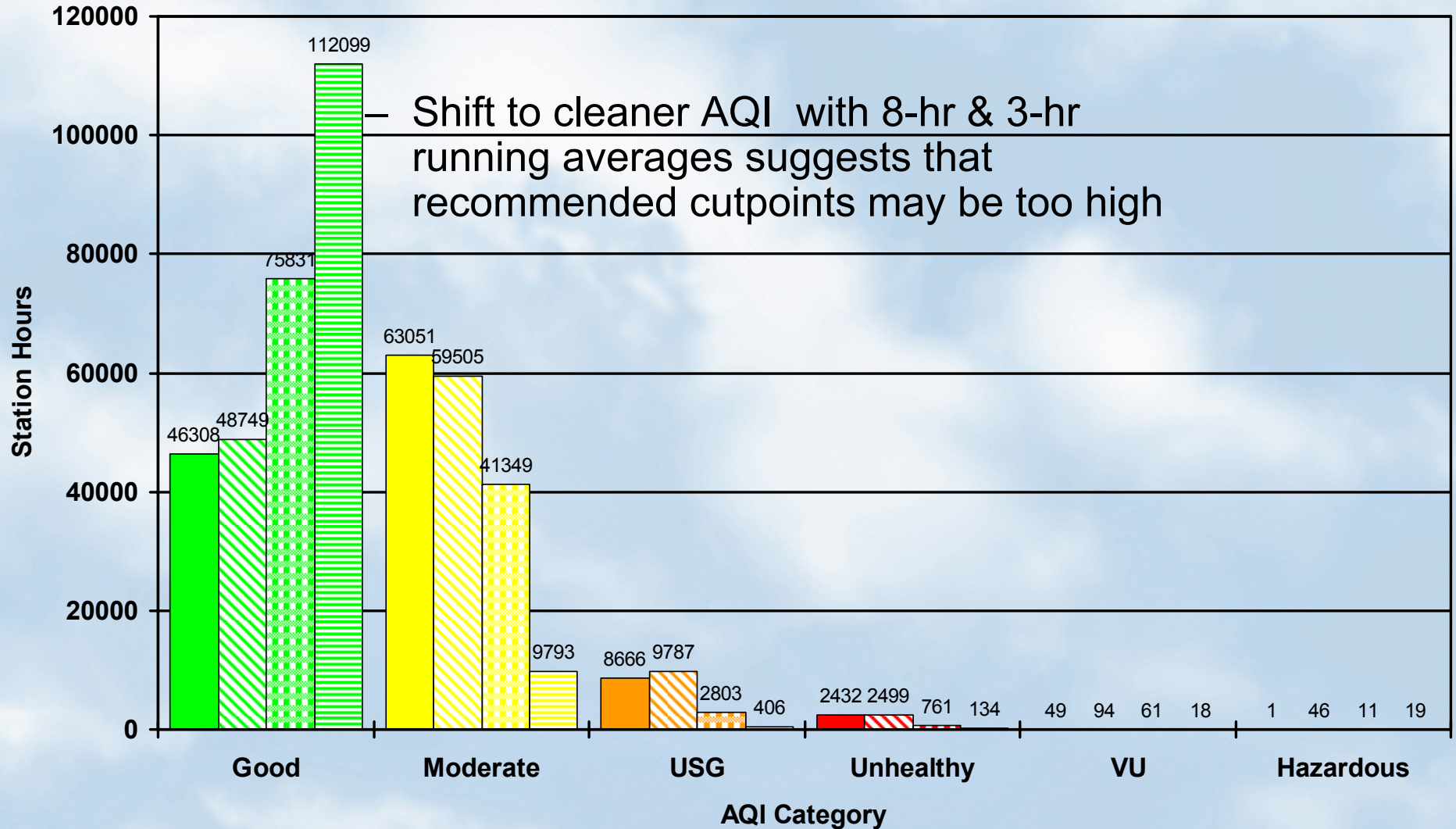
- Guidance document written by the California Office of Environmental Health Hazard Assessment, the U.S. Environmental Protection Agency; and the Missoula County Health Department
- Input from individuals in several other state and federal agencies, in particular the California Department of Health Services, the California Air Resources Board, and the Washington State Department of Health
- Based on more precautionary breakpoints used by Washington & Montana
- AQI Scaling Factors from **EPA SCREEN model**
- http://oehha.ca.gov/air/risk_assess/wildfirev8.pdf

Wildfire Smoke AQI Guidance

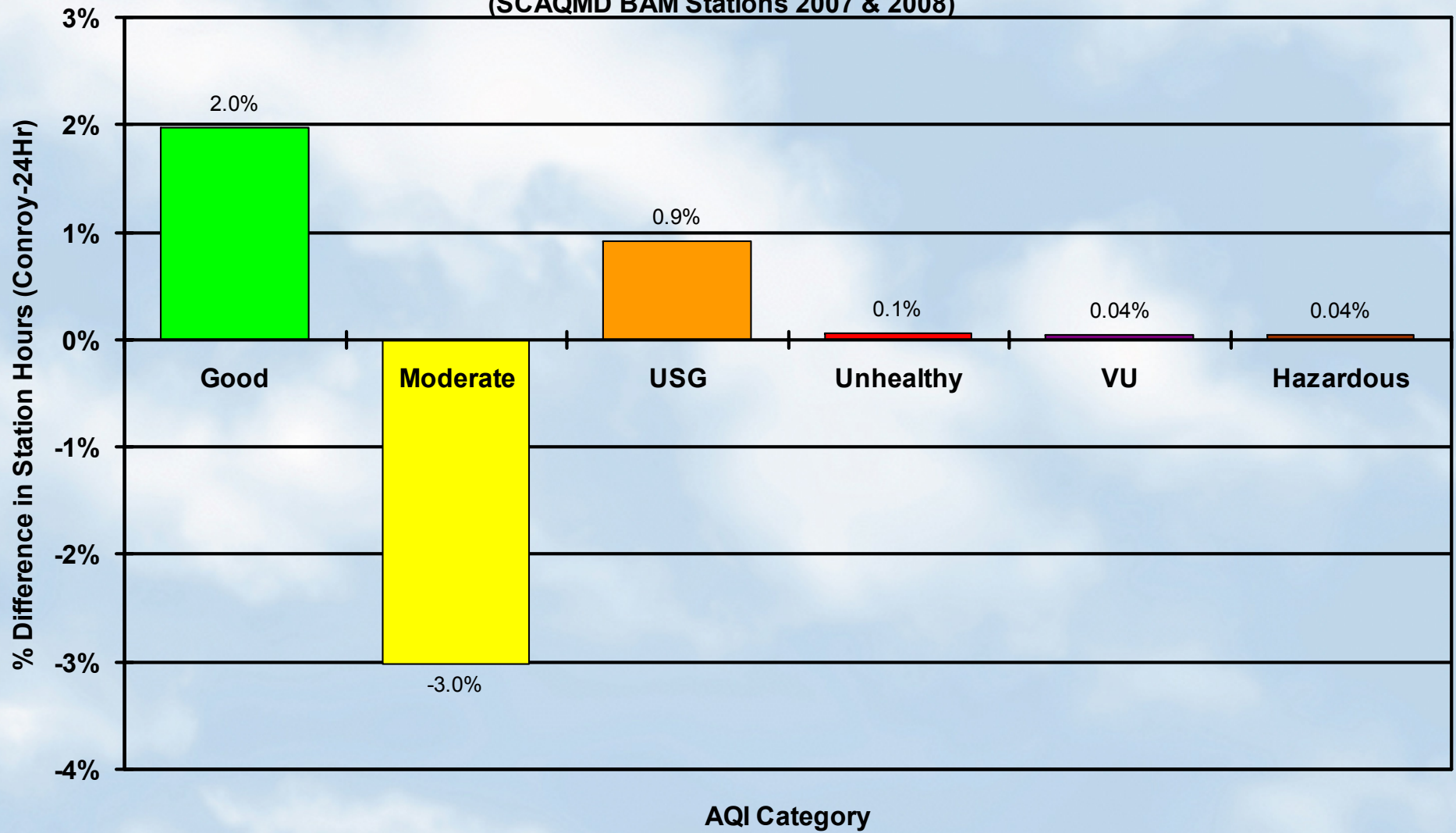
(updated with 1/15/09 Proposed EPA AQI cutpoints)

AQI	PM2.5 or PM10 Level ($\mu\text{g}/\text{m}^3$, 1- to 3-Hr Avg) [PM₂₄ ÷ 0.4]	PM2.5 or PM10 Level ($\mu\text{g}/\text{m}^3$, 8-Hr Avg) [PM₂₄ ÷ 0.7]	PM2.5 or PM10 Level ($\mu\text{g}/\text{m}^3$, 24-Hr Avg)	Visibility (miles, in arid conditions)
Good (0-50)	0-38	0-22	0-15.4	≥ 11
Moderate (51-100)	39-88	23-50	15.5-35.4	6-10
USG (101-150)	89-138	51-79	35.5-55.4	3-5
Unhealthy (151-200)	139-375	80-214	55.5-150.4	1.5-2.75
Very Unhealthy (201-300)	376-626	215-357	150.5-250.4	1-1.25
Hazardous (>300)	≥ 626	≥ 358	≥ 250.5	< 1

PM2.5 AQI Category Hours by Method SCAQMD BAM Stations 2007-2008



% Change in Basin-Wide PM2.5 Station Hours
due to Switch from Running 24-Hour Average to Conroy Method
(SCAQMD BAM Stations 2007 & 2008)



Example: Southern California Wildfires

November 2008

- Strong Santa Ana Winds
- Three Fires:
 - **Tea** (Santa Barbara; Nov 13-17; 1,940 Acres)
 - **Sayre** (Sylmar; Nov 14-20; 11,262 Acres)
 - **Freeway Complex** (Yorba Linda, Brea, Chino Hills; Nov 15-19; 30,305 Acres)
- > 50,000 Residents Evacuated
- > 43,000 Acres Burned
- > 1,000 Structures Destroyed
- Air Quality Impacts for 8 Days +
- AQI Mapping Changes were made on the fly

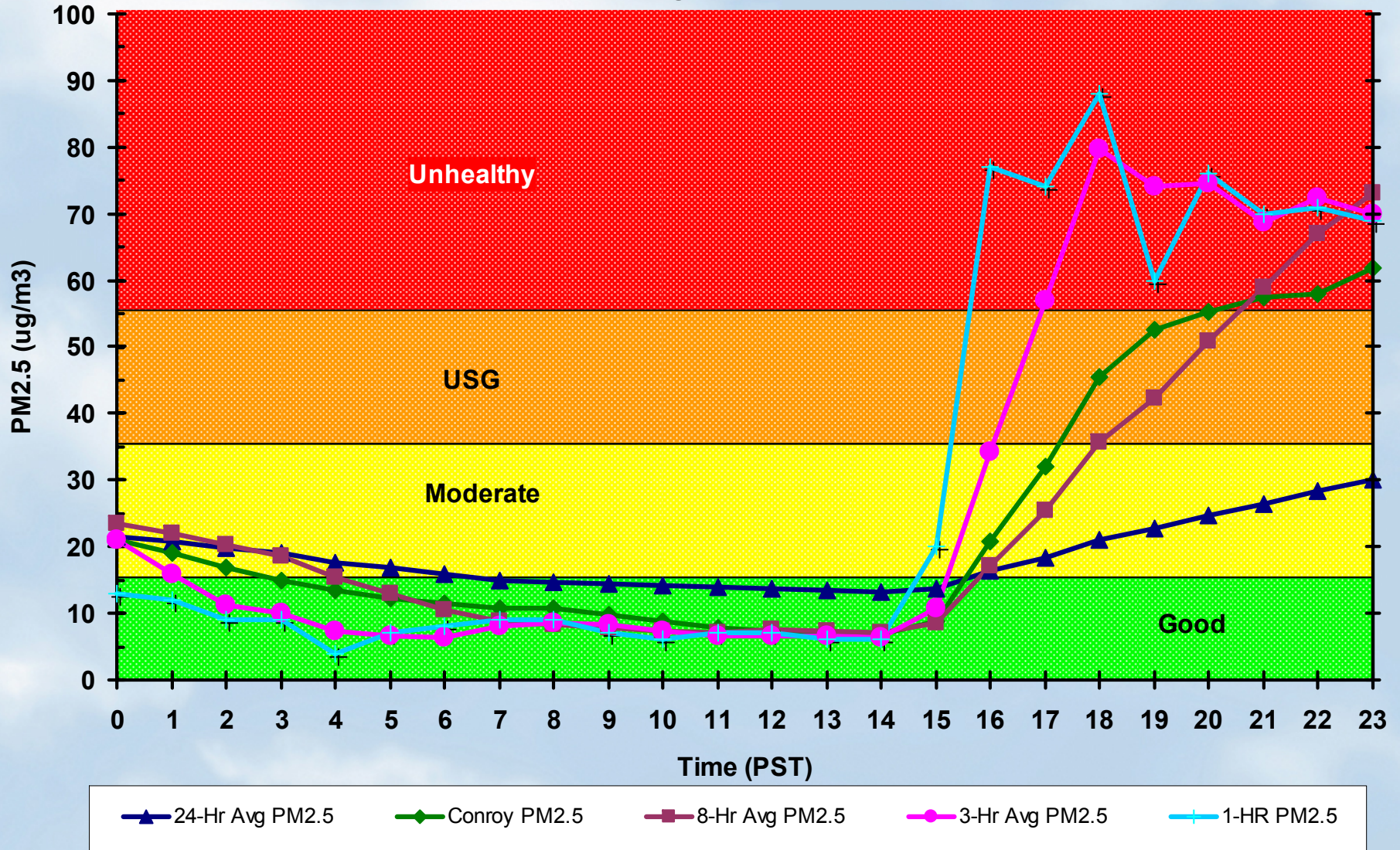
November 15, 2008 ~1030 PST
NASA MODIS Terra Satellite True Color Image



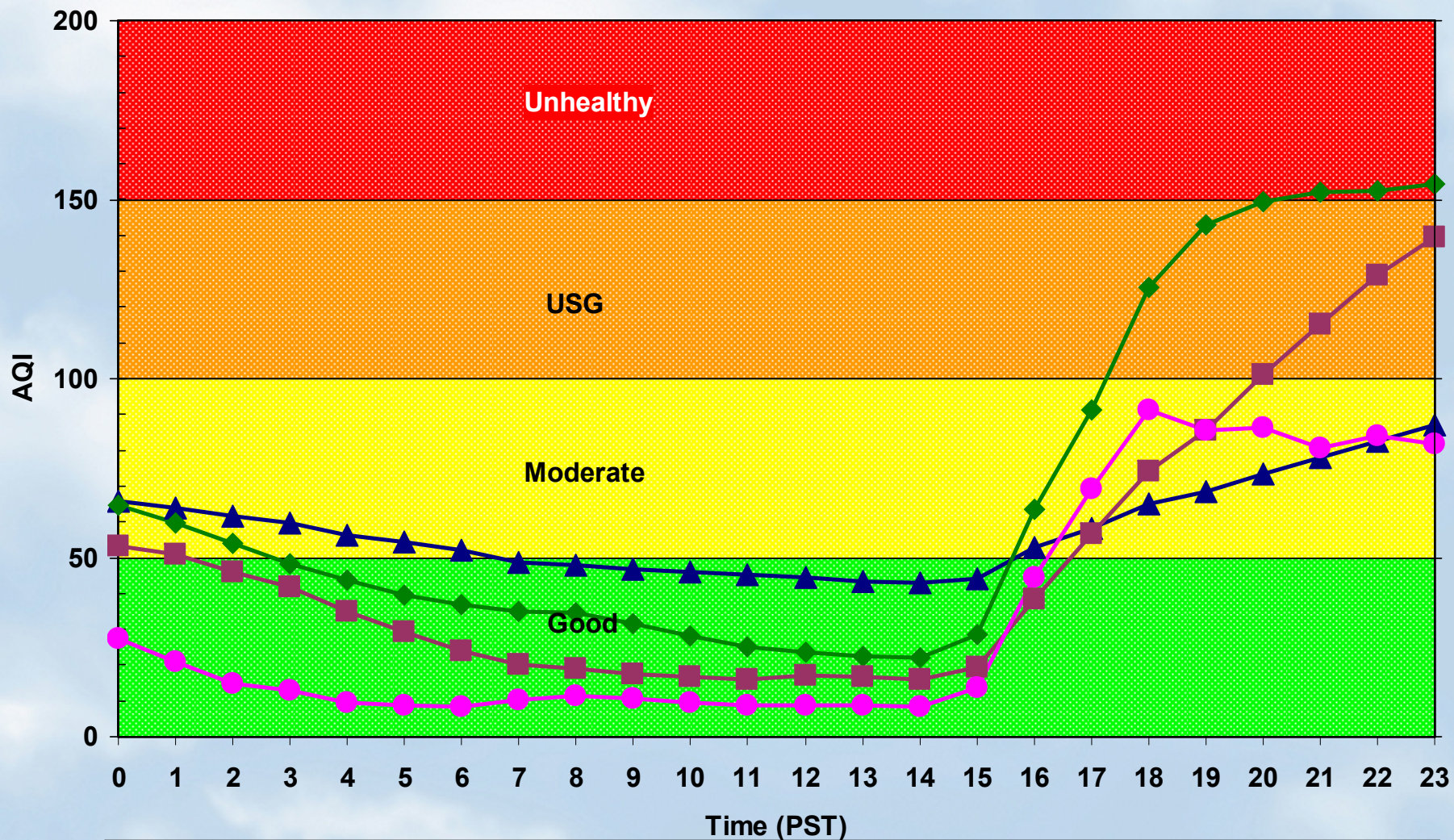
Burbank BAM PM2.5 Concentrations

Saturday, November 15, 2008

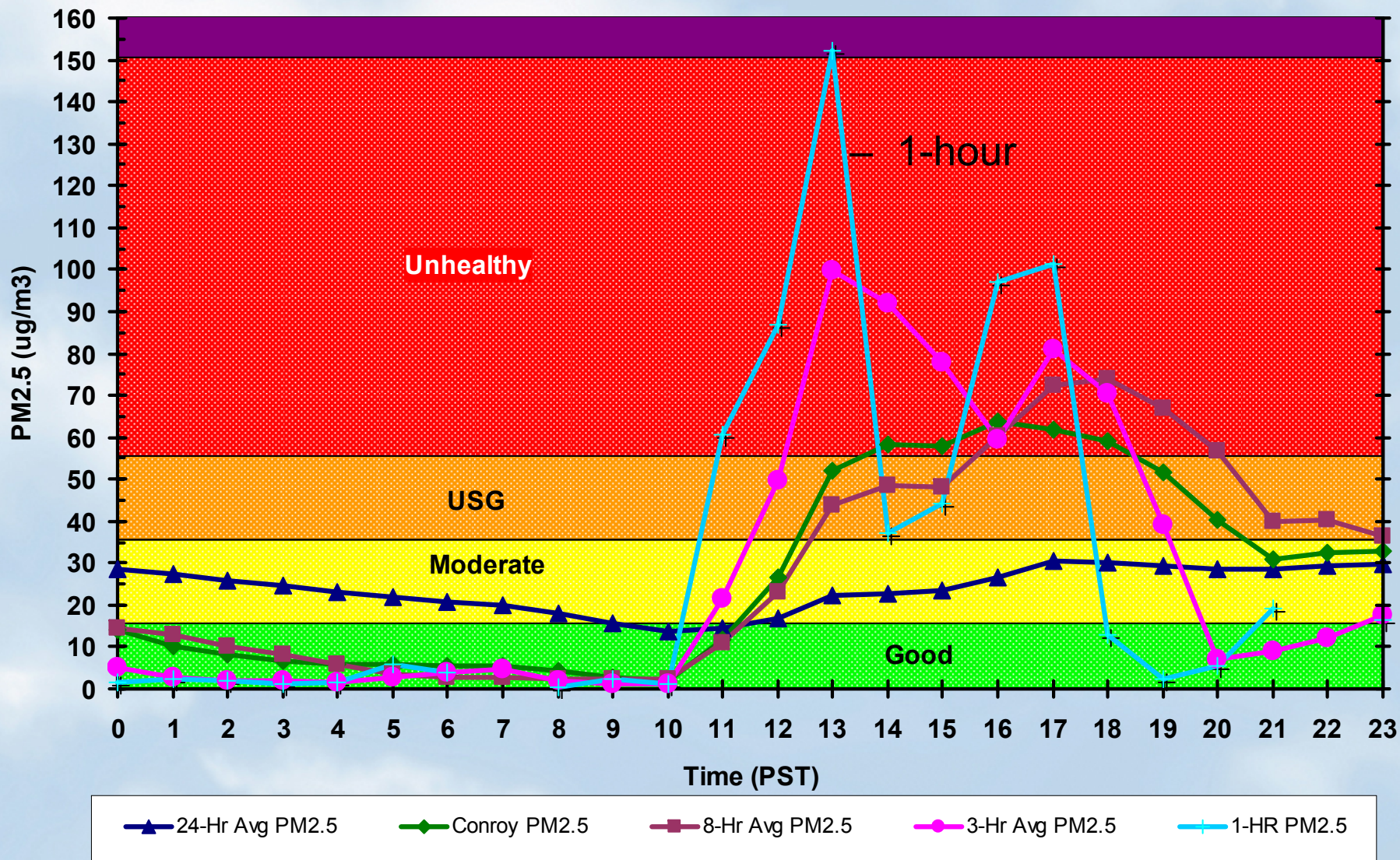
(plotted against 24-Hr AQI)



Burbank AQI November 15, 2008

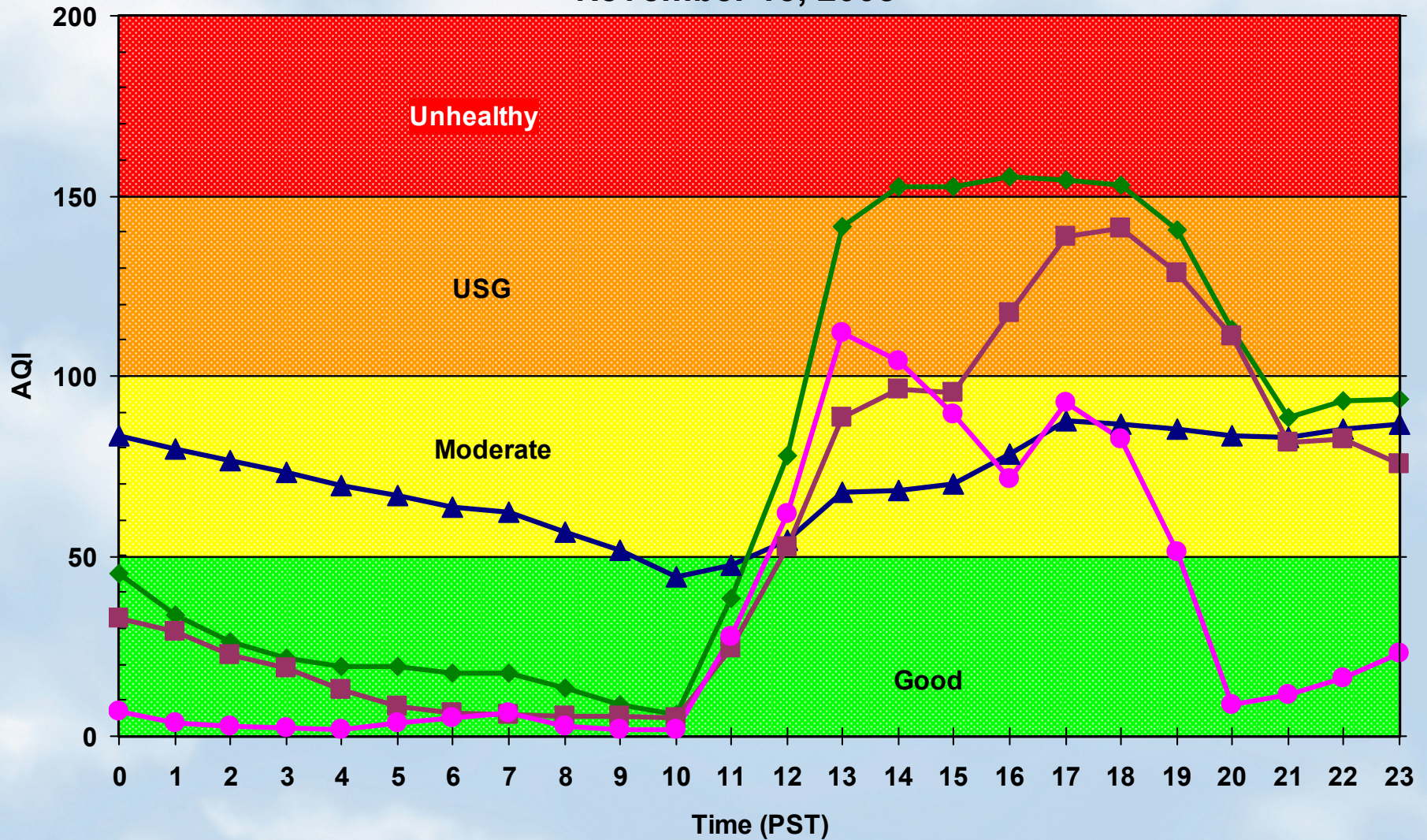


Anaheim PM2.5 Concentrations Saturday, November 15, 2008

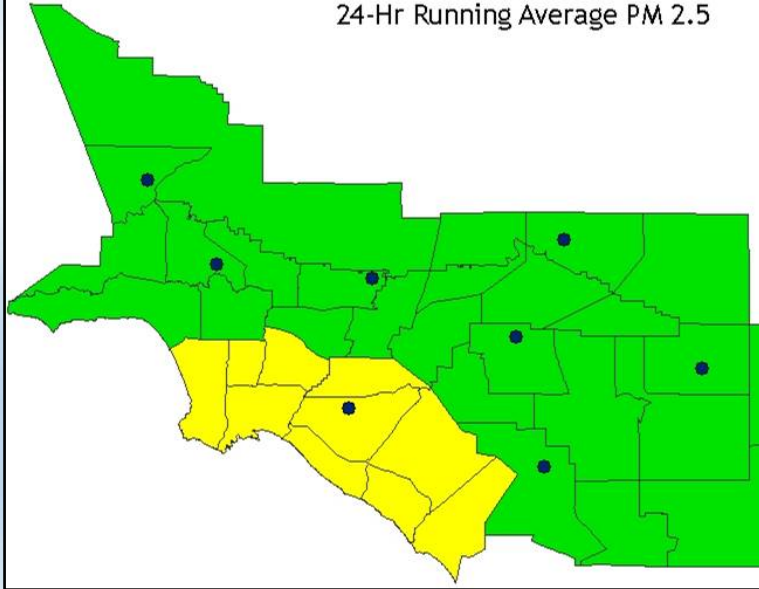


Anaheim AQI

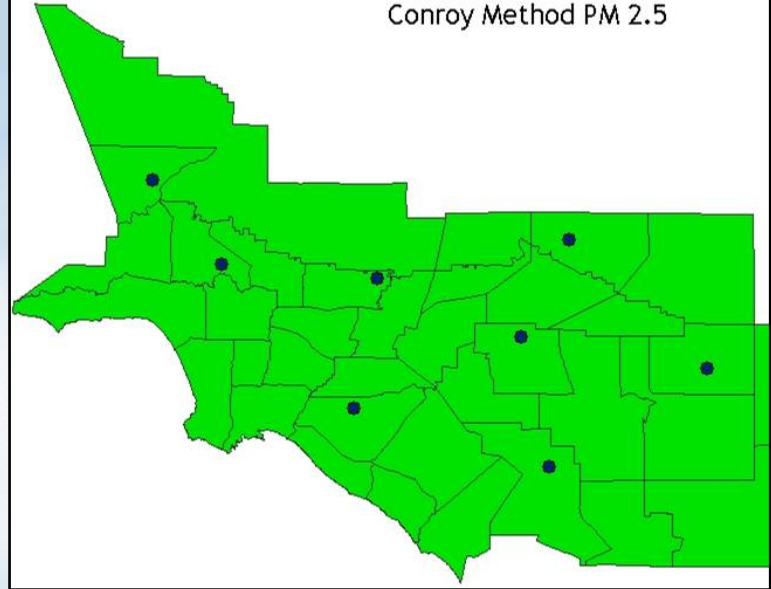
November 15, 2008



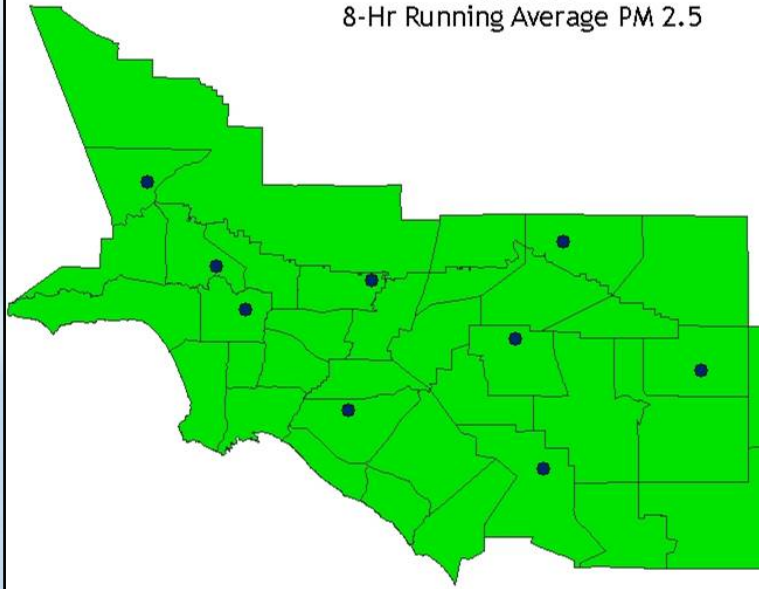
November 15, 2008
0900 PST
24-Hr Running Average PM 2.5



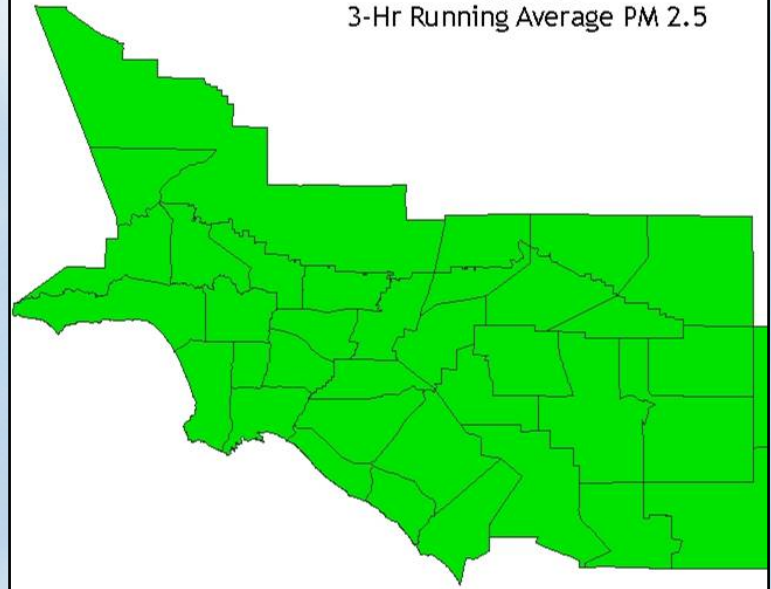
November 15, 2008
0900 PST
Conroy Method PM 2.5



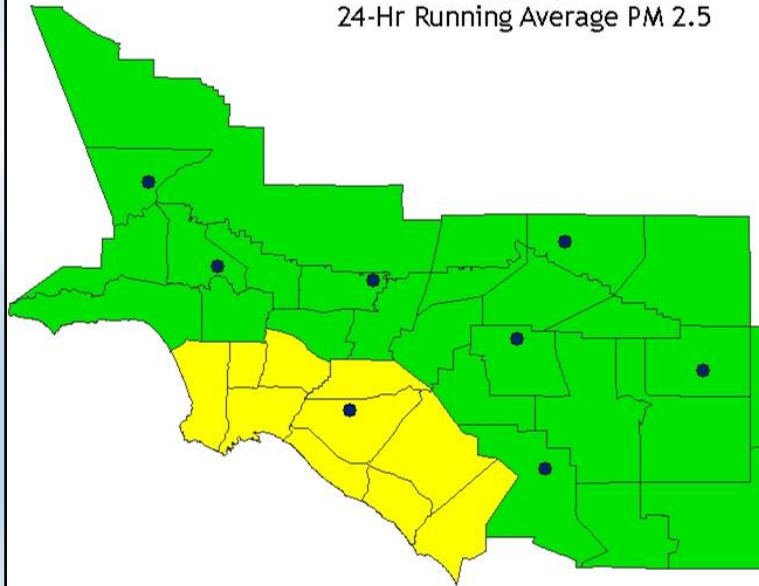
November 15, 2008
0900 PST
8-Hr Running Average PM 2.5



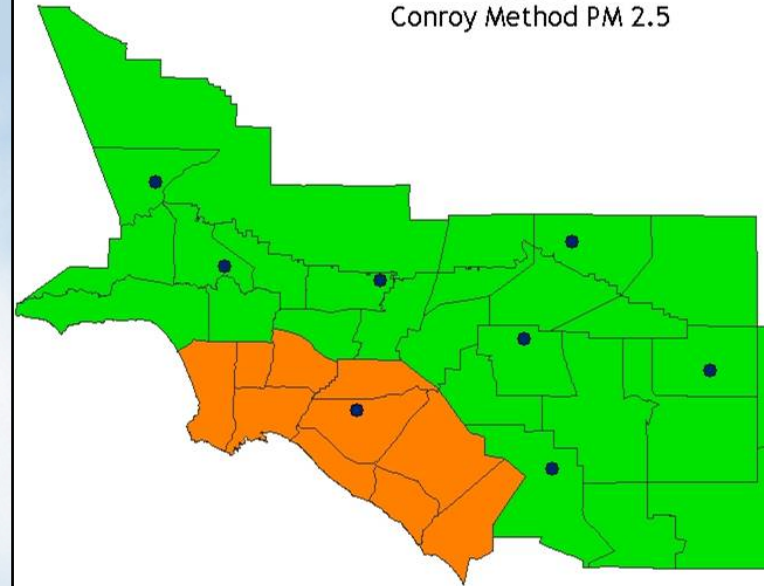
November 15, 2008
0900 PST
3-Hr Running Average PM 2.5



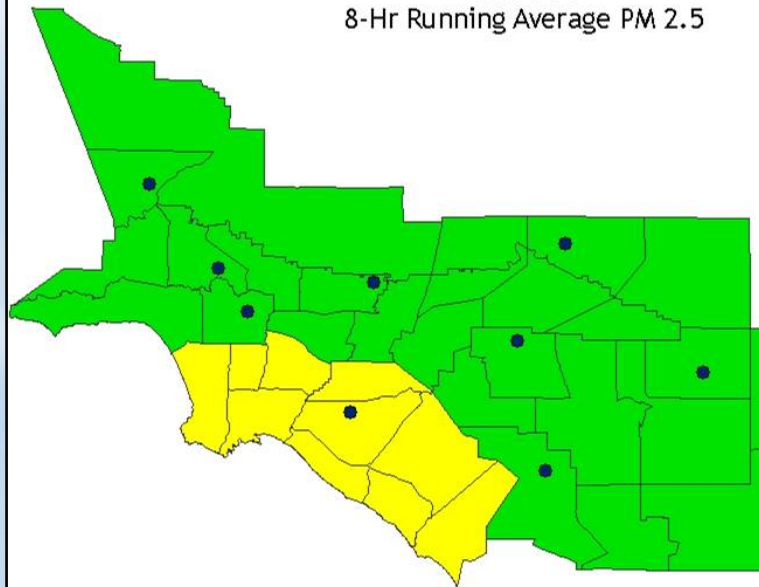
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1300 PST
24-Hr Running Average PM 2.5



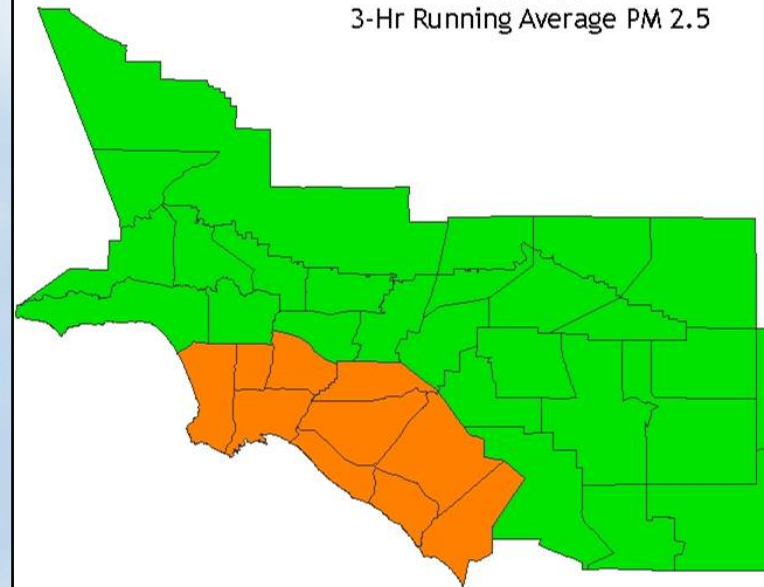
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1300 PST
Conroy Method PM 2.5



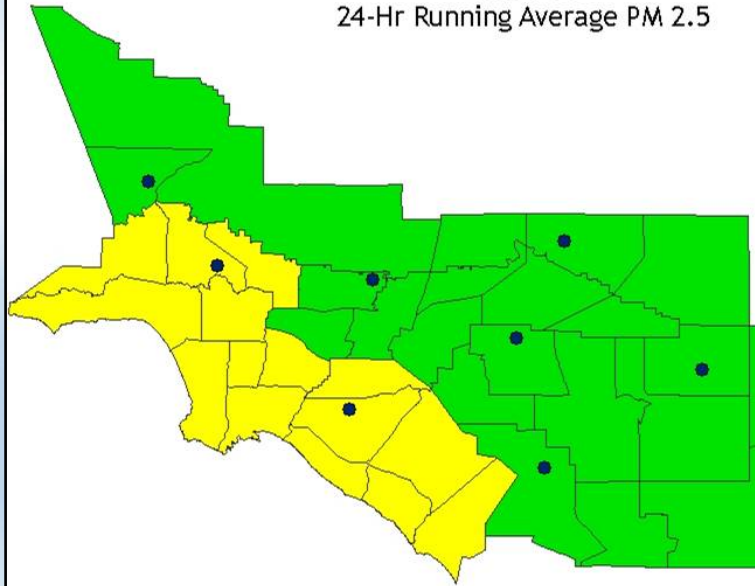
November 15, 2008
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8-Hr Running Average PM 2.5



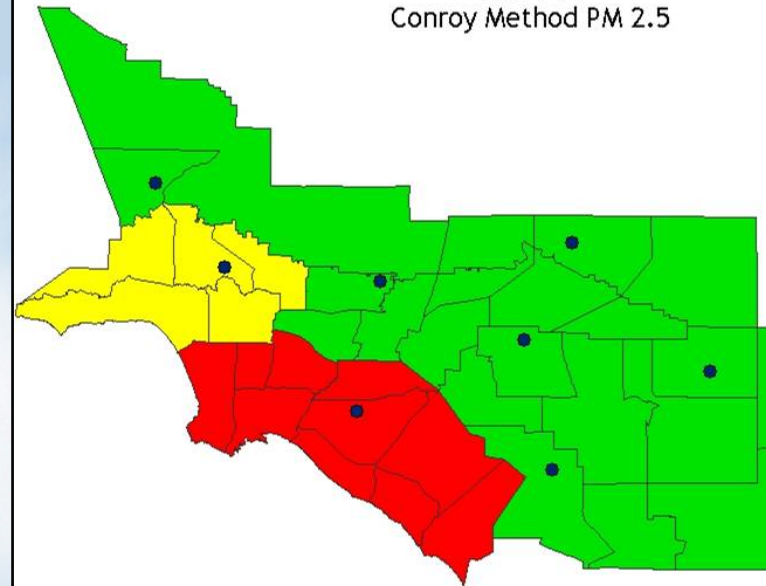
November 15, 2008
1300 PST
3-Hr Running Average PM 2.5



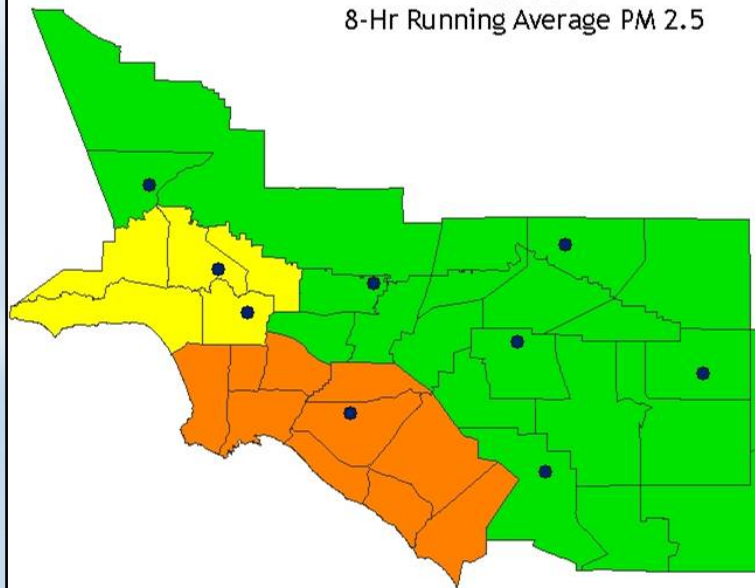
November 15, 2008
1700 PST
24-Hr Running Average PM 2.5



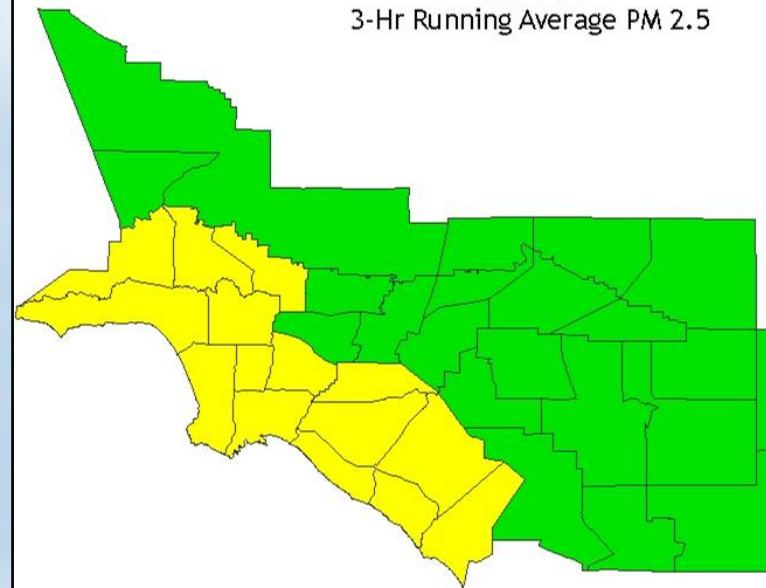
November 15, 2008
1700 PST
Conroy Method PM 2.5



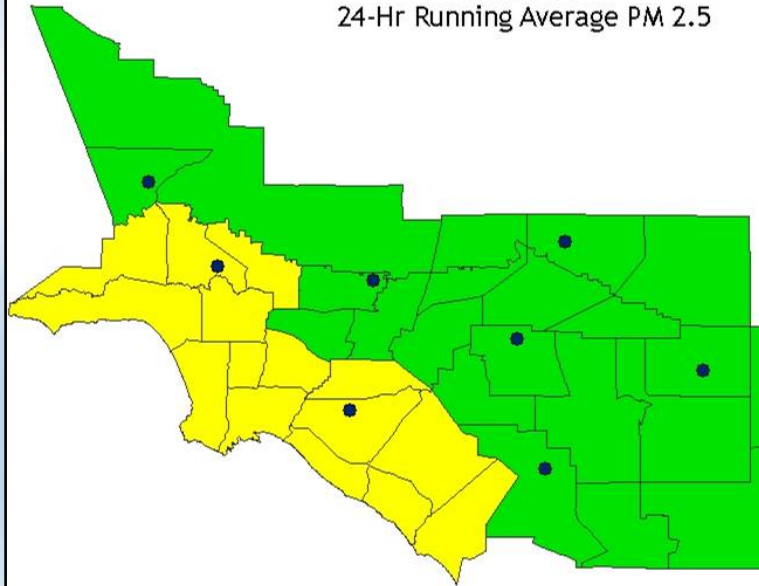
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1700 PST
8-Hr Running Average PM 2.5



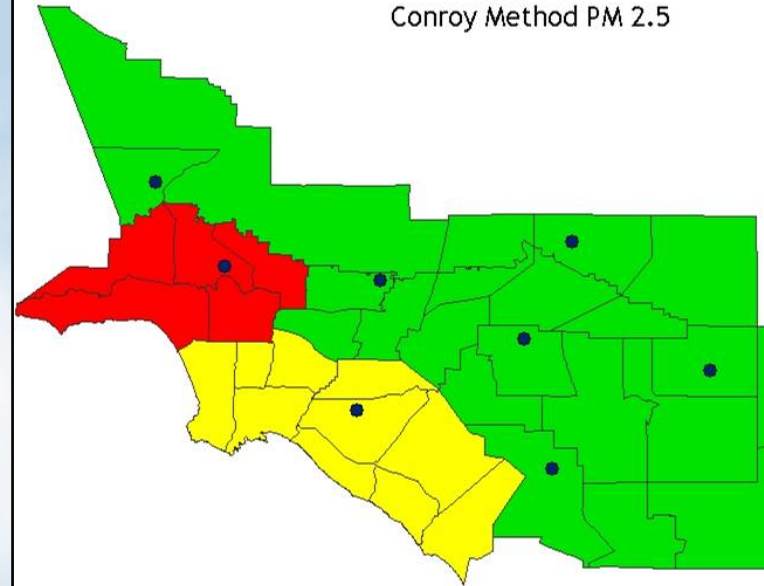
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3-Hr Running Average PM 2.5



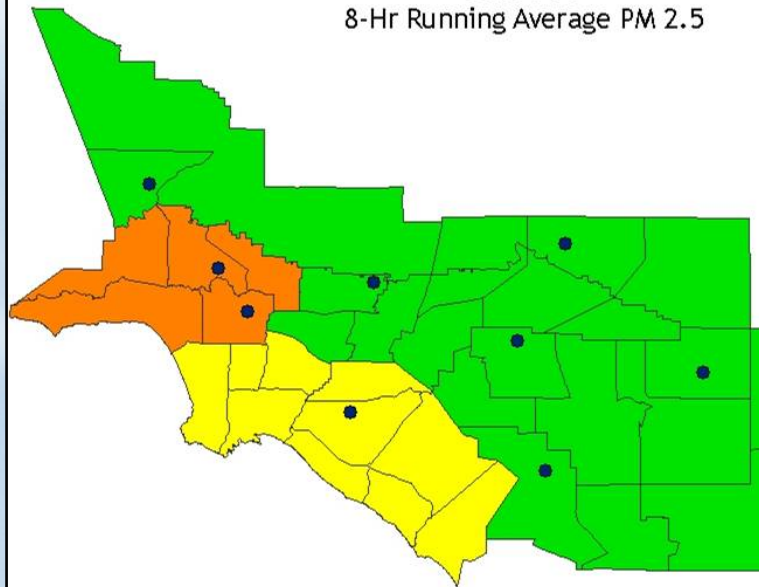
November 15, 2008
2100 PST
24-Hr Running Average PM 2.5



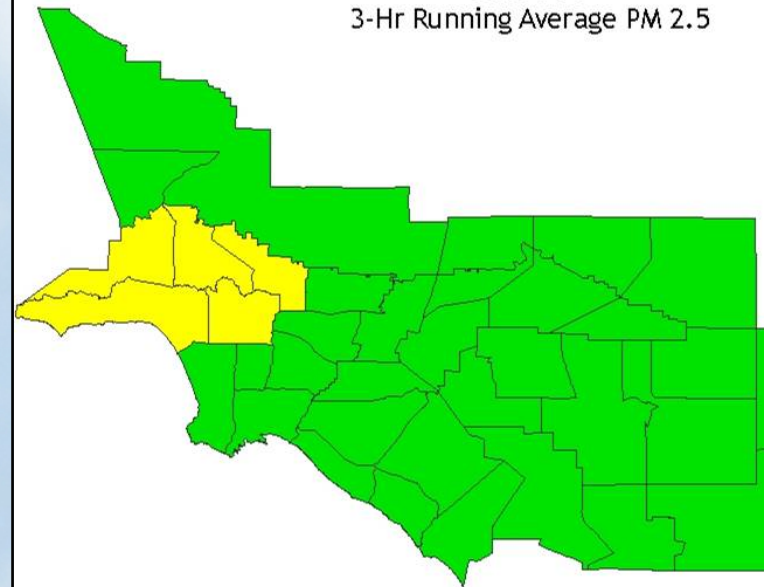
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Conroy Method PM 2.5



November 15, 2008
2100 PST
8-Hr Running Average PM 2.5

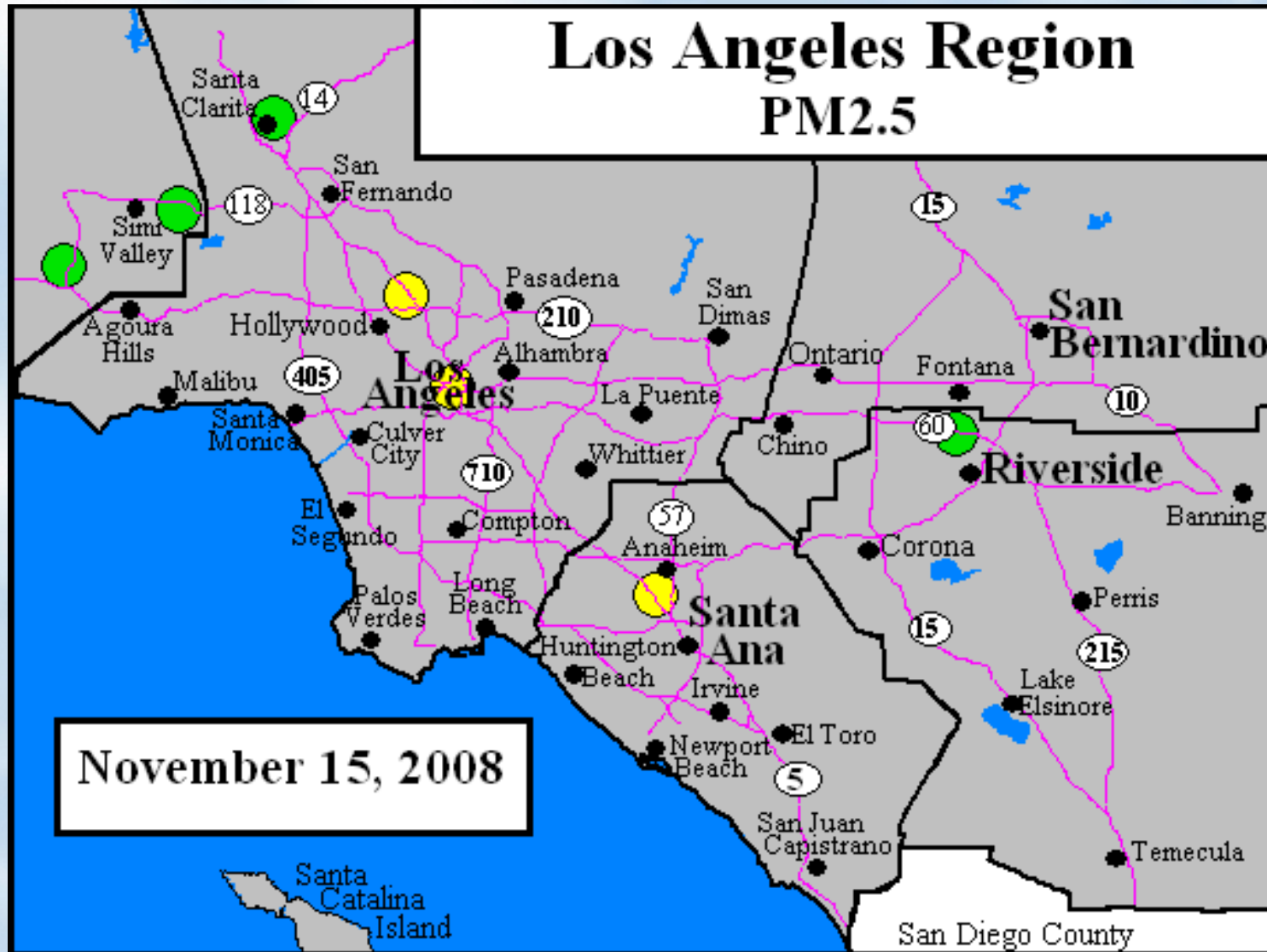


November 15, 2008
2100 PST
3-Hr Running Average PM 2.5



Wildfire – Day 1

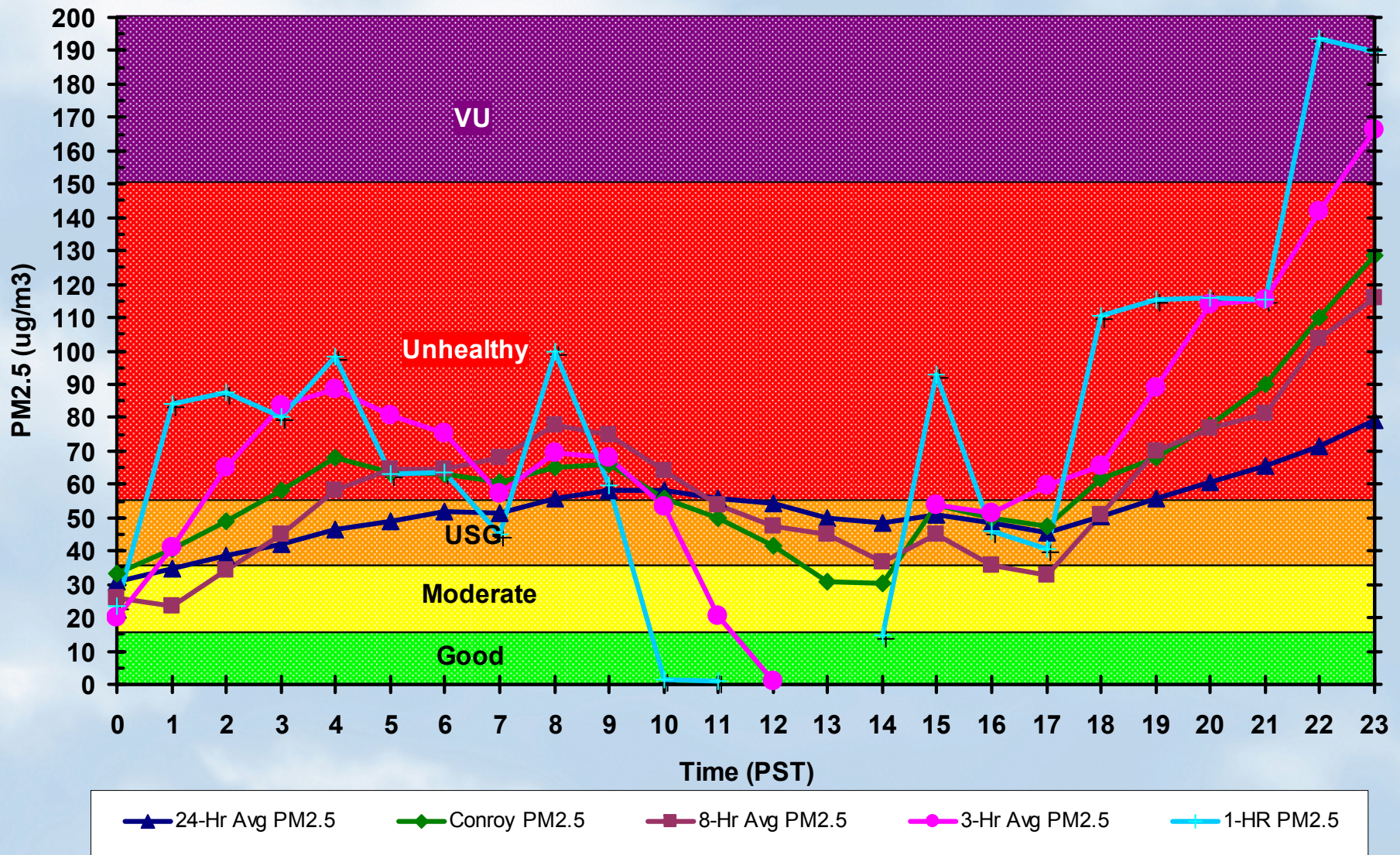
AIRNow PM2.5 (midnight to midnight 24-Hr average)



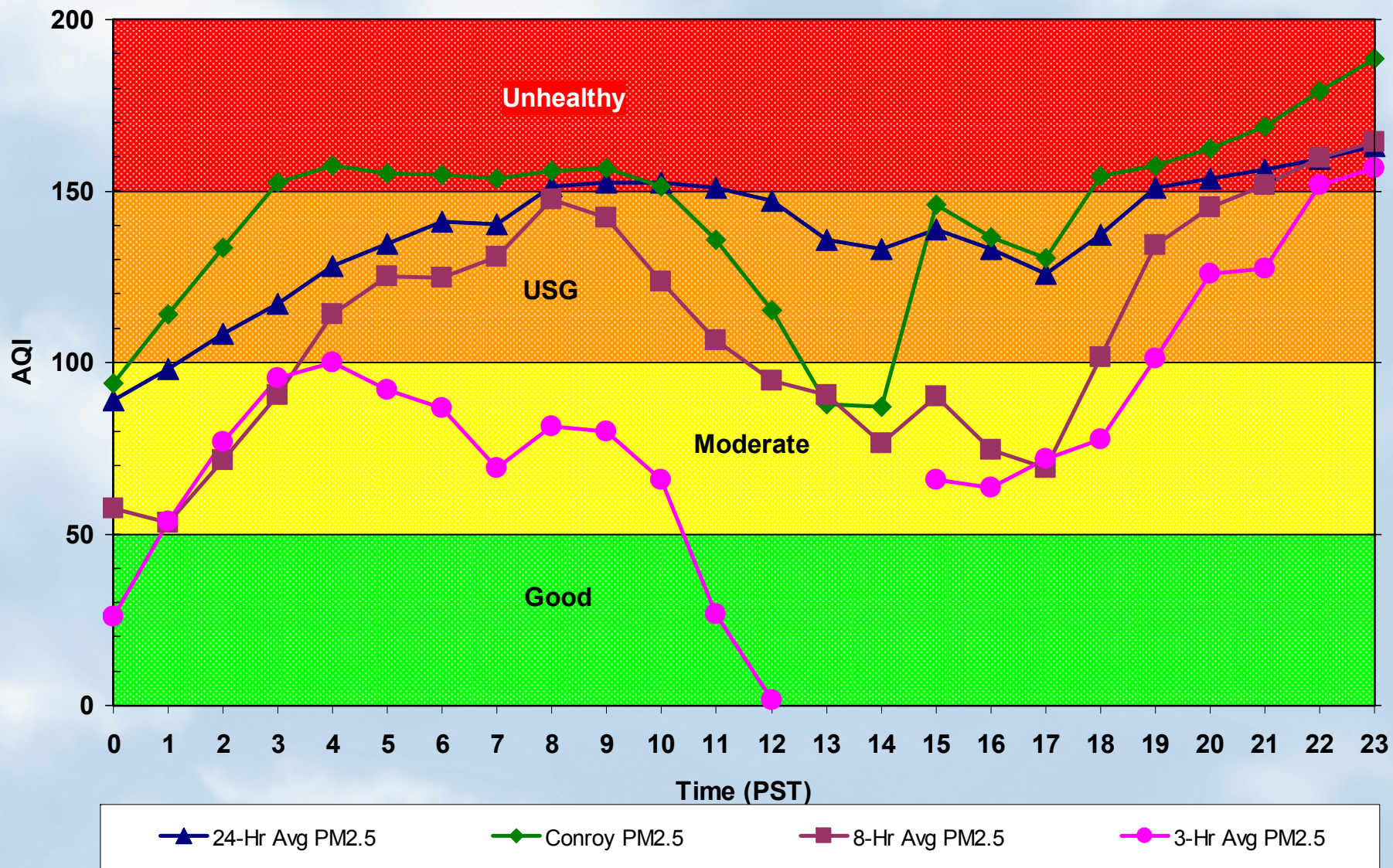
November 16, 2008 ~1330 PST
NASA MODIS Aqua Satellite True Color Image



Anaheim PM2.5 Concentrations Sunday, November 16, 2008

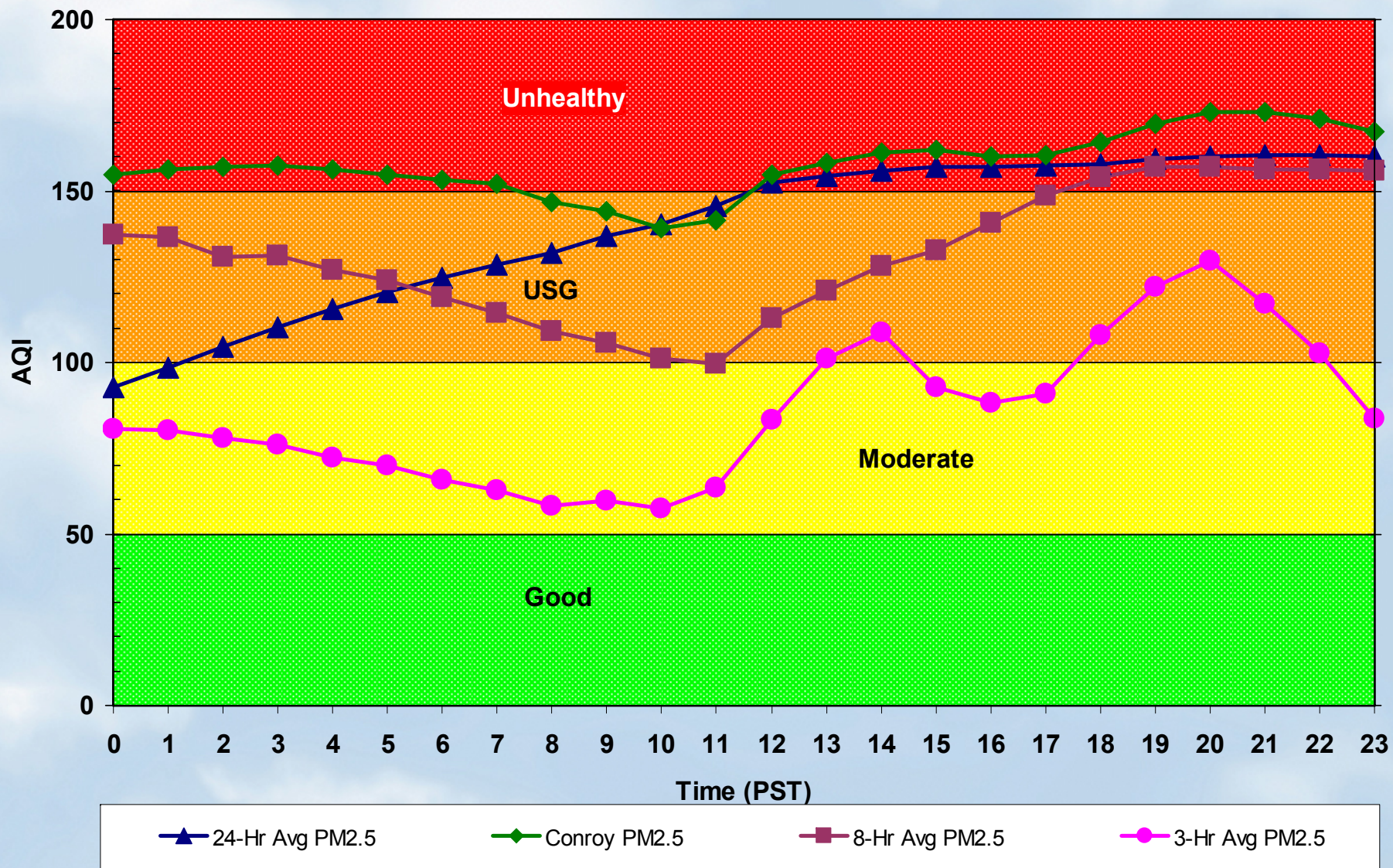


Anaheim AQI November 16, 2008

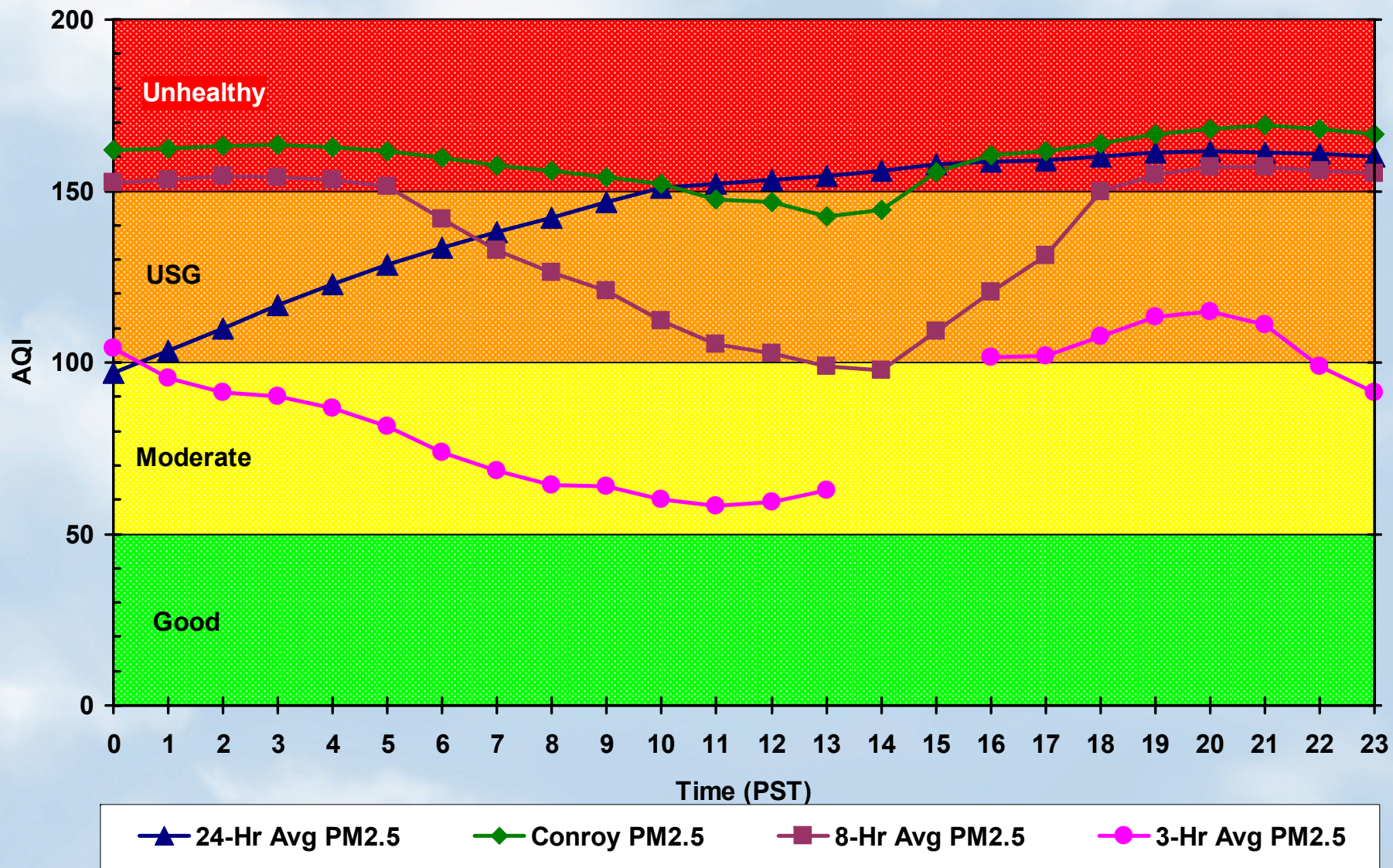


Burbank AQI

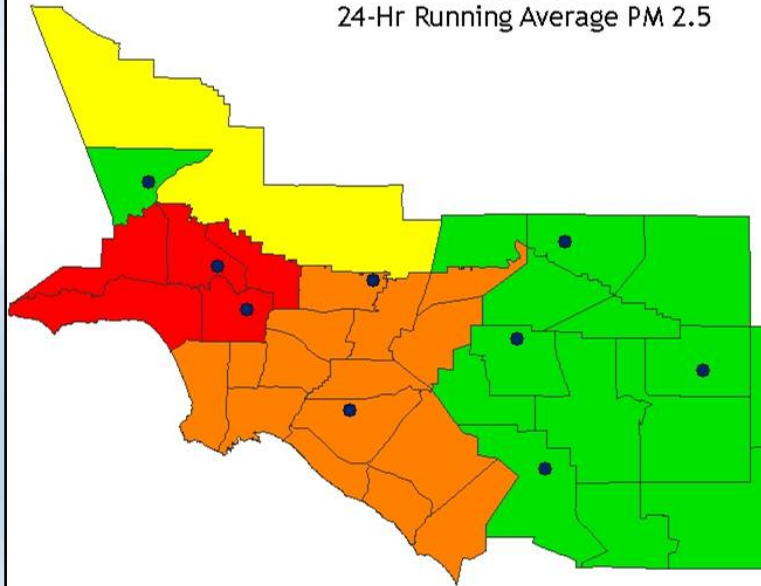
November 16, 2008



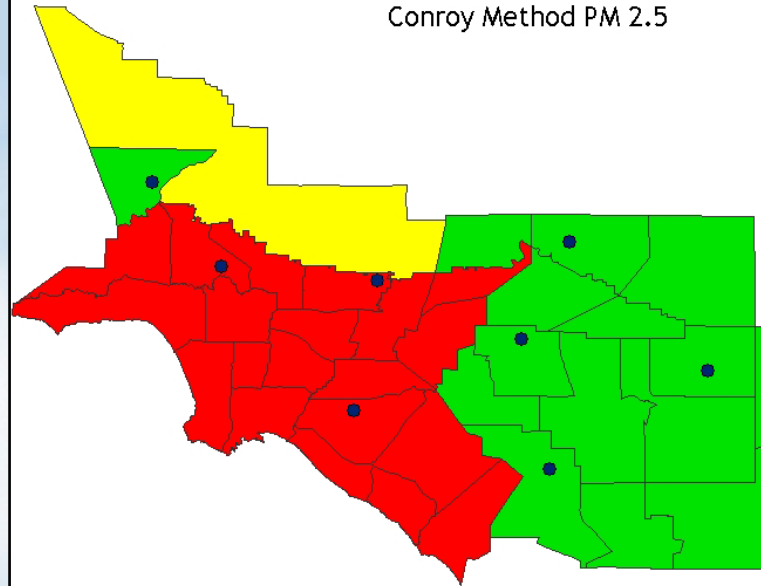
Central Los Angeles AQI November 16, 2008



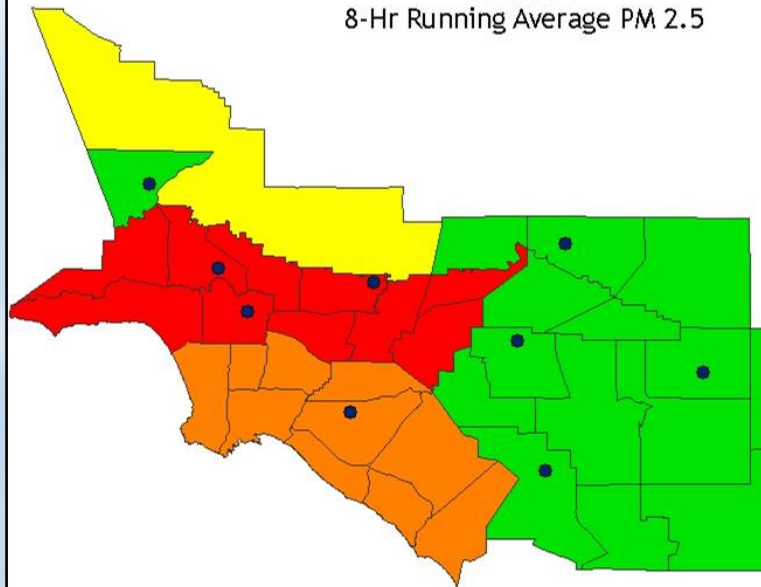
November 16, 2008
1800 PST
24-Hr Running Average PM 2.5



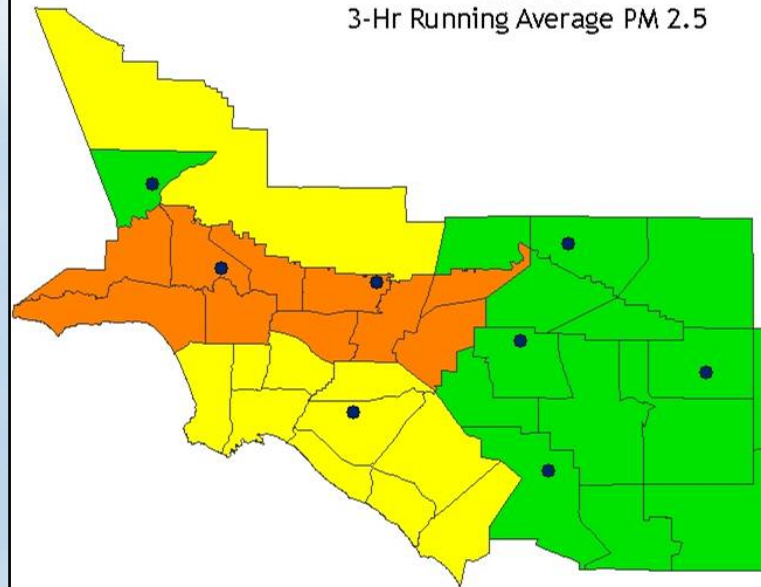
November 16, 2008
1800 PST
Conroy Method PM 2.5



November 16, 2008
1800 PST
8-Hr Running Average PM 2.5



November 16, 2008
1800 PST
3-Hr Running Average PM 2.5



Smoke from Freeway Complex Fire

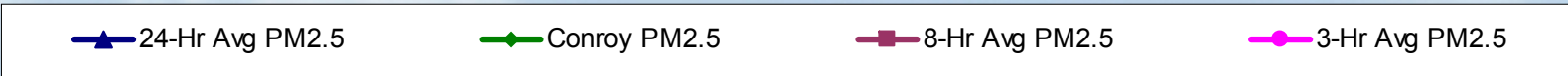
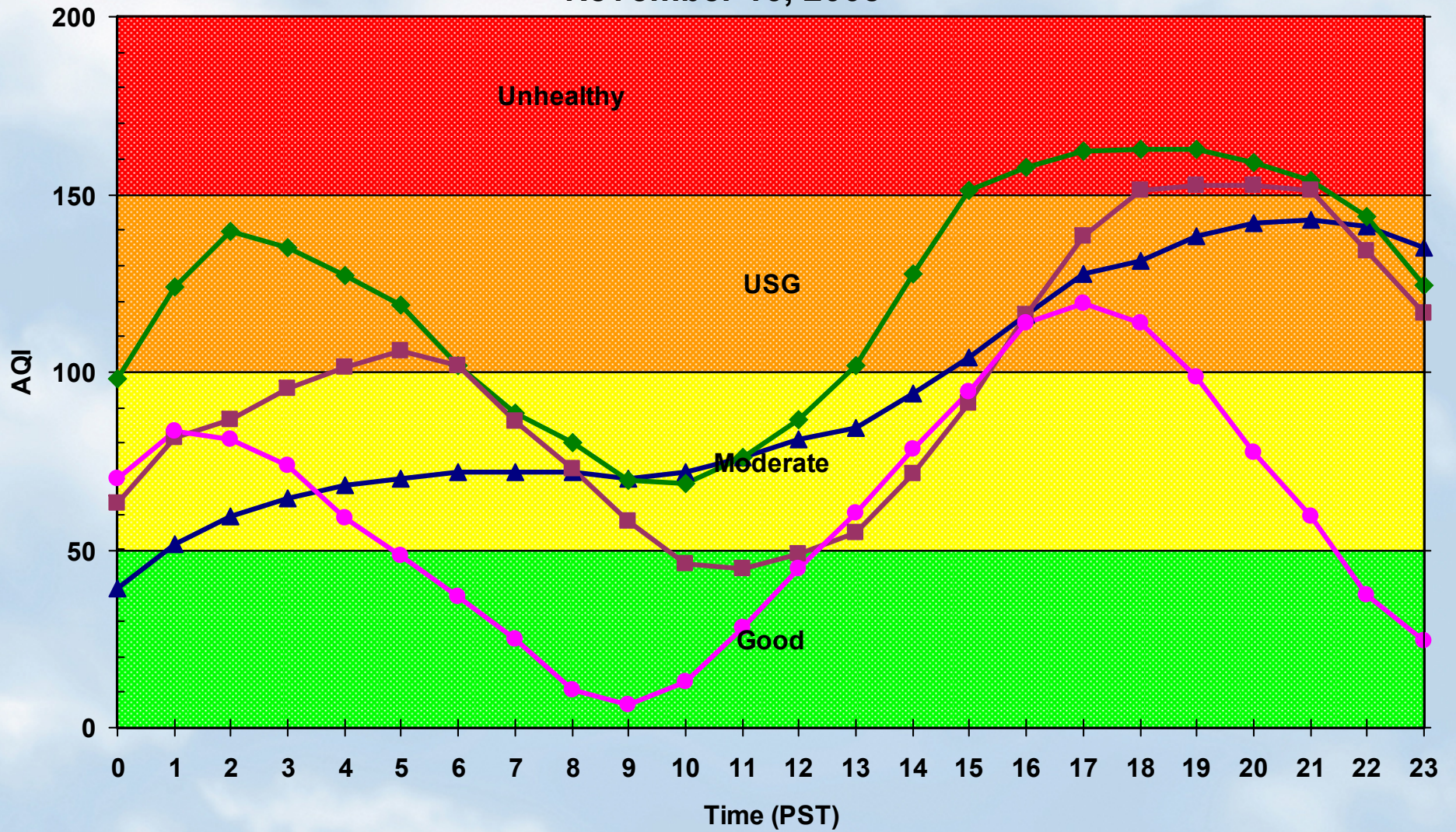
Looking South from Diamond Bar

November 16, 2008 ~Noon

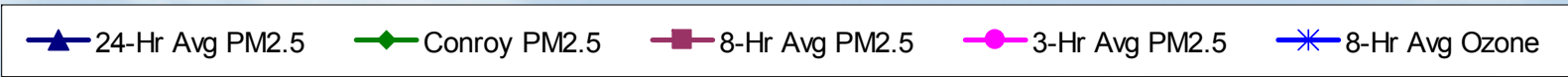
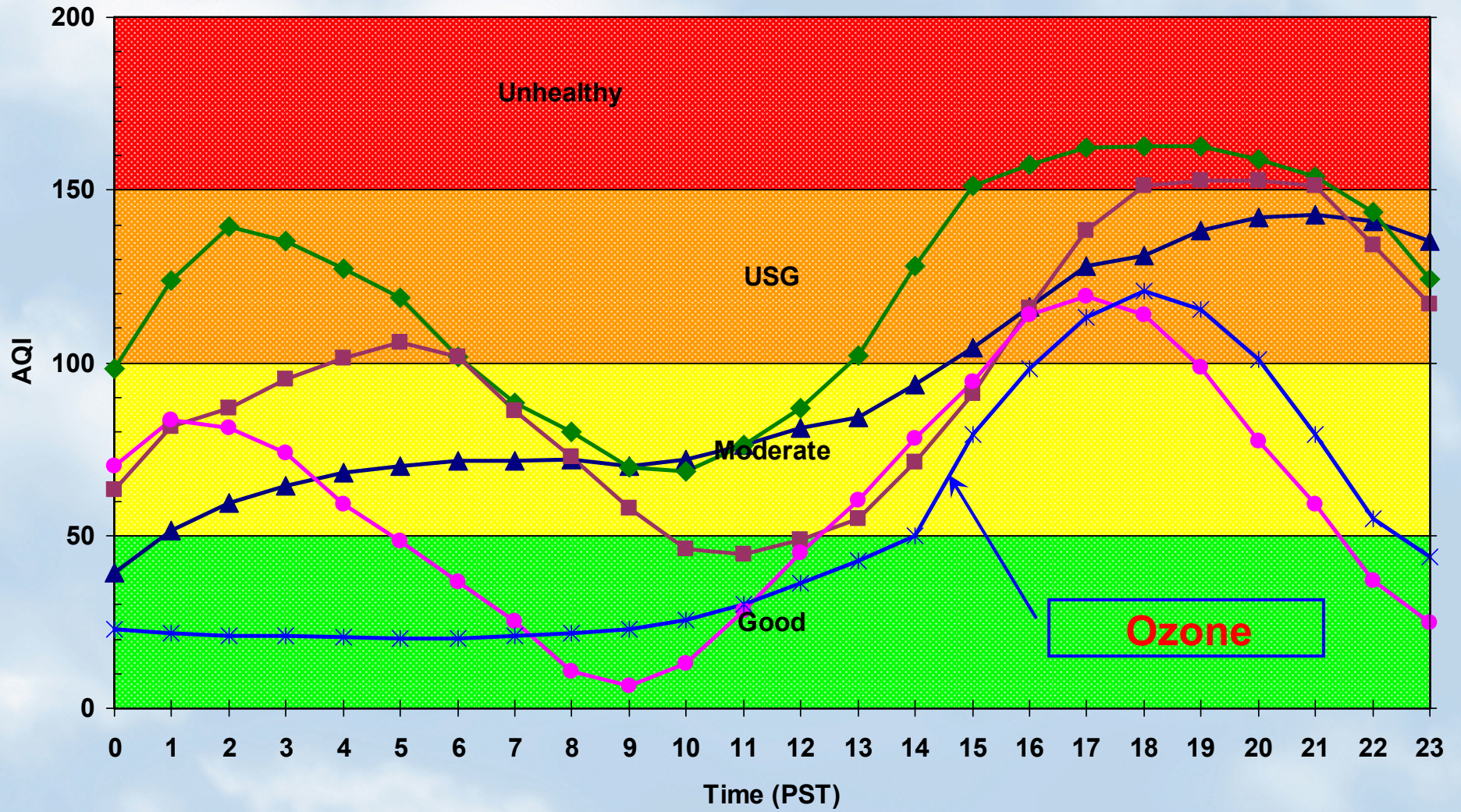


Photo Courtesy Denny Shaw, SCAQMD

Glendora AQI PM2.5 November 16, 2008



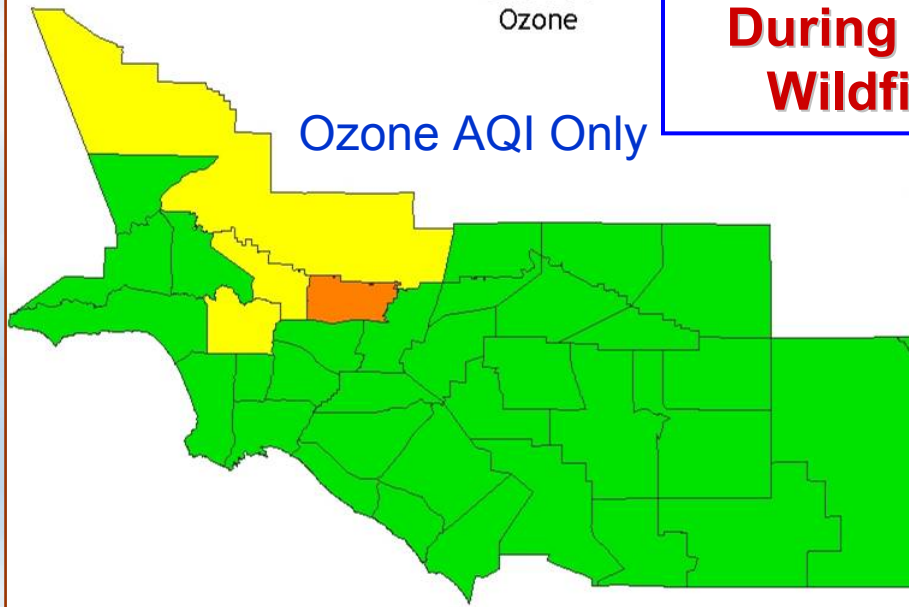
Glendora AQI PM2.5 & Ozone November 16, 2008



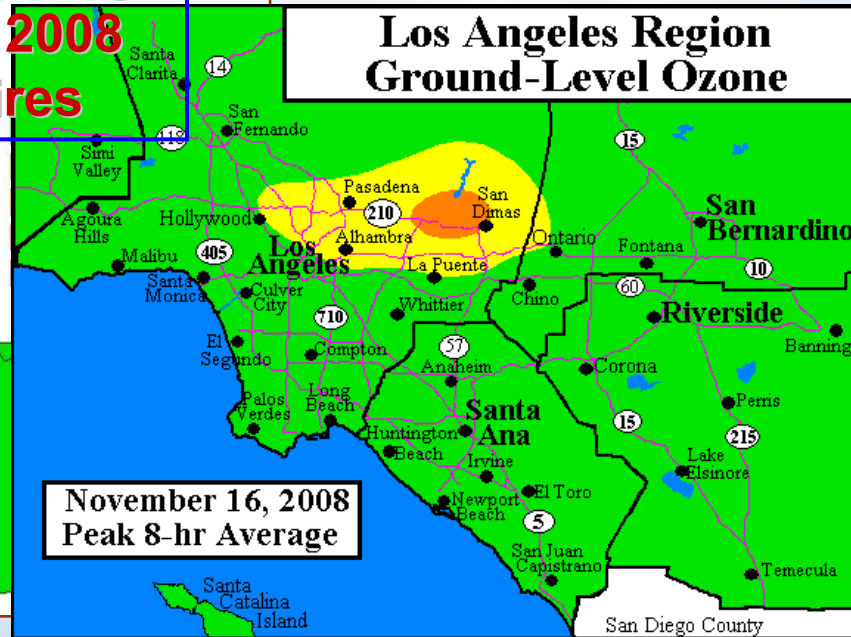
November 16, 2008
1800 PST
Ozone

AQI Mapping During 2008 Wildfires

Ozone AQI Only

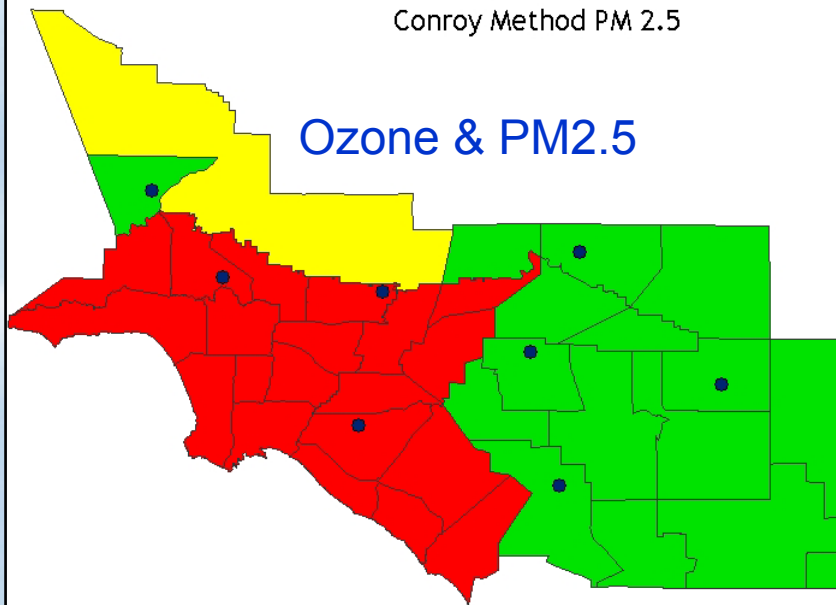


Los Angeles Region Ground-Level Ozone



November 16, 2008
1800 PST
Conroy Method PM 2.5

Ozone & PM2.5



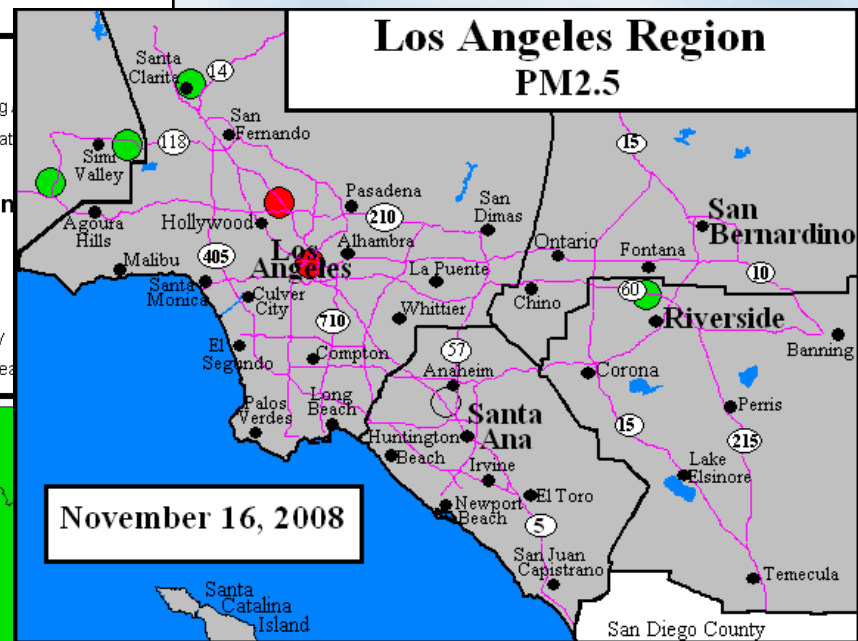
Legend

- Monitoring (white square)
- PM2.5 Stat (black dot)

Air Quality Index

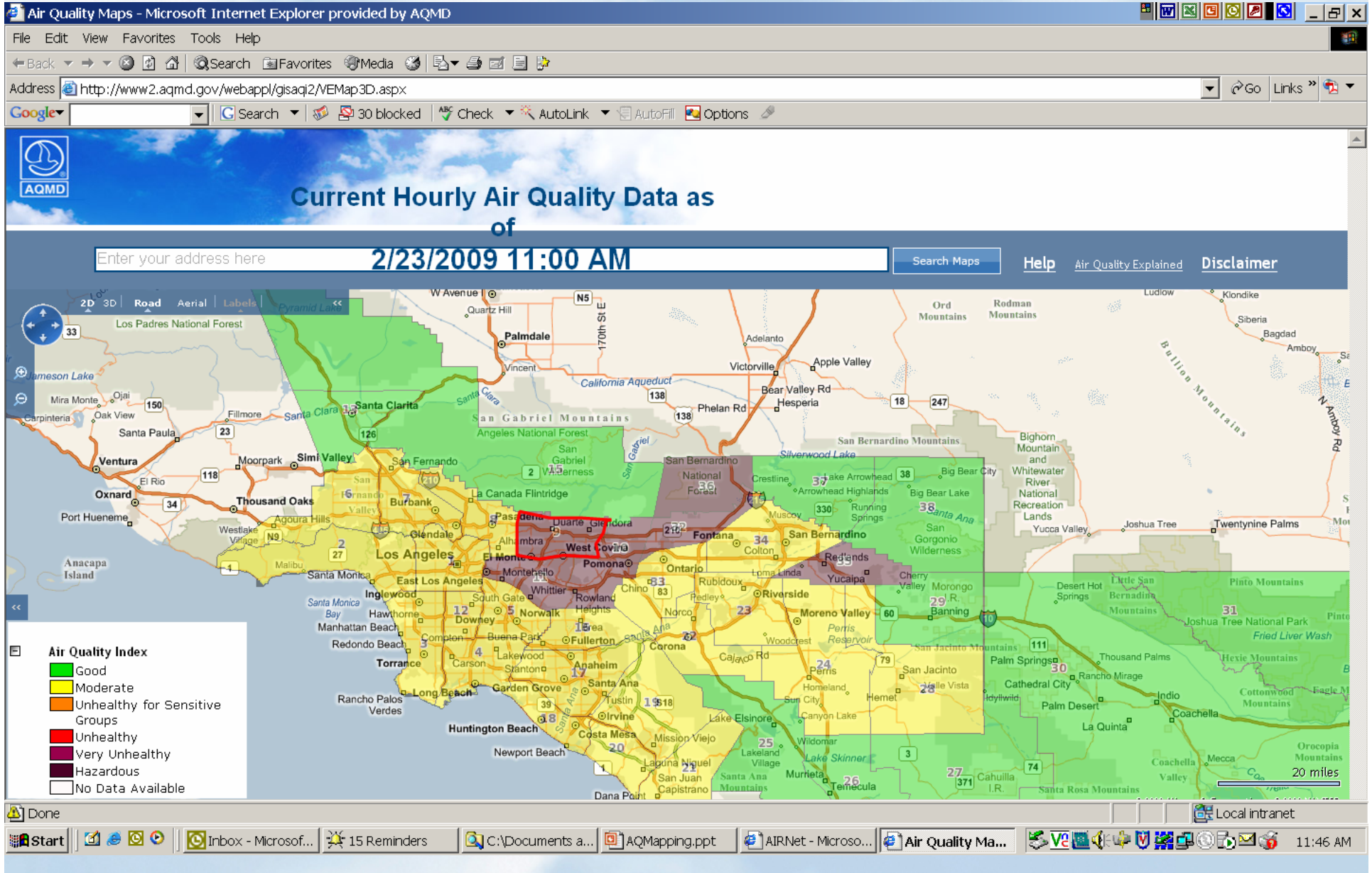
- Good (green square)
- Moderate (yellow square)
- USG (orange square)
- Unhealthy (red square)
- Very Unhealthy (purple square)

Los Angeles Region PM2.5



Issue: BAM Error Codes not screened

Glendora PM2.5 BAM read 994 ug/m3 for several hours



Glendora PM2.5 BAM Error Code 994 $\mu\text{g}/\text{m}^3$ for ~30 hours on weekend

Air Quality Maps - Microsoft Internet Explorer provided by AQMD

File Edit View Favorites Tools Help

Address <http://www.2.aqmd.gov/webappl/gisaq2/VEMap3D.aspx>

Google Search 30 blocked Check AutoLink AutoFill Options

Current Hourly Air Quality of

2/23/2009 11:00

Enter your address here

Air Quality Readings

Area Number	9
Area Name	East San Gabriel Valley
AQI Category	Hazardous
AQI Value	466
Pollutant	Fine Particulate Matter (PM2.5) - 24 Hr Average
Reading Date Time	2/23/2009 11:00:00 AM
	East San Gabriel Valley 1
	East San Gabriel Valley 2

Search Maps Help Air Quality Explained Disclaimer

Air Quality Index

- Good
- Moderate
- Unhealthy for Sensitive Groups
- Unhealthy
- Very Unhealthy
- Hazardous
- No Data Available

Done

Start Telemetry - M... 15 Reminders C:\Document... AQMapping.ppt AIRNet - Micr... Air Quality ... Local intranet 11:47 AM

Exceedance Notification Report Email

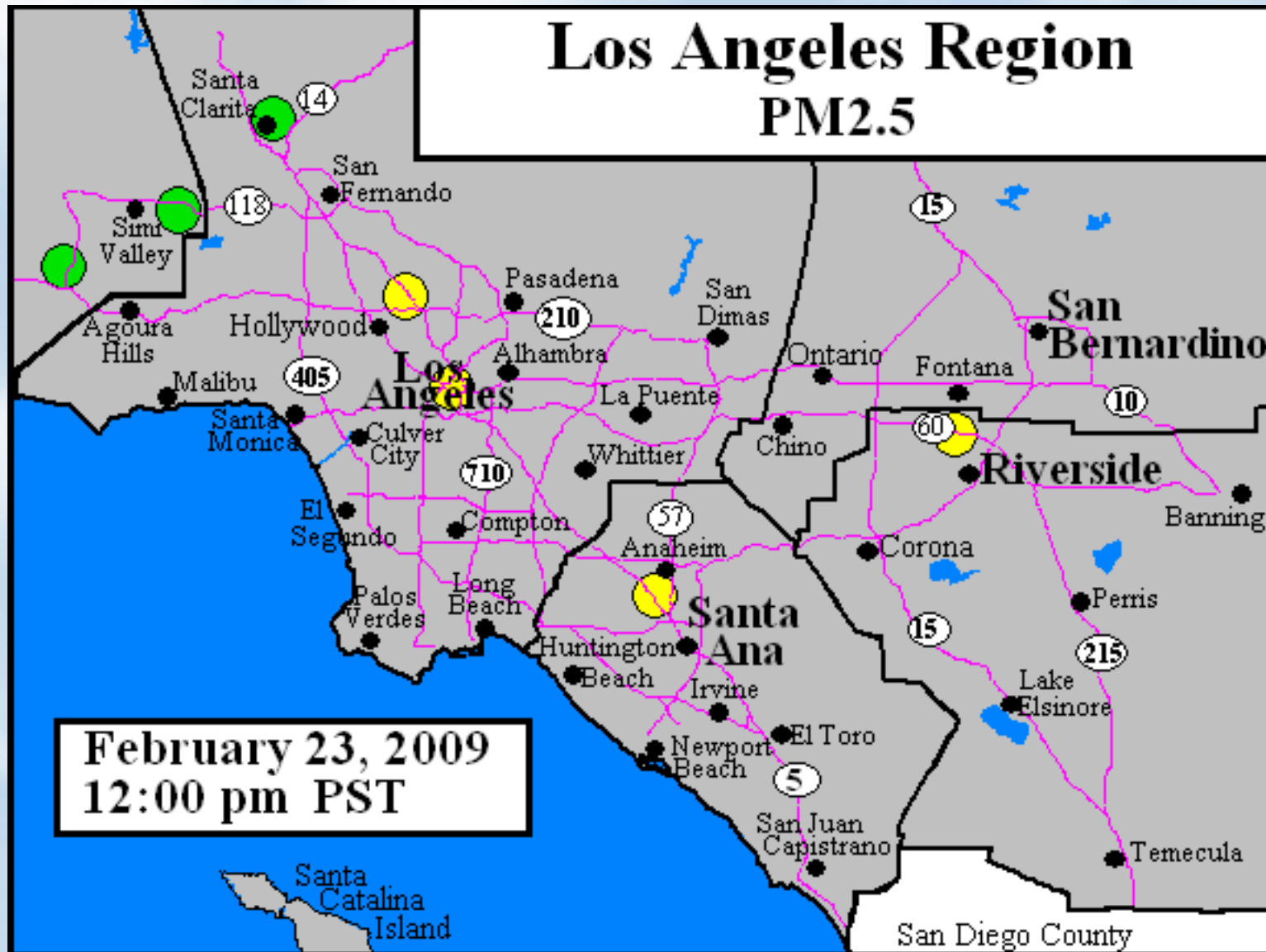
Exceedance Notification			
2/23/2009			
Pollutant	Concentration	Averaging Time	Location
PM25	994 ug/m3	1-hr	GLEN

These emails are sent to key staff based on pre-determined thresholds

AQMD is adding screening for error codes, other outliers and sticking values

AIRNow PM2.5 February 23, 2009

Outlier Effectively Screened by AIRNow

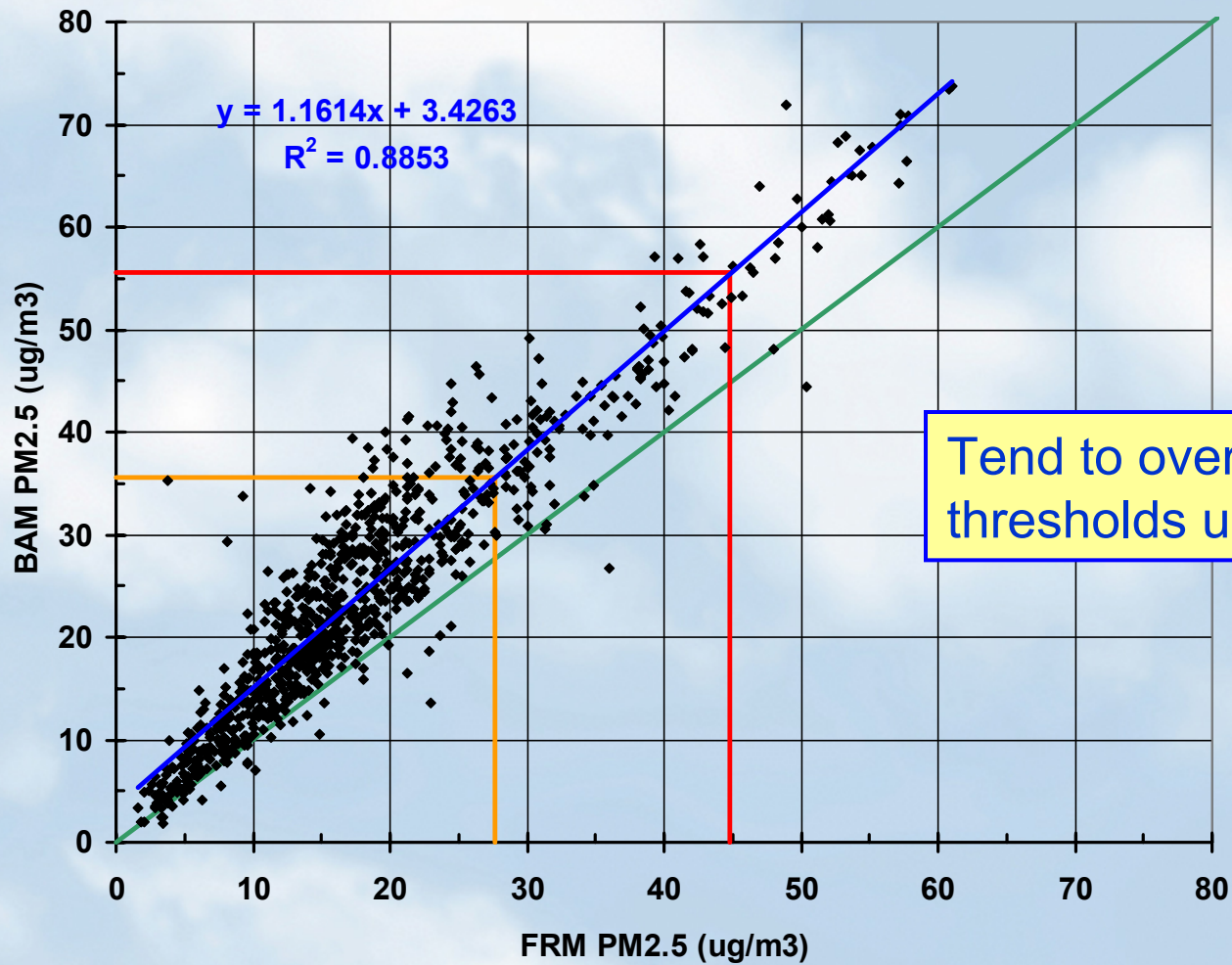


Real-Time PM2.5 Issues

- Adjustment of BAM PM2.5 to FRM
 - BAMs tend to be higher than FRM
 - Linear regression adjustment looks promising

Regression to adjust BAM PM2.5 to FRM looks promising

Rubidoux PM2.5
January 2006 - December 2008

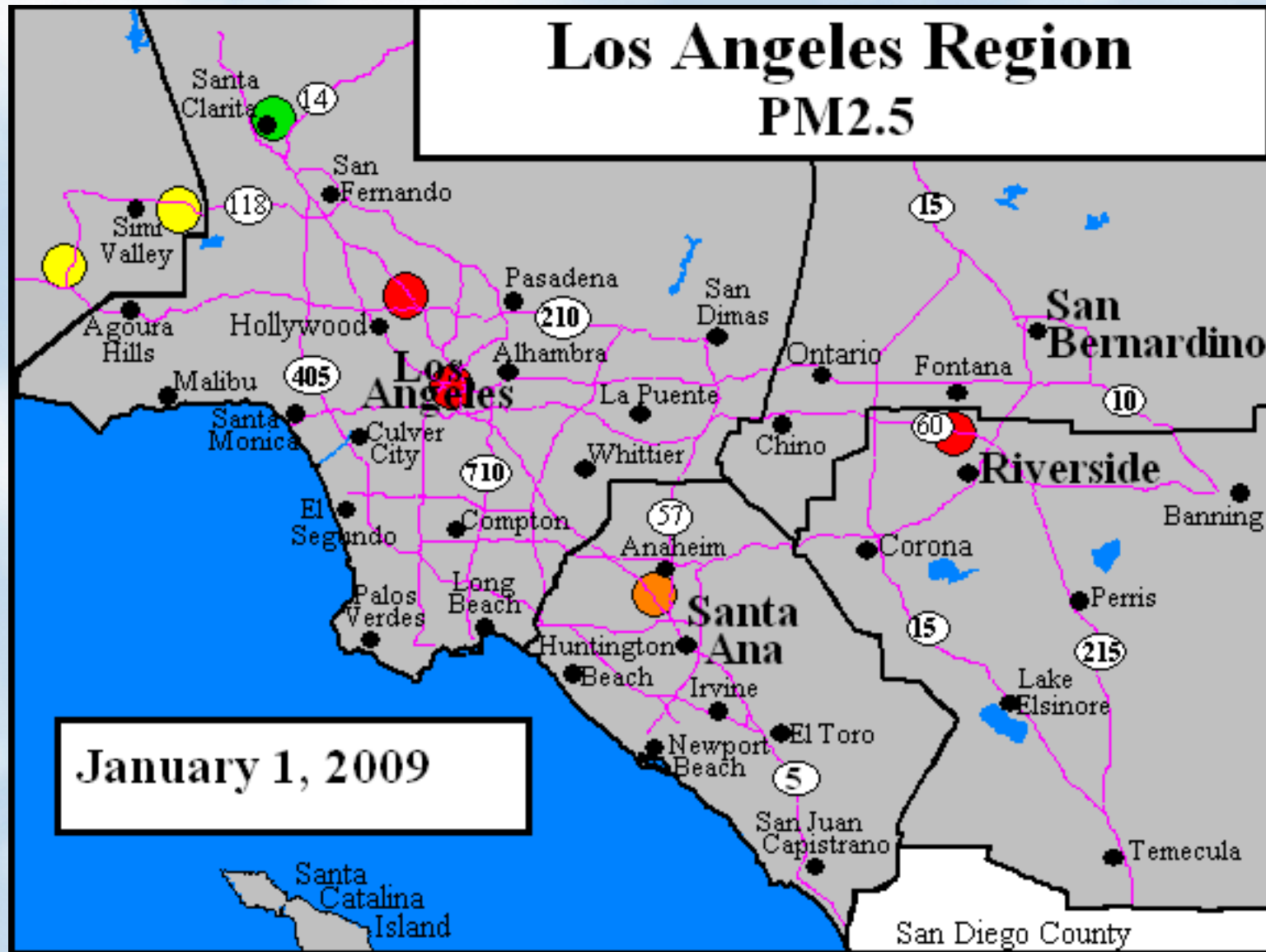


Real-Time PM2.5 Issues

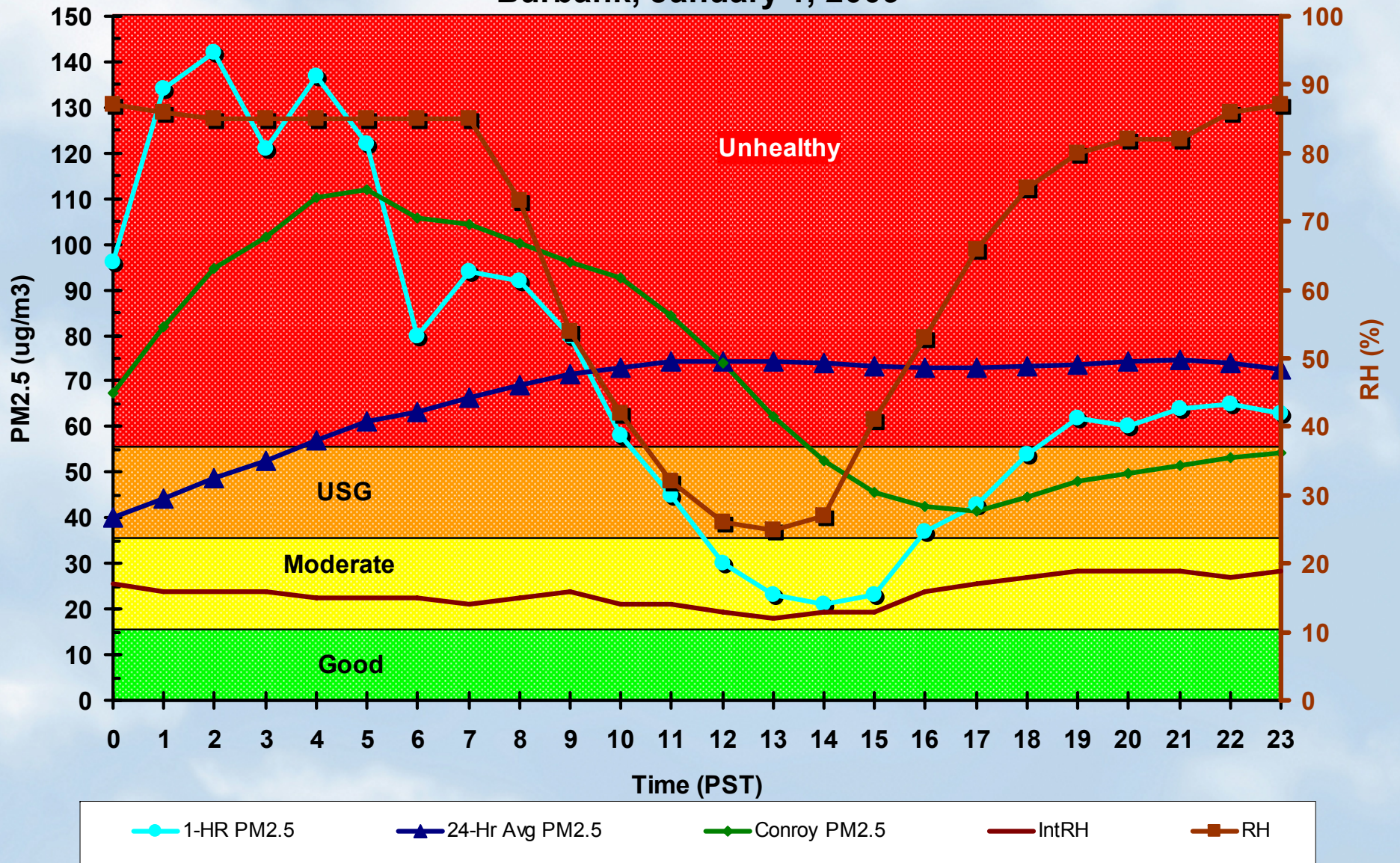
- Adjustment of BAM PM2.5 to FRM
 - BAMs tend to be higher than FRM
 - Linear regression adjustment looks promising
- Fog Effect on BAM PM2.5
 - Dense fog (visibilities $\leq 1/4$ mile) occurs on an average of ~ 17 days per year at downtown Los Angeles, more near the coast
 - BAM PM2.5 increase appears to be related to fog droplets, not just humidity
 - Is it possible to adjust the data for fog or RH?
 - Internal BAM RH may be useful
 - No solutions yet

Issue: Fog Effect on BAM PM2.5

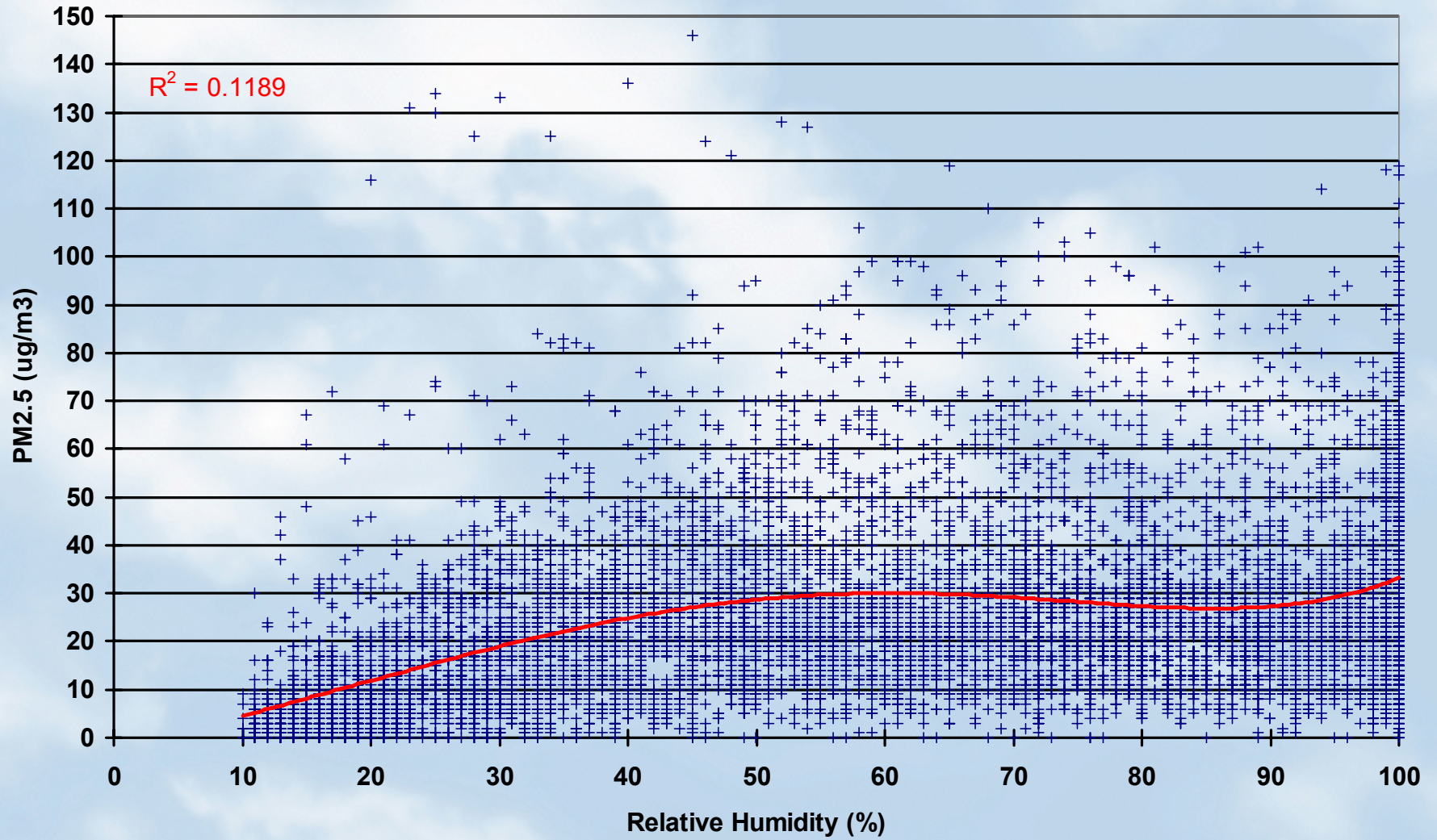
AIRNow PM2.5 (midnight to midnight)



BAM PM2.5 Concentration & Relative Humidity Burbank, January 1, 2009

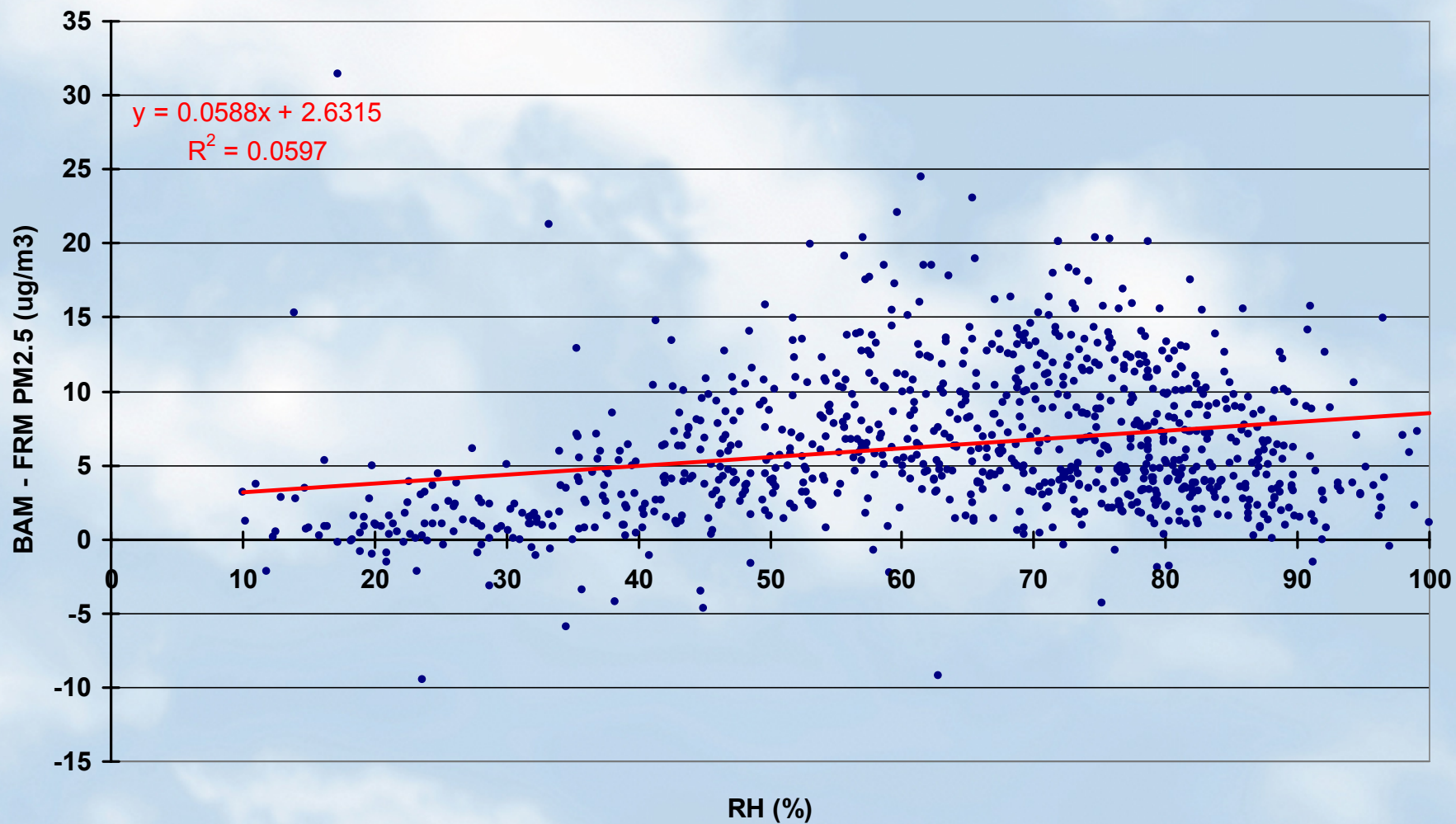


Rubidoux PM2.5 vs. RH



Rubidoux PM2.5 Difference vs RH

January 2006 - December 2008



Next Steps

- Update 1-Hr to 8-Hr Ozone Regression Equations
- Explore other methods for 8-Hr Ozone
- Improve map proxy stations and backup proxies for station failures
- Explore lower AQI cutpoints for 3-Hr and 8-Hr averaged PM2.5
- Continue with Conroy Method – for now
- Consider BAM to FRM regression adjustments
- Continue to explore Fog/Humidity issue with BAM PM2.5
 - Is a BAM data adjustment for RH/Fog possible?
 - Invalidation of data in fog conditions may be the answer?