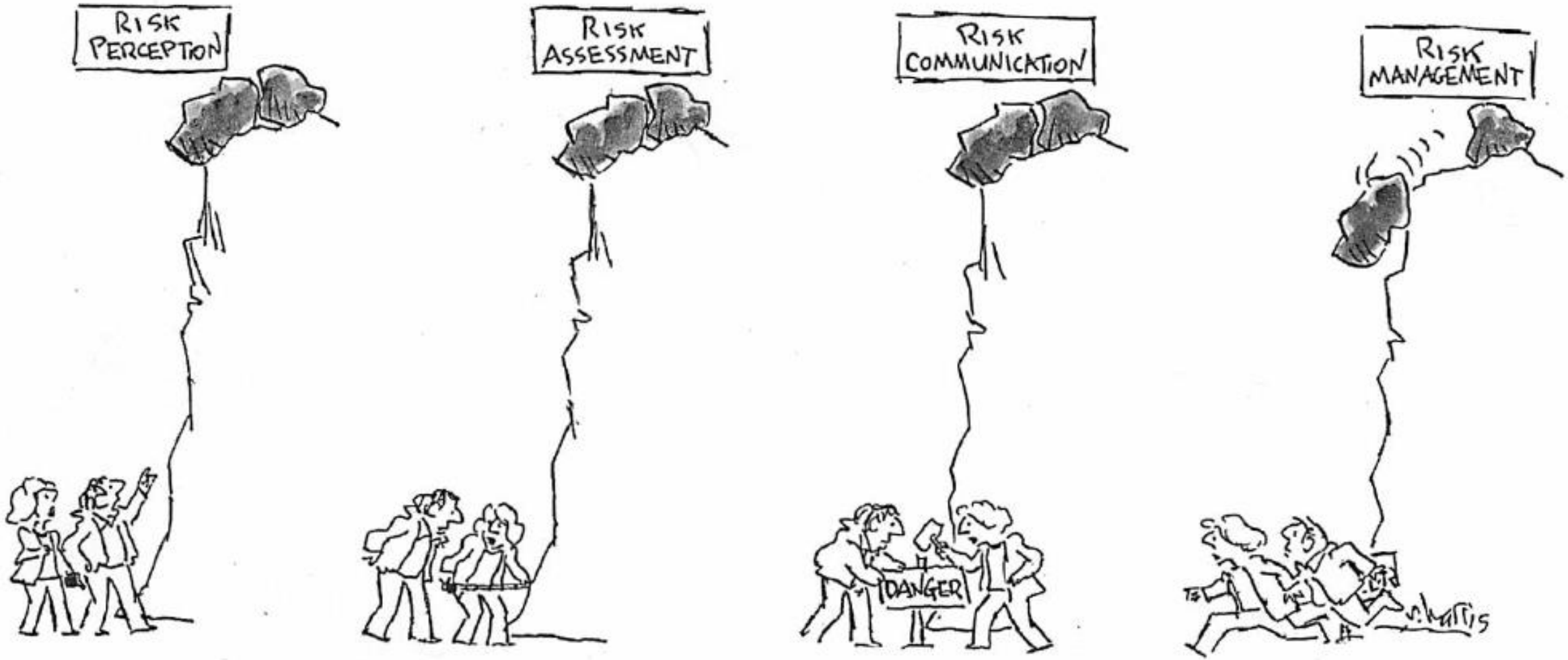
Challenges to Interpretation of New Air Sensor Data: What Does it Mean?

John Vandenberg, PhD
National Program Director
Human Health Risk Assessment Program
National Center for Environmental Assessment
U.S. Environmental Protection Agency

My Air Quality: Using Sensors to Know What's in Your Air
Diamond Bar, CA
November 21, 2014



Challenges to Interpretation of New Air Sensor Data: What Does it Mean?

Data itself is not “information”: Interpretation required

- For an individual:
  - What does a reading mean for me, my family?
  - Is my home safe? Where should I exercise?
- For a community:
  - What neighborhoods are impacted the most?
- For State and Local officials:
  - How do I respond to citizen inquiries?

Air Sensors Health Group (ASHG) formed to support data interpretation

- Includes EPA Program offices and Regional representatives
  - Office of Research and Development (several programs)
  - Office of Air and Radiation
  - EPA Regional Offices
- Includes other Federal Agencies:
  - National Institute for Environmental Health Sciences
  - National Institute for Occupational Safety and Health
  - Centers for Disease Control
  - National Library of Medicine

ASHG Goals

- To help the state/local agencies and regions on the front lines of answering phone calls from concerned citizens
- To help consumers understand how to interpret the readings from their sensors
- To help guide sensor developers to produce instruments with meaningful information or translation

Initial ASHG Approaches

- Consider available reference values
- Consider what is “normal” air quality

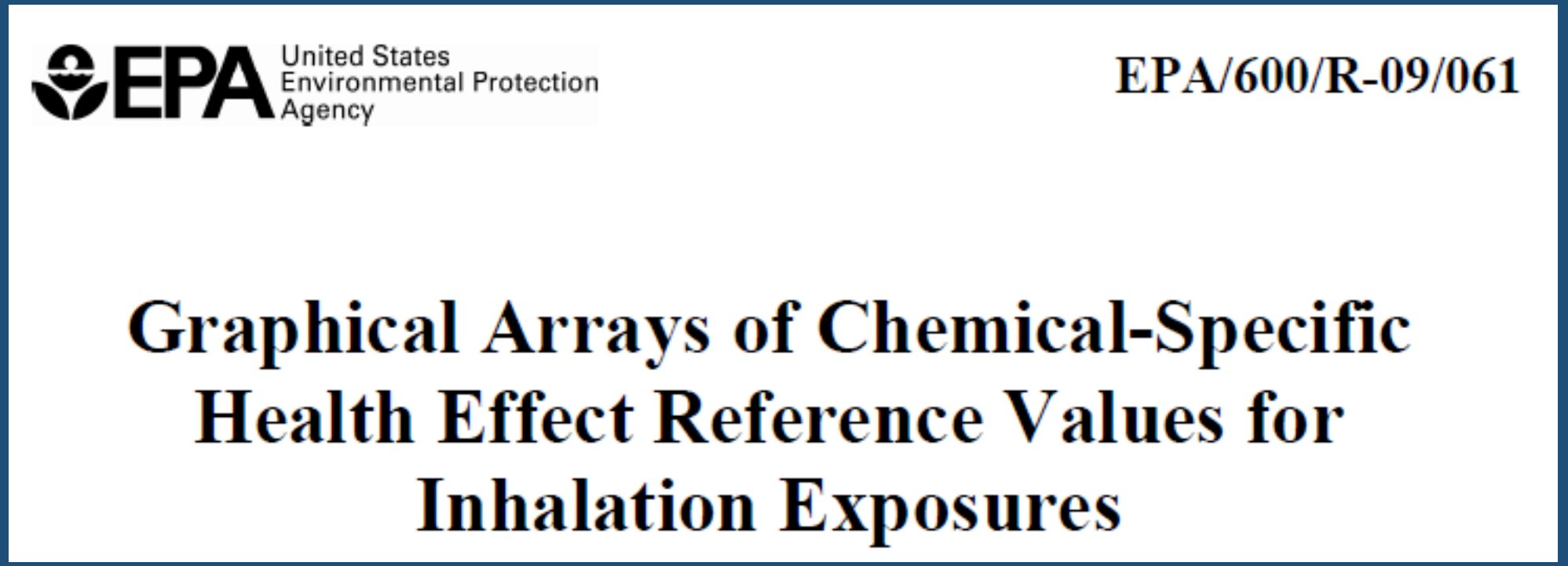
Understanding Reference Values

Values vary due to assumptions that depend on target population and intended exposure scenario

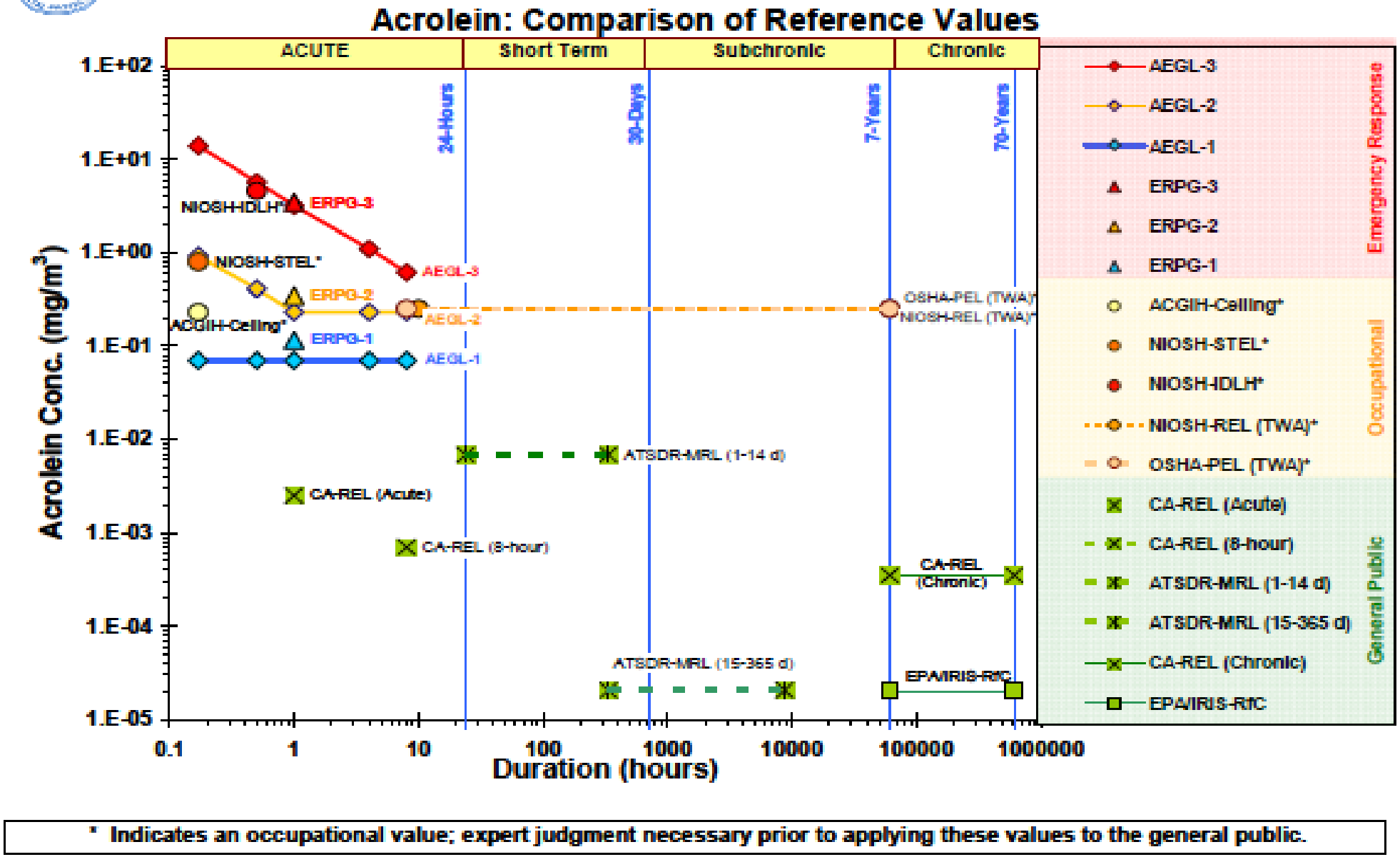
- Occupational values:
  - 8-hour work shift TWA or 15-minute STEL
  - Healthy workers
  - 40-year exposure duration
  - Safety factors
- Emergency response values:
  - Degrees of severity – all include some level of effect
  - Aid in evacuation/Take-shelter decisions
  - Assume “once in a lifetime” exposure scenario, not routine excursions

Extrapolation factors may not account for general population, sensitive subpopulations, or dosimetry

Air Reference Value Evaluation



Office of Research and Development
National Center for Environmental Assessment
Research Triangle Park, NC



* Indicates an occupational value; expert judgment necessary prior to applying these values to the general public.

Figure 2.1. Comparison of Available Health Effect Reference Values for Inhalation Exposure to Acrolein

Table 2-1. Summary of Available Inhalation Reference Values for 24 Chemicals

	Emergency Response			Occupational							General Public				
	AEGL	ERPG	TEEL	IDLH	TLV	PEL	REL	CDC WPL	STEL	Ceiling	RfC	MRL	CA-REL	CDC GPL	WHO Air Quality Guideline
Acrolein	X	X		X		X	X		X	X	X	X	X		
Ammonia	X	X		X	X	X	X		X		X	X	X		
Arsine (SA)*	X	X		X	X	X				X	X		X		
Chlorine*	X	X		X	X				X	X	X	X	X		
Chromium VI			X	X	X	X	X				X	X	X		
Cyanogen Chloride*		X								X					
Etyhlene Glycol Methyl Ether			X	X	X	X	X				X		X		
Ethylene Oxide	X	X		X	X	X	X			X		X	X		
Formaldehyde	X	X		X		X	X		X	X		X	X		X
Soman (GD) + Cyclosarin (GF)*	X			X					X						
Hydrogen Cyanaide (AC)*	X	X		X		X			X	X	X		X		
Hydrogen Fluoride	X	X		X	X	X	X		X			X	X		
Hydrogen Sulfide	X	X		X	X				X	X					
Lewisite (L)*	X							X						X	
Mercury	X	X		X	X		X			X	X	X	X		
Methylene Chloride	X	X		X	X	X			X			X	X		X
Percholoroetyhlene	X	X		X	X	X	X		X	X		X	X		
Phosgene (CG)*	X	X		X	X	X	X			X	X		X		
Phosphine*	X	X		X	X	X	X		X		X		X		
Sarin (GB)*	X			X				X	X					X	
Styrene	X	X		X	X	X	X		X	X	X	X	X		X
Sulfur Mustard (HD)*	X			X				X	X			X		X	
Tabun (GA)*	X			X				X	X					X	
VX*	X			X				X	X					X	

* indicates a chemical warfare agent

Reference Values?

- Consider available reference values
- Consider what is “normal” air quality

- National Ambient Air Quality Standards: 4 components
  - Indicator (e.g., ozone)
  - Level (e.g., 75 ppb)
  - Averaging time (8 hour daily maximum) **
  - Form (4th highest average across 3 years) **

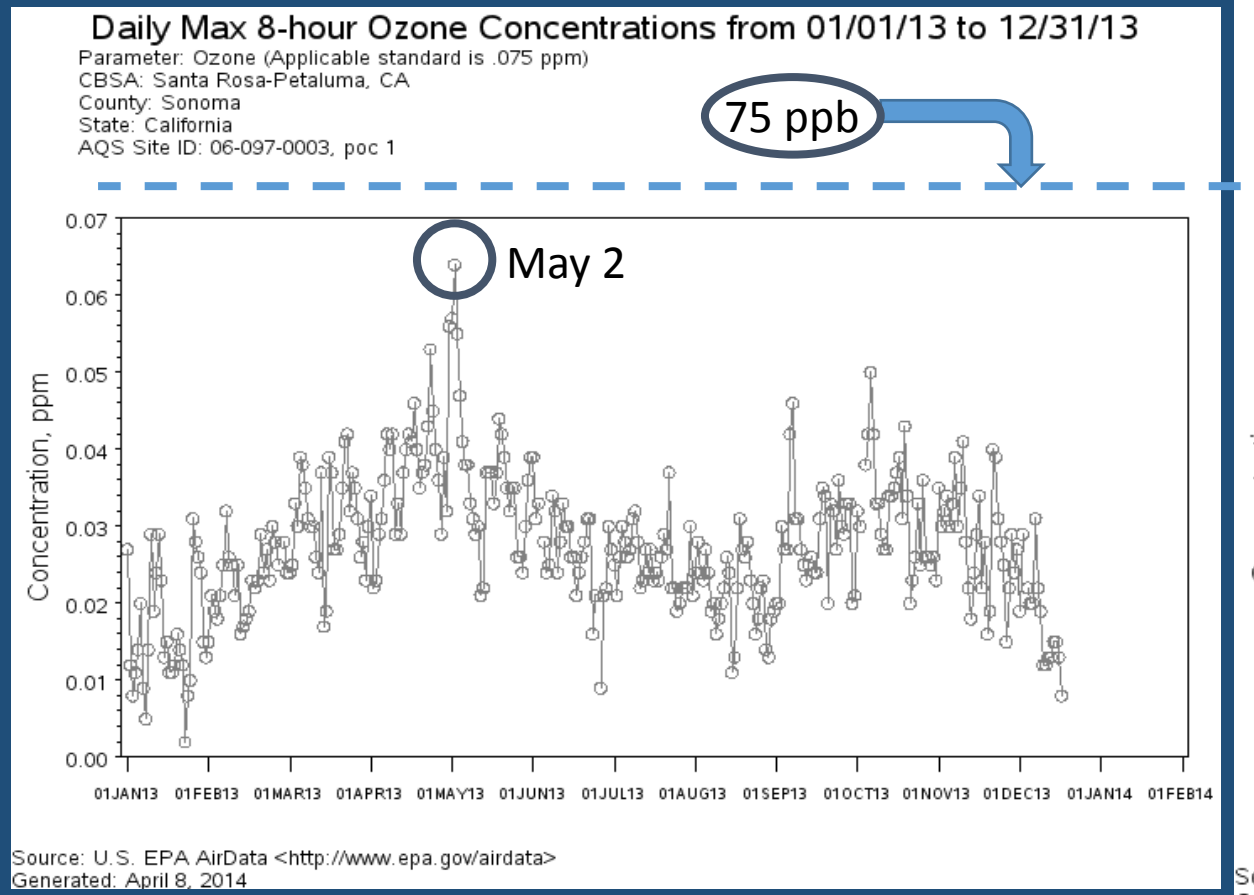
** = short-term exposure data (minutes, hour) does not match up with standard
e.g., a one minute reading of 85 ppb does not mean the standard has been exceeded

What is “Normal” Air Quality?

- Examine one year of data (2013) at two contrasting sites near San Francisco, California (“higher concentration” vs. “lower concentration”)
  - Results should not be generalized. Relationships and patterns likely vary for other geographic locations, monitoring equipment, etc.
  - 1-minute data provided by Mark Stoelting, Bay Area Air Quality Management District

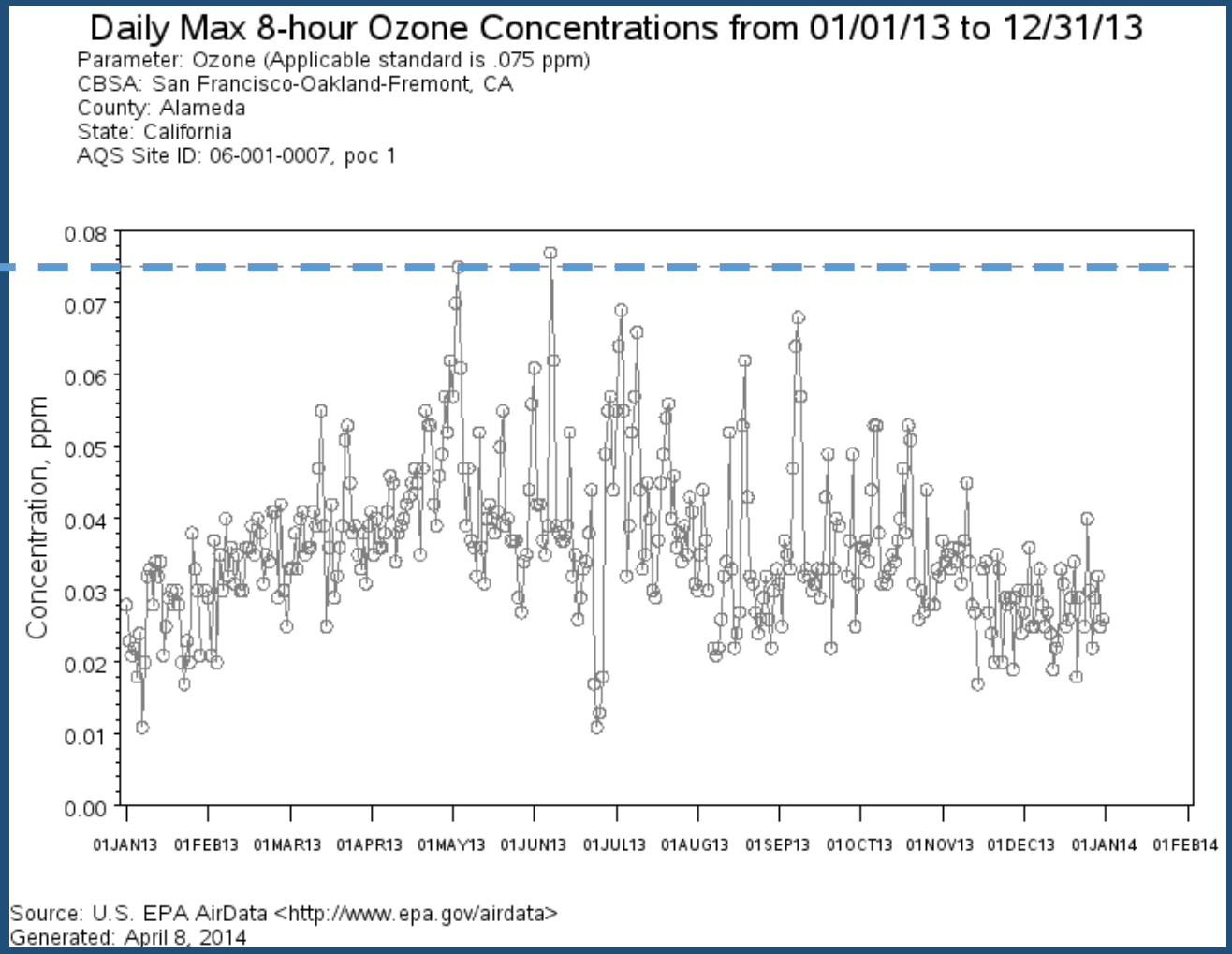
Santa Rosa

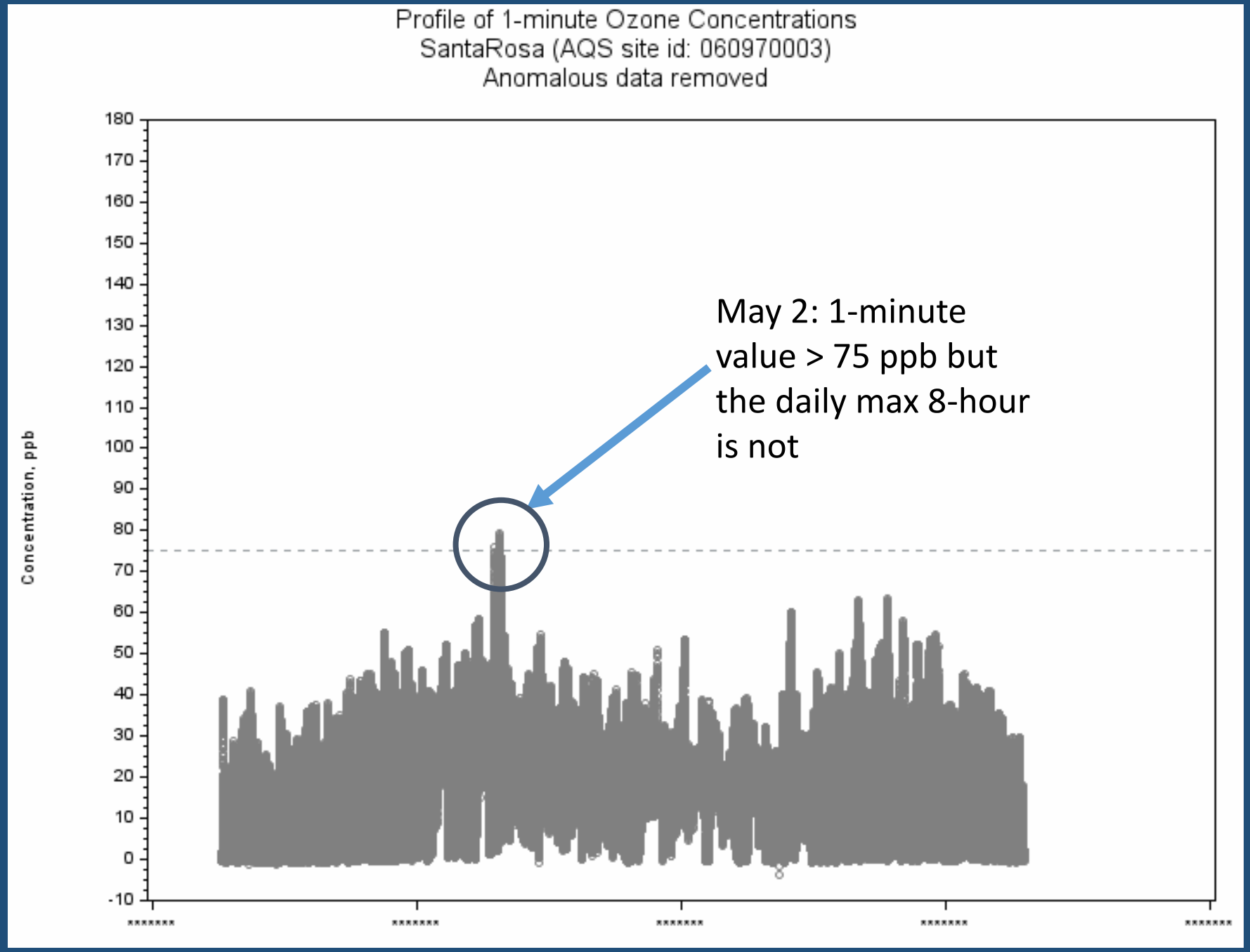
(lower concentration)



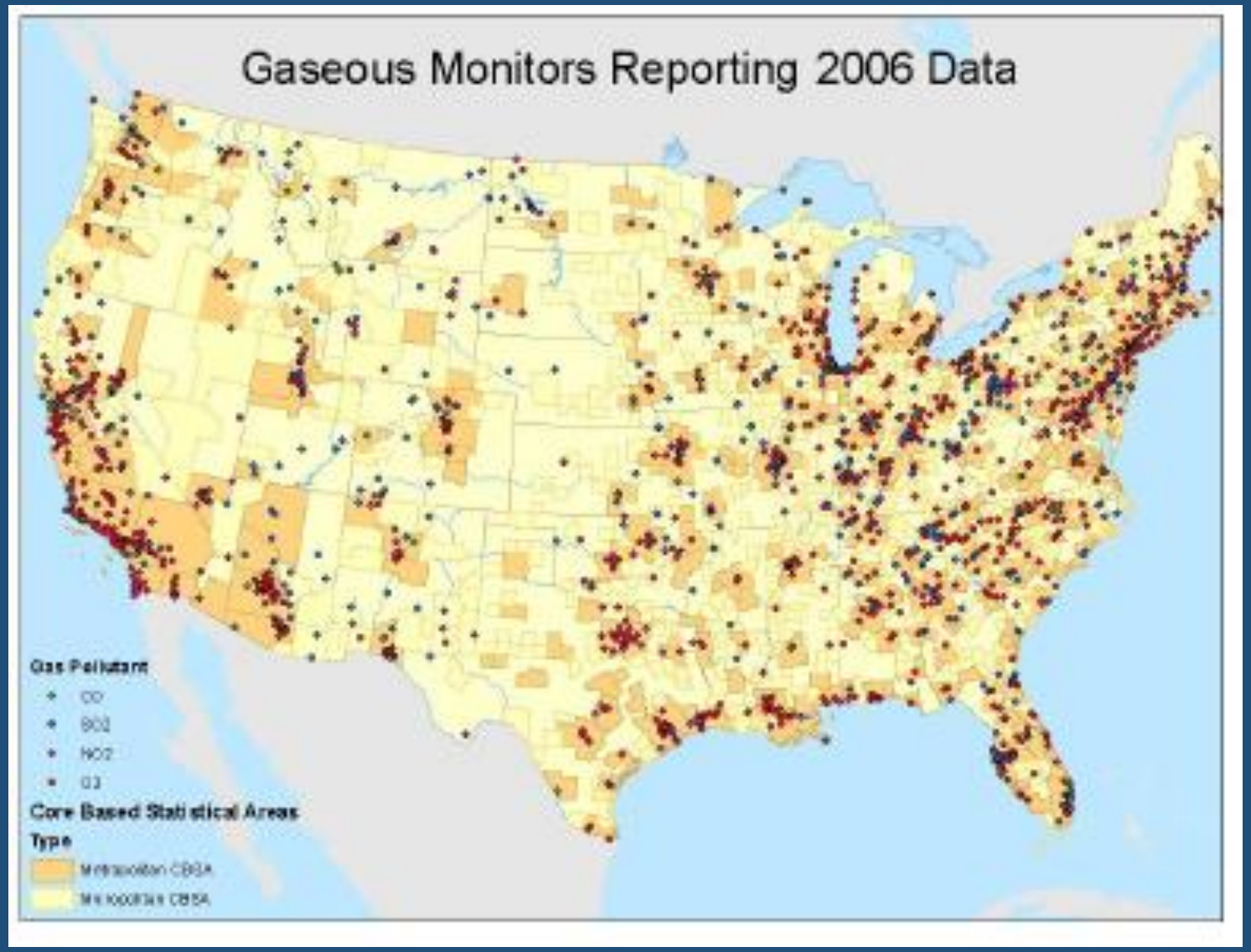
Livermore

(higher concentration)



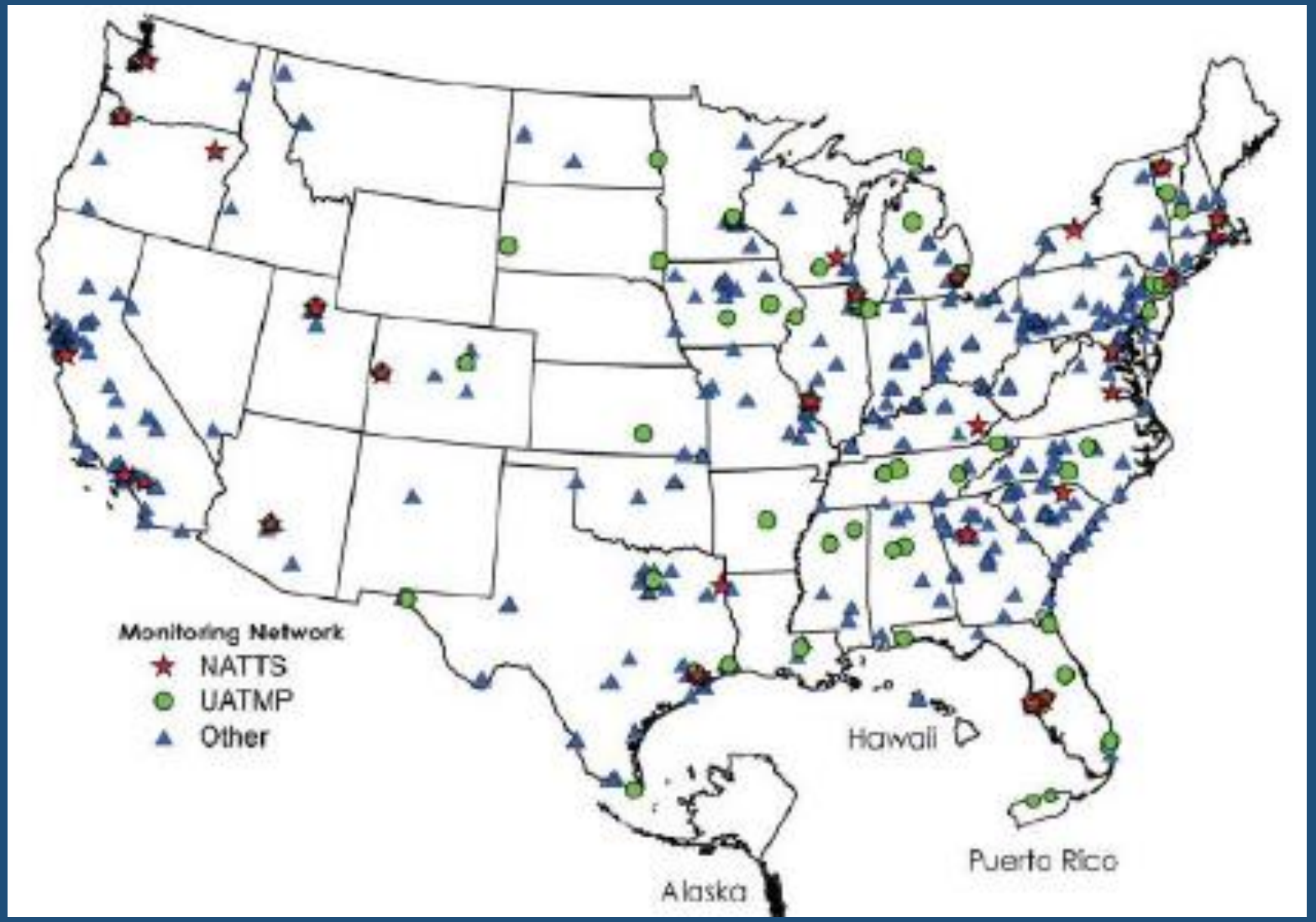

Profile of 1-minute Ozone Concentrations
SantaRosa (AQS site id: 060970003)
Anomalous data removed
Concentration, ppb
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
****
****
****
****
****
May 2: 1-minute value > 75 ppb but the daily max 8-hour is not

An Advantage to the initial ASGH focus on gaseous criteria pollutants is the large network of monitors



Messaging for $PM_{2.5}$ is also under development

Monitoring data is limited for most Hazardous Air Pollutants, i.e. what is “normal” more difficult to evaluate



Conclusions

- Lack of short-term health reference values for general population exposure
- Lack of short-term health effects studies
- Short-term new sensor data does NOT compare to National Ambient Air Quality Standards
- Short-term (minute-by-minute) air monitoring available for some criteria air pollutants, which can be used to communicate what is “normal”
- Major challenge is effective and appropriate communication
- ASHG is working to develop information to support interpretation of new air sensor data